Д.Е. Ершов, Д.В. Сучков, Е.В. Артюшина

ГЛОБАЛЬНАЯ ЭКОНОМИКА

МАКРОЭКОНОМИКА В СИСТЕМЕ ОТКРЫТЫХ НАЦИОНАЛЬНЫХ РЫНКОВ.

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Chapter 12

National Income Accounting and the Balance of Payments

Preview

- National income accounts
  - ❑ measures of national income
  - ❑ measures of value of production
  - ❑ measures of value of expenditure
- National saving, investment and the current account
- Balance of payments accounts

National Income Accounts

- Records the value of **national income** that results from *production* and *expenditure*.
  - ❑ Producers earn income from buyers who spend money on goods and services.
  - ❑ The amount of expenditure by buyers = the amount of income for sellers = the value of production.
  - ❑ National income is often defined to be the *income earned by a nation's factors of production.*

National Income Accounts: GNP

- **Gross national product** (GNP) is the value of all final goods and services *produced by a nation's factors of production* in a given time period.

- ❑ What are factors of production? workers (labor), physical capital (like factories and equipment), natural resources and other factors that are used to produce goods and services.
- ❑ The value of final goods and services produced by US labor, capital and natural resources are counted as US GNP.

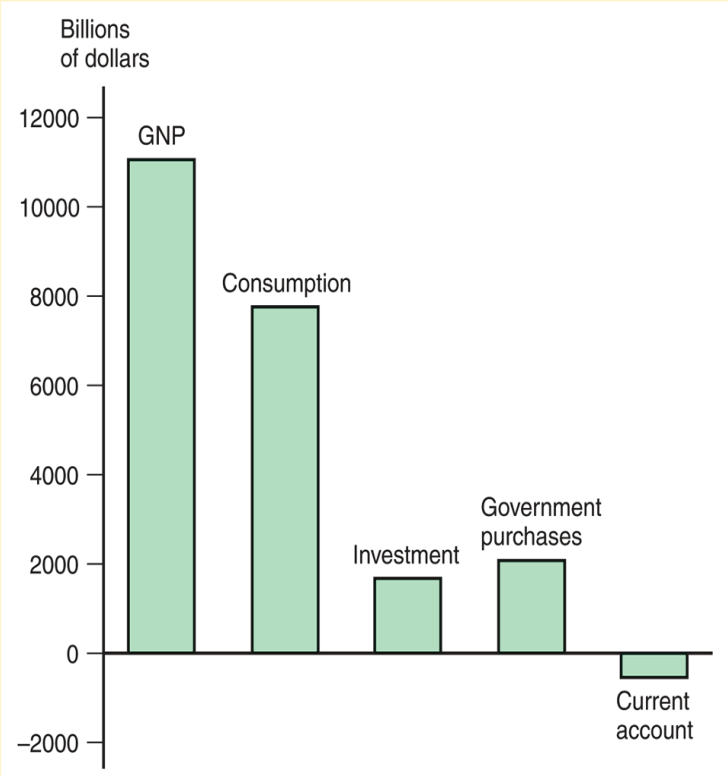
- GNP is calculated by adding the value of expenditure on final goods and services produced.
- There are 4 types of expenditure:
  - ❑ Consumption: expenditure by domestic residents
  - ❑ Investment: expenditure by firms on plants & equipment
  - ❑ Government purchases: expenditure by governments on goods and services
  - ❑ Current account balance (exports minus imports): net expenditure by foreigners on domestic goods and services

Figure 12-1

U.S. GNP and Its Components

America's $11.1 trillion 2003 gross national product can be broken down into the four components shown.

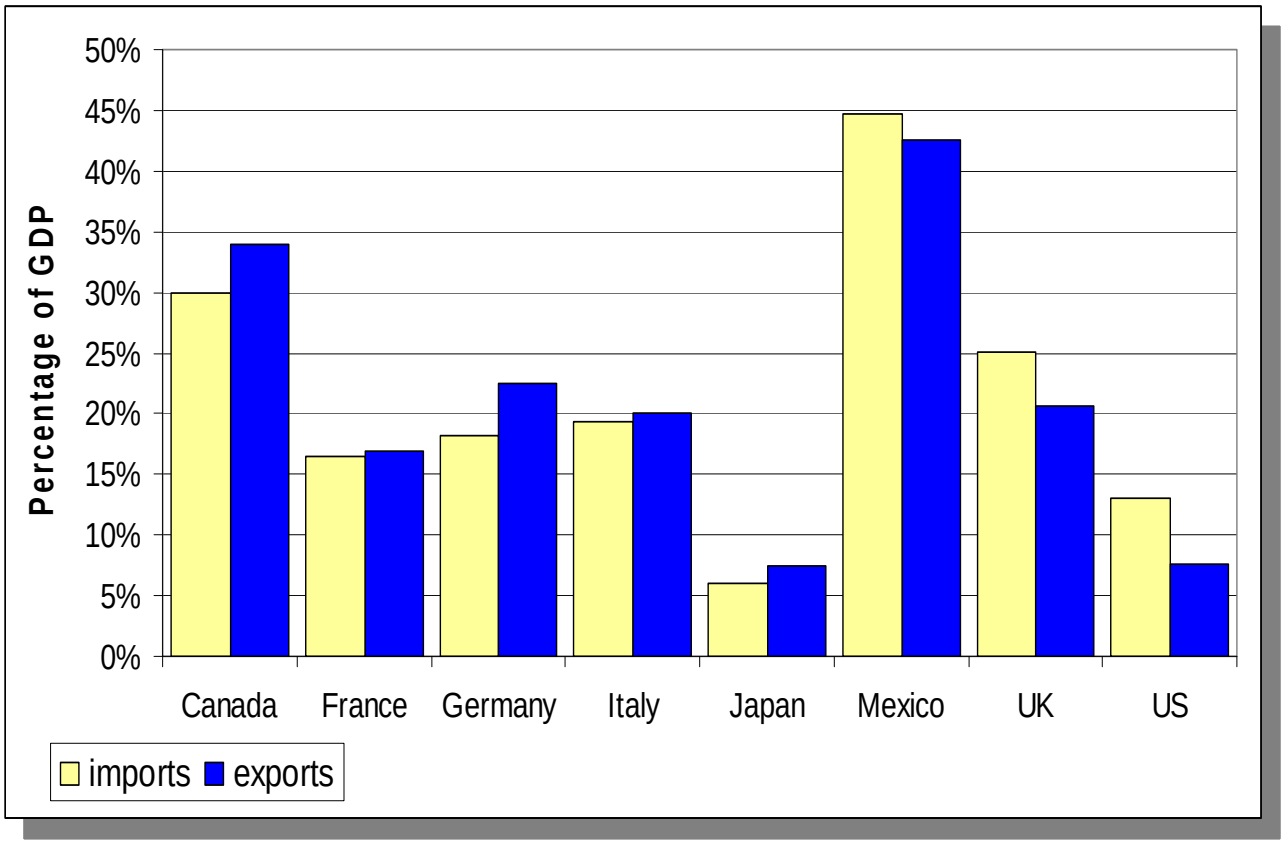
Source: *Economic Indicators,* U.S. Government Printing Office, July 2004.

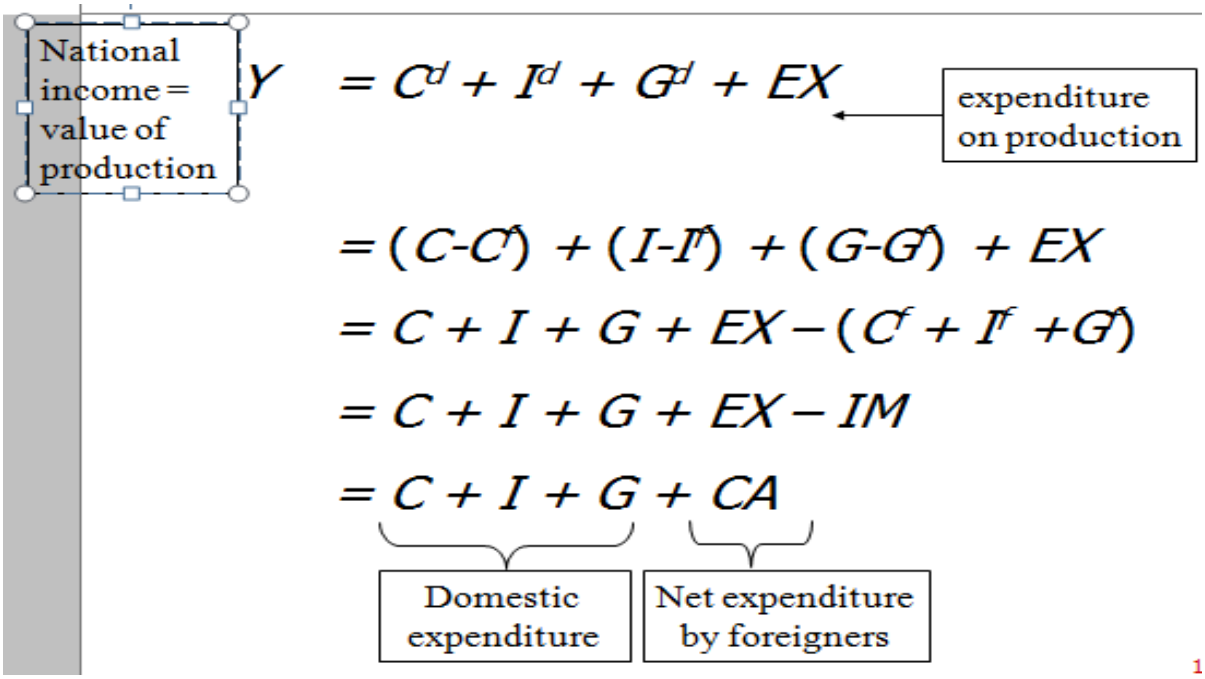


National Income Accounts

- GNP is one measure of national income, but a more precise measure of national income is GNP adjusted for following:
    1. **Depreciation** of capital results in a loss of income to capital owners, so the amount of depreciation is subtracted from GNP.
    2. **Indirect business taxes** reduce income to businesses, so the amount of these taxes is subtracted from GNP.
- Another approximate measure of national income is **gross domestic product** (GDP):
- Gross domestic product measures the final value of all goods and services that are produced *within a country* in a given time period.
- GDP = GNP – factor payments from foreign countries + factor payments to foreign countries

Imports and Exports As a Fraction of GDP



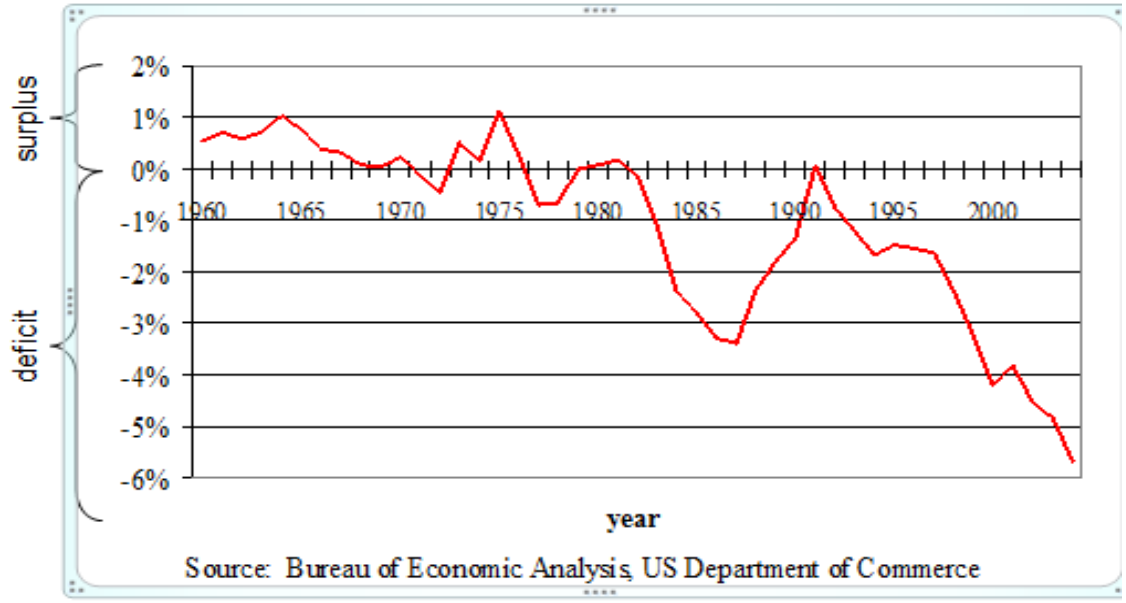


Expenditure and Production in an Open Economy

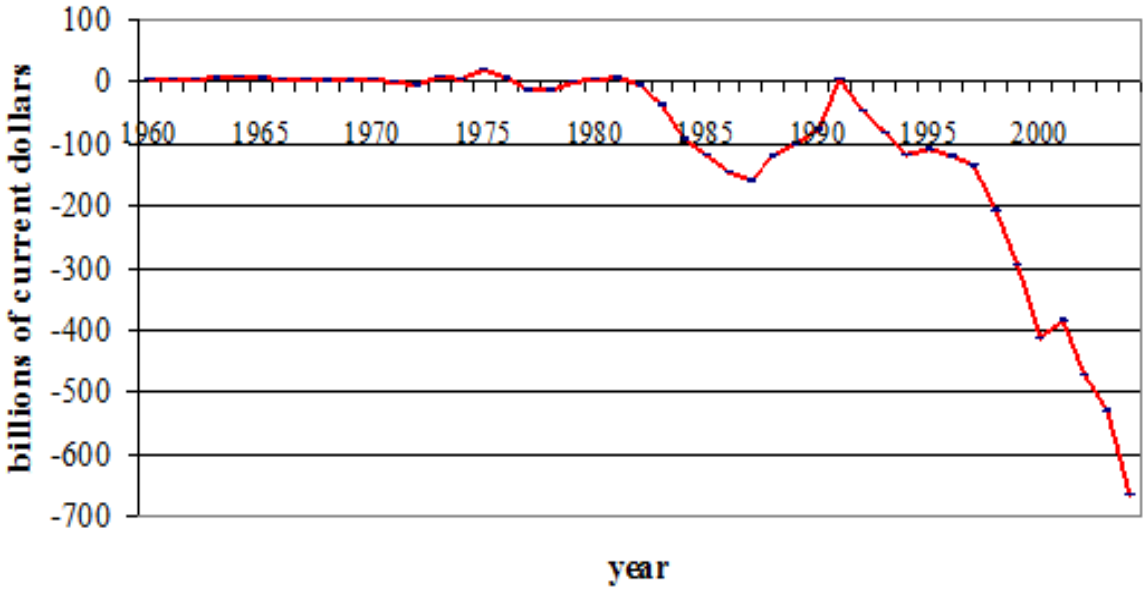
$$CA = EX - IM = Y - (C + I + G)$$

- When production > domestic expenditure, exports > imports: current account > 0, trade balance > 0
  - ❑ when a country exports more than it imports, it earns more income from exports than it spends on imports
  - ❑ net foreign wealth is increasing
- When production < domestic expenditure, exports < imports: current account < 0, trade balance < 0
  - ❑ when a country exports less than it imports, it earns less income from exports than it spends on imports
  - ❑ net foreign wealth is decreasing

US Current Account As a Percentage of GDP, 1960–2004



US Current Account, 1960–2004



US Current Account and Net Foreign Wealth, 1977–2003

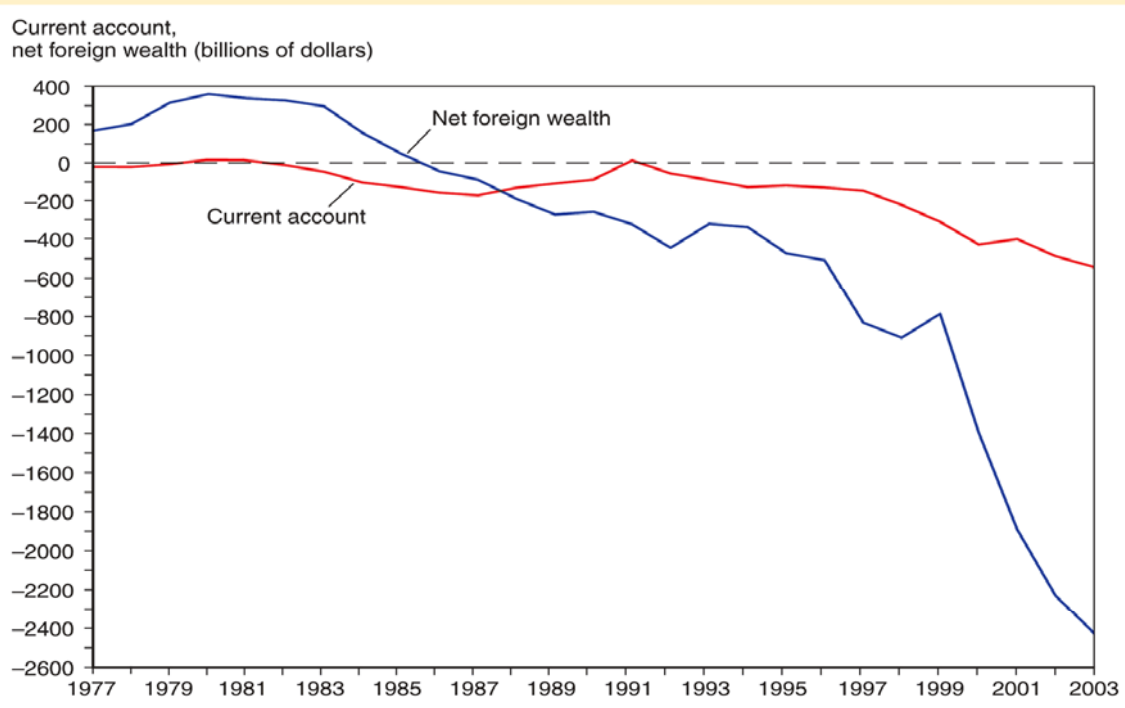


Figure 12-2

The U.S. Current Account and Net Foreign Wealth Position, 1977–2003

A string of current account deficits in the 1980s reduced America's net foreign wealth until, by the early 21st century, the country had accumulated a substantial net foreign debt.

Source: U.S. Government Printing Office, *Economic Indicators,* April 2004.

Saving and the Current Account

- National saving (S) = national income (Y) that is not spent on consumption (C) or government purchases (G).
- $Y - C - G$
- $(Y - C - T) + (T - G)$
- $S^p + S^g = S$

How Is the Current Account Related to National Saving?

$$\boldsymbol{CA = Y - (C + I + G)}$$

implies

$$CA = (Y - C - G) - I$$

$$= S - I$$

current account = national saving – investment

current account = net foreign investment

- A country that imports more than it exports has low national saving relative to investment.

$$CA = S - I \qquad or \qquad I = S - CA$$

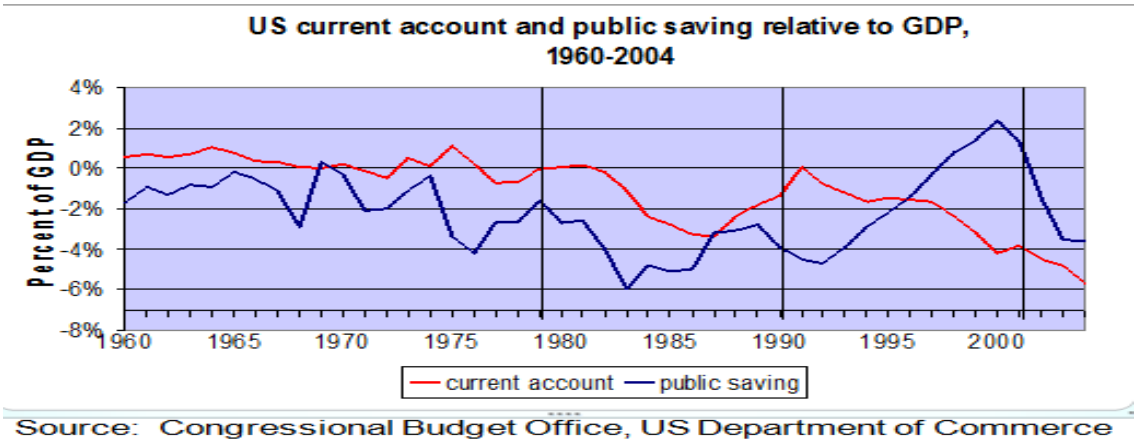
- Countries can finance investment either by saving or by acquiring foreign funds equal to the current account deficit.
  - ❑ a current account deficit implies a financial capital inflow or negative net foreign investment.
- When $S > I$, then $CA > 0$ and net foreign investment and financial capital outflows for the domestic economy are positive.

$$CA = S^p + S^g - I$$

$= S^p$ – government deficit – I

- Government deficit is negative government saving
  - ❑ equal to G – T
- A high government deficit causes a negative current account balance, all other things equal.

Inverse Relationship Between Public Saving and Current Account?



Balance of Payments Accounts

• A country's balance of payments accounts accounts for its payments to and its receipts from foreigners.

• Each international transaction enters the accounts twice: once as a credit (+) and once as a debit (-).

- The balance of payment accounts are separated into 3 broad accounts:
  - **current account**: accounts for flows of goods and services (imports and exports).
  - **financial account**: accounts for flows of financial assets (financial capital).
  - **capital account**: flows of special categories of assets (capital), typically non-market, non-produced, or intangible assets like debt forgiveness, copyrights and trademarks.

Example of Balance of Payment Accounting

- You import a DVD of Japanese anime by using your debit card.
- The Japanese producer of anime deposits the funds in its bank account in San Francisco. The bank credits the account by the amount of the deposit.

DVD purchase (current account)	–$30
Credit ("sale") of bank account by bank (financial account)	+$30

- You invest in the Japanese stock market by buying $500 in Sony stock.
- Sony deposits your funds in its Los Angeles bank account. The bank credits the account by the amount of the deposit.

Purchase of stock (financial account)	–$500
Credit ("sale") of bank account by bank (financial account)	+$500

- US banks forgive a $100 M debt owed by the government of Argentina through debt restructuring.
- US banks who hold the debt thereby reduce the debt by crediting Argentina's bank accounts

Debt forgiveness: non-market transfer (capital account)	–$100 M
Credit ("sale") of bank account by bank (financial account)	+$100 M

How Do the Balance of Payments Accounts Balance?

- Due to the double entry of each transaction, the balance of payments accounts will balance by the following equation:

current account +

financial account +

capital account = 0

Balance of Payments Accounts

- Each of the 3 broad accounts are more finely divided:
- **Current account**: imports and exports
    1. merchandise (goods like DVDs)
    2. services (payments for legal services, shipping services, tourist meals,…)
    3. income receipts (interest and dividend payments, earnings of firms and workers operating in foreign countries)
- **Current account**: *net unilateral transfers*
    1. gifts (transfers) across countries that do not purchase a good or service nor serve as income
- **Capital account**: records special asset transfers, but this is a minor account for the US.

- **Financial account**: the difference between sales of domestic assets to foreigners and purchases of foreign assets by domestic citizens.
- **Financial (capital) inflow**
    1. Foreigners loan to domestic citizens by acquiring domestic assets.
    2. Foreign owned (sold) assets in the domestic economy are a credit (+)
- **Financial (capital) outflow**
    1. Domestic citizens loan to foreigners by acquiring foreign assets.
    2. Domestically owned (purchased) assets in foreign economies are a debit (-)
- **Financial account** has at least 3 categories:
    1. **Official (international) reserve assets**
    2. All other assets
    3. **Statistical discrepancy**
- **Statistical discrepancy**
    1. Data from a transaction may come from different sources that differ in coverage, accuracy, and timing.
    2. The balance of payments accounts therefore seldom balance in practice.
    3. The statistical discrepancy is the account added to or subtracted from the financial account to make it balance with the current account and capital account.
- **Official (international) reserve assets**: foreign assets held by central banks to cushion against instability in international markets.
    1. Assets include government bonds, currency, gold and accounts at the International Monetary Fund.
    2. Official reserve assets owned by (sold to) foreign central banks are a credit (+).

3. Official reserve assets owned by (purchased by) the domestic central bank are a debit (-).

- The negative value of the official reserve assets is called the **official settlements balance** or "balance of payments".

1. It is the sum of the current account, the capital account, the non-reserve portion of the financial account, and the statistical discrepancy.

2. A negative official settlements balance may indicate that a country is depleting its official international reserve assets or may be incurring debts to foreign central banks.

- selling foreign currency by the domestic central bank and buying domestic assets by foreign central banks are credits for official international reserve assets, and therefore reduce the official settlements balance.

US Balance of Payments Accounts, 2003 in Billions of Dollars

TABLE 12-2 U.S. Balance of Payments Accounts for 2003 (billions of dollars)

	Credits	Debits
Current Account		
(1) Exports	+1,314.9	
Of which:		
Goods	+713.1	
Services	+307.4	
Income receipts	+294.4	
(2) Imports		−1,778.1
Of which:		
Goods		−1,260.7
Services		−256.3
Income payments		−261.1
(3) Net unilateral current transfers		−67.4
Balance on current account [(1) + (2) + (3)]		−530.7
Capital Account		
(4)		−3.1

TABLE 12-2 U.S. Balance of Payments Accounts for 2003 (billions of dollars)

	Credits	Debits
Financial Account		
(5) U.S. assets held abroad (increase −)		−283.4
Of which:		
Official reserve assets	+1.5	
Other assets		−284.9
(6) Foreign assets held in U.S. (increase +)	+829.2	
Of which:		
Official reserve assets	+248.6	
Other assets	+580.6	
Balance on financial account [(5) + (6)]	+545.8	
Statistical discrepancy [sum of (1) through (6) with sign reversed]		−12.0

Source: U.S. Department of Commerce, *Survey of Current Business*, July 2004. Totals may differ from sums because of rounding.

US Balance of Payments Accounts

- The US has the most negative net foreign wealth in the world, and so is therefore the world's largest debtor nation.
- And its current account deficit in 2004 was $670 billion dollars, so that net foreign wealth continued to decrease.
- The value of foreign assets held by the US has grown since 1980, but liabilities of the US (debt held by foreigners) has grown more quickly.

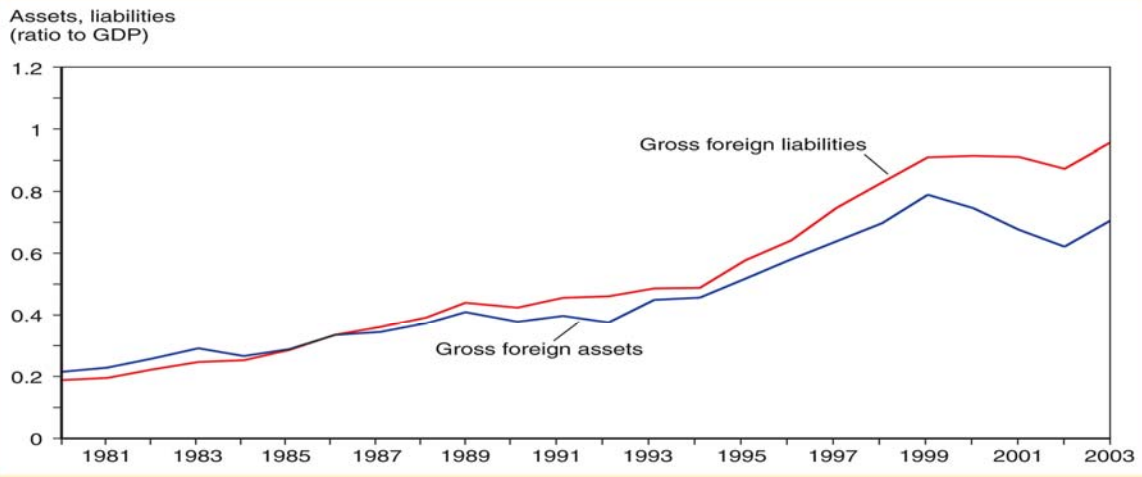


Figure 12-3

U.S. Gross Foreign Assets and Liabilities, 1980–2003

Note: Since 1980, both the foreign assets and the liabilities of the United States have increased sharply. But liabilities have risen more quickly, leaving the United States with a substantial net foreign debt.

Source: Philip R. Lane and Gian Maria Milesi-Ferretti, "Financial Globalization and Exchange Rates." Photocopy, Trinity College Dublin and IMF, June 2004.

- About 70% of foreign assets held by the US are denominated in foreign currencies and almost all of US liabilities (debt) are denominated in dollars.
- Changes in the exchange rate influence value of net foreign wealth (gross foreign assets minus gross foreign liabilities).

A depreciation of the US dollar makes foreign assets held by the US more valuable, but does not change the dollar value of dollar denominated debt.

Summary

1. A country's GNP is roughly equal to the income received by its factors of production.
2. In an open economy, GNP equals the sum of consumption, investment, government purchases, and the current account.
3. GDP is equal to GNP minus net receipts of factor income from abroad. It measures the output produced within a country's borders.
4. National saving minus domestic investment equals the current account (≈ exports minus imports).
5. The current account equals the country's net foreign investment (net outflows of financial assets).
6. The balance of payments accounts records flows of goods & services and flows of financial assets across countries.
    1. It has 3 parts: current account, capital account and financial account, which balance each other.
    2. Transactions of goods and services appear in the current account; transactions of financial assets appear in the financial account.
7. Official international reserve assets are a component of the financial account which records official assets held by central banks.
8. The official settlements balance is the negative value of official international reserve assets, and it shows a central bank's holdings of

foreign assets relative to foreign central banks' holdings of domestic assets.

9. The US is the largest debtor nation, and its foreign debt continues to grow because its current account continues to be negative.

TABLE 12-1 National Income Accounts for Agraria, an Open Economy (bushels of wheat)

GNP (total output)	=	Consumption	+	Investment	+	Government purchases	+	Exports	–	Imports
100	=	75[a]	+	25	+	10	+	10	–	20[b]

[a] 55 bushels of wheat + (0.5 bushel per gallon) × (40 gallons of milk).

[b] 0.5 bushel per gallon × 40 gallons of milk.

TABLE 12-3 International Investment Position of the United States at Year End, 2002 and 2003 (millions of dollars)

Line	Type of investment	Position, 2002 r	Changes in position in 2003				Position, 2003 p
			Attributable to			Total	
			Financial flows	Valuation adjustments			
				Price changes	Exchange-rate changes 1	Other changes 2	
			(a)	(b)	(c)	(d)	(a+b+c+d)	
	Net international investment position of the United States:							
1	With direct investment positions at current cost (line 3 less line 24)	−2,233,018	−545,759	37,112	255,457	55,526	−197,664	−2,430,682
2	With direct investment positions at market value (line 4 less line 25)	−2,553,407	−545,759	−13,696	397,918	63,954	−97,583	−2,650,990
	U.S.-owned assets abroad:							
3	With direct investment at current cost (lines 5+10+15)	6,413,535	283,414	355,668	327,520	−177,445	789,157	7,202,692
4	With direct investment at market value (lines 5+10+16)	6,613,320	283,414	676,650	468,722	−178,138	1,250,648	7,863,968
5	U.S. official reserve assets	156,602	−1,523	18,059	8,438	1	24,975	183,577
6	Gold	90,806		3 18,059		4 1	18,060	108,866
7	Special drawing rights	12,166	−601		1,073		472	12,638
8	Reserve position in the International Monetary Fund	21,979	−1,494		2,050		556	22,535
9	Foreign currencies	33,651	572		5,315		5,887	39,538
10	U.S. Government assets, other than official reserve assets	85,309	−537				−537	84,772
11	U.S. credits and other long-term assets 5	82,682	−702				−702	81,980
12	Repayable in dollars	82,406	−700				−700	81,706
13	Other 6	276	−2				−2	274
14	U.S. foreign currency holdings and U.S. short-term assets	2,627	165				165	2,792
	U.S. private assets:							
15	With direct investment at current cost (lines 17+19+22+23)	6,168,624	285,474	337,609	319,082	−177,446	764,719	6,934,343
16	With direct investment at market value (lines 18+19+22+23)	6,369,409	285,474	658,591	460,284	−178,139	1,226,210	7,595,619
	Direct investment abroad:							
17	At current cost	1,839,995	173,799	9,472	58,756	−13,009	229,018	2,069,013
18	At market value	2,039,780	173,799	330,454	199,958	−13,702	690,509	2,730,289
19	Foreign securities	1,846,879	72,337	328,137	227,021		627,495	2,474,374
20	Bonds	501,762	−28,094	3,209	25,253		368	502,130
21	Corporate stocks	1,345,117	100,431	324,928	201,768		627,127	1,972,244
22	U.S. claims on unaffiliated foreigners reported by U.S. nonbanking concerns	908,024	28,932		18,093	−340,377	−293,352	614,672
23	U.S. claims reported by U.S. banks, not included elsewhere	1,574,726	10,406		15,212	175,940	201,558	1,776,284

TABLE 12-3 International Investment Position of the United States at Year End, 2002 and 2003 (millions of dollars)

	Foreign-owned assets in the United States:							
24	**With direct investment at current cost (lines 26+33)**	**8,646,553**	**829,173**	**318,556**	**72,063**	**−232,971**	**986,821**	**9,633,374**
25	**With direct investment at market value (lines 26+34)**	**9,166,727**	**829,173**	**690,346**	**70,804**	**−242,092**	**1,348,231**	**10,514,958**
26	Foreign official assets in the United States	1,212,723	248,573	3,920		8,945	261,438	1,474,161
27	U.S. Government securities	954,896	194,568	−16,845		12,410	190,133	1,145,029
28	U.S. Treasury securities	796,449	169,685	−13,947		4,476	160,214	956,663
29	Other	158,447	24,883	−2,898		7,934	29,919	188,366
30	Other U.S. Government liabilities[r]	17,144	−564				−564	16,580
31	U.S. liabilities reported by U.S. banks, not included elsewhere	144,646	49,420			−3,465	45,955	190,601
32	Other foreign official assets	96,037	5,149	20,765			25,914	121,951
	Other foreign assets:							
33	With direct investment at current cost (lines 35+37+38+41+42+43)	7,433,830	580,600	314,636	72,063	−241,916	725,383	8,159,213
34	With direct investment at market value (lines 36+37+38+41+42+43)	7,954,004	580,600	686,426	70,804	−251,037	1,086,793	9,040,797
	Direct investment in the United States:							
35	At current cost	1,505,171	39,890	6,460	1,259	1,175	48,784	1,553,955
36	At market value	2,025,345	39,890	378,250		−7,946	410,194	2,435,539
37	U.S. Treasury securities	457,670	113,432	−11,612		−16,948	84,872	542,542
38	U.S. securities other than U.S. Treasury securities	2,786,647	250,981	319,788	48,437	−14,803	604,403	3,391,050
39	Corporate and other bonds	1,600,414	213,718	5,205	48,437	−14,803	252,557	1,852,971
40	Corporate stocks	1,186,233	37,263	314,583			351,846	1,538,079
41	U.S. currency	301,268	16,640				16,640	317,908
42	U.S. liabilities to unaffiliated foreigners reported by U.S. nonbanking concerns	864,632	84,014		11,269	−493,372	−398,089	466,543
43	U.S. liabilities reported by U.S. banks, not included elsewhere	1,518,442	75,643		11,098	282,032	368,773	1,887,215

[p] Preliminary.
[r] Revised.
1. Represents gains or losses on foreign-currency-denominated assets due to their revaluation at current exchange rates.
2. Includes changes in coverage, capital gains and losses of direct investment affiliates, and other statistical adjustments to the value of assets.
3. Reflects changes in the value of the official gold stock due to fluctuations in the market price of gold.
4. Reflects changes in gold stock from U.S. Treasury sales of gold medallions and commemorative and bullion coins; also reflects replenishment through open market purchases. These demonetizations/monetizations are not included in international transactions financial flows.
5. Also includes paid-in capital subscriptions to international financial institutions and resources provided to foreigners under foreign assistance programs requiring repayment over several years. Excludes World War I debts that are not being serviced.
6. Includes indebtedness that the borrower may contractually, or at its option, repay with its currency, with a third country's currency, or by delivery of materials or transfer of services.
7. Primarily U.S. Government liabilities associated with military sales contracts and other transactions arranged with or through foreign official agencies.

Source: U.S. Department of Commerce, Bureau of Economic Analysis, *Survey of Current Business,* July 2004.

Chapter 13

Exchange Rates and the Foreign Exchange Market: An Asset Approach

Preview

- The basics of exchange rates
- Exchange rates and the prices of goods
- The foreign exchange markets
- The demand for currency and other assets
- A model of foreign exchange markets
  - ❑ role of interest rates on currency deposits
  - ❑ role of expectations about the exchange rates

Definitions of Exchange Rates

- Exchange rates are quoted as foreign currency per unit of domestic currency or domestic currency per unit of foreign currency.
  - How much can be exchanged for one dollar? ¥102/$1
  - How much can be exchanged for one yen? $0.0098/¥1
- Exchange rate allow us to denominate the cost or price of a good or service in a common currency.
  - How much does a Honda cost? ¥3,000,000
  - Or, ¥3,000,000 x $0.0098/¥1 = $29,400

Depreciation and Appreciation

- **Depreciation** is a decrease in the value of a currency relative to another currency.
  - A depreciated currency is *less valuable* (less expensive) and therefore can be exchanged for (can buy) a smaller amount of foreign currency.
  - $1/€1 ! $1.20/€1 means that the dollar has depreciated relative to the euro. It now takes $1.20 to buy one euro, so that the dollar is less valuable.
  - The euro has appreciated relative to the dollar: it is now more valuable.
- **Appreciation** is an increase in the value of a currency relative to another currency.
  - An appreciated currency is *more valuable* (more expensive) and therefore can be exchanged for (can buy) a larger amount of foreign currency.

- $1/€1 ! $0.90/€1 means that the dollar has appreciated relative to the euro. It now takes only $0.90 to buy one euro, so that the dollar is more valuable.
- The euro has depreciated relative to the dollar: it is now less valuable.

- A depreciated currency is less valuable, and therefore it can buy fewer foreign produced goods that are denominated in foreign currency.
  - How much does a Honda cost? ¥3,000,000
  - ¥3,000,000 x $0.0098/¥1 = $29,400
  - ¥3,000,000 x $0.0100/¥1 = $30,000
- A depreciated currency means that *imports* are more expensive and domestically produced goods and *exports* are less expensive.
- A depreciated currency lowers the price of exports relative to the price of imports.
- An appreciated currency is more valuable, and therefore it can buy more foreign produced goods that are denominated in foreign currency.
  - How much does a Honda cost? ¥3,000,000
  - ¥3,000,000 x $0.0098/¥1 = $29,400
  - ¥3,000,000 x $0.0090/¥1 = $27,000
- An appreciated currency means that *imports* are less expensive and domestically produced goods and *exports* are more expensive.
- An appreciated currency raises the price of exports relative to the price of imports.

The Foreign Exchange Market

The participants:

1. Commercial banks and other depository institutions: transactions involve buying/selling of bank deposits in different currencies for investment.

2. Non bank financial institutions (pension funds, insurance funds) may buy/sell foreign assets.
3. Private firms: conduct foreign currency transactions to buy/sell goods, assets or services.
4. Central banks: conduct official international reserves transactions.
5. Buying and selling in the foreign exchange market are dominated by commercial banks.
    1. Inter-bank transactions of deposits in foreign currencies occur in amounts $1 million or more per transaction.
    2. Central banks sometimes intervene, but the direct effects of their transactions are usually small and transitory.

Characteristics of the market:

- Trading occurs mostly in major financial cities: London, New York, Tokyo, Frankfurt, Singapore.
- The volume of foreign exchange has grown:
    - ❑ in 1989 the daily volume of trading was $600 billion, in 2001 the daily volume of trading was $1.2 trillion.
- About 90% of transactions in 2001 involved US dollars.
- Computers transmit information rapidly and have integrated markets.
- The integration of markets implies that there is no significant **arbitrage** between markets.
    - ❑ if dollars are cheaper in New York than in London, people will buy them in New York and stop buying them in London. The price of dollars in New York rises and the price of dollars in London falls, until the prices in the two markets are equal.
- **Spot rates** are exchange rates for currency exchanges "on the spot", or when trading is executed in the present.
- **Forward rates** are exchange rates for currency exchanges that will occur at a future ("forward") date.

- ❑ forward dates are typically 30, 90, 180 or 360 days in the future.
- ❑ rates are negotiated between individual institutions in the present, but the exchange occurs in the future.

Spot and Forward Rates

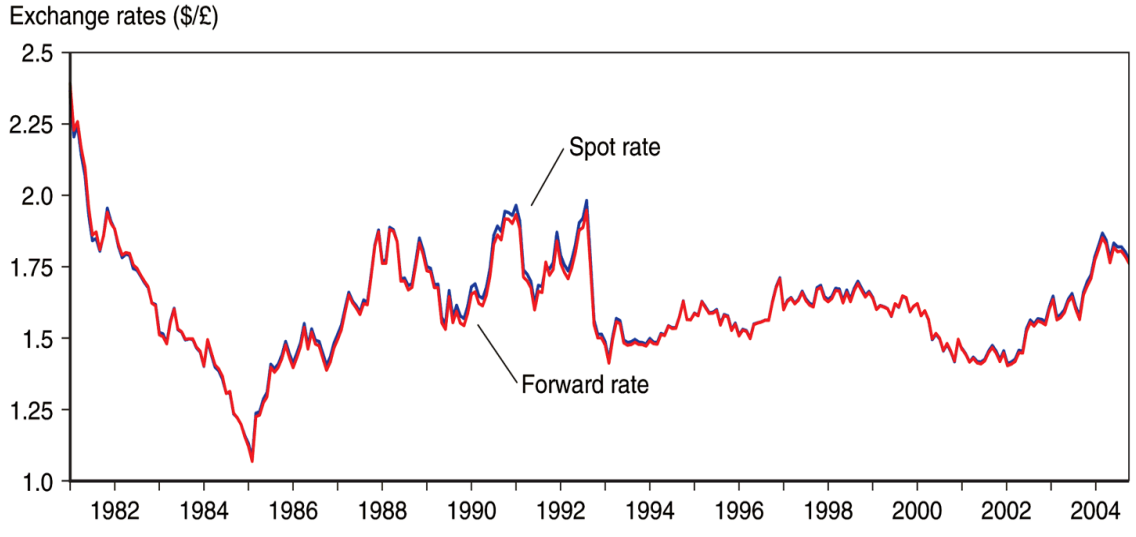


Figure 13-1

Dollar/Pound Spot and Forward Exchange Rates, 1981–2004

Spot and forward exchange rates tend to move in a highly correlated fashion.

Source: *Datastream.* Rates shown are 90-day forward exchange rates and spot exchange rates, at end of month.

Other methods of currency exchange

- **Foreign exchange swaps**: a combination of a spot sale with a forward repurchase, both negotiated between individual institutions.
  - ❑ swaps often result in lower fees or transactions costs because they combine two transactions.
- **Futures contracts**: a contract designed by a *third party* for a *standard* amount of foreign currency delivered/received on a *standard* date.
  - ❑ contracts can be bought and sold in markets, and only the current owner is obliged to fulfill the contract.

Other Methods of Currency Exchange

- **Options contracts**: a contract designed by a *third party* for a *standard* amount of foreign currency delivered/received on or before a *standard* date.
  - ❑ contracts can be bought and sold in markets.
  - ❑ a contract gives the owner the option, but not obligation, of buying or selling currency if the need arises.

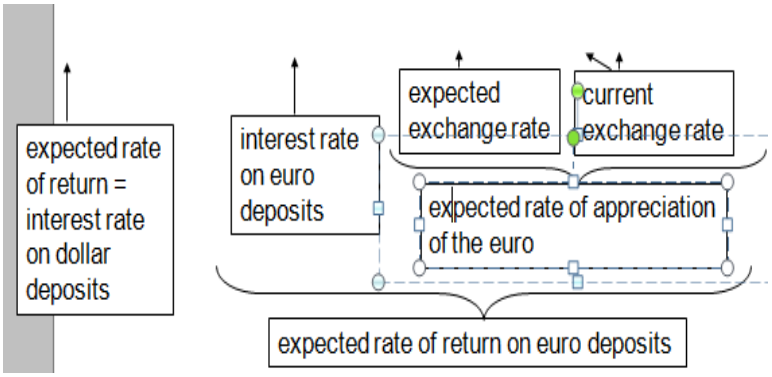
The Demand for Currency Deposits

- What influences the demand for (willingness to buy) deposits denominated in domestic or foreign currency?
- Factors that influence the return on assets determine the demand for those assets.
- **Rate of return**: the percentage change in value that an asset offers during a time period.
  - The annual return for $100 savings account with an interest rate of 2% is $100 x 1.02 = $102, so that the rate of return = ($102 - $100)/$100 = 2%
- **Real rate of return**: inflation-adjusted rate of return.
  - stated in terms of real purchasing power: the amount of real goods & services that can be purchased with the asset.
  - the real rate of return for the above savings account when inflation is 1.5%: 2% – 1.5% = 0.5%. The asset can purchase 0.5% more goods and services after 1 year.
- If prices are given at some level, inflation is 0% and (nominal) rates of return = real rates of return.
- For bank deposits in different currencies, we often assume that prices are given at some level. (A good short run assumption.)

- **Risk** of holding assets also influences decisions about whether to buy them.
- **Liquidity** of an asset, or ease of using the asset to buy goods and services, also influences the willingness to buy assets.
- But we assume that risk and liquidity of bank deposits in the foreign exchange market are the same, regardless of their currency denomination.
    - risk and liquidity are only of secondary importance when deciding to buy or sell currency.
    - importers and exporters may be concerned about risk and liquidity, but they make up a small fraction of the market.
- We assume that investors are primarily concerned about the rates of return on bank deposits. Rates of return are determined by
    - interest rates that the assets earn
    - expectations about appreciation or depreciation
- A currency's **interest rate** is the amount of a currency an individual can earn by lending a unit of the currency for a year.
- The rate of return for a deposit in domestic currency is the interest rate that the bank deposit earns.
- To compare the rate of return on a deposit in domestic currency with one in foreign currency, consider
    - the interest rate for the foreign currency deposit
    - the expected rate of appreciation or depreciation of the foreign currency relative to the domestic currency.
- Suppose the interest rate on a dollar deposit is 2%.
- Suppose the interest rate on a euro deposit is 4%.
- Does a euro deposit yield a higher expected rate of return?
    - Suppose today the exchange rate is \$1/€1, and the expected rate 1 year in the future is \$0.97/€1.
    - \$100 can be exchanged today for €100.

    - These €100 will yield €104 after 1 year.
    - These €104 are expected to be worth \$0.97/€1 x €104 = \$100.88.
- The rate of return in terms of dollars from investing in euro deposits is (\$100.88-\$100)/\$100 = 0.88%.
- Let's compare this rate of return with the rate of return from a dollar deposit.
    - rate of return is simply the interest rate
    - After 1 year the \$100 is expected to yield \$102: (\$102-\$100)/\$100 = 2%
- The euro deposit has a lower expected rate of return: *all* investors will prefer dollar deposits and *none* are willing to hold euro deposits.
- Note that the expected rate of appreciation of the euro is (\$0.97- \$1)/\$1 = -0.03 = -3%.
- We simplify the analysis by saying that the dollar rate of return on euro deposits approximately equals
    - the interest rate on euro deposits
    - plus the expected rate of appreciation on euro deposits
    - 4% + -3% = 1% ≈ 0.88%
- $R_€ + (E^e_{\$/€} - E_{\$/€})/E_{\$/€}$
- The difference in the rate of return on dollar deposits and euro deposits is
- $R_\$ - (R_€ + (E^e_{\$/€} - E_{\$/€})/E_{\$/€}) =$

$R_\$$ $R_€$ $- (E^e_{\$/€} - E_{\$/€})/E_{\$/€}$



The Demand for Currency Assets

TABLE 13-3 Comparing Dollar Rates of Return on Dollar and Euro Deposits

Case	Dollar Interest Rate $R_\$$	Euro Interest Rate $R_€$	Expected Rate of Dollar Depreciation Against Euro $\frac{E^e_{\$/€} - E_{\$/€}}{E_{\$/€}}$	Rate of Return Difference Between Dollar and Euro Deposits $R_\$ - R_€ - \frac{(E^e_{\$/€} - E_{\$/€})}{E_{\$/€}}$
1	0.10	0.06	0.00	0.04
2	0.10	0.06	0.04	0.00
3	0.10	0.06	0.08	−0.04
4	0.10	0.12	−0.04	0.02

The Market for Foreign Exchange

- We use the
  - ❑ demand for (rate of return on) dollar denominated deposits
  - ❑ and the demand for (rate of return on) foreign currency denominated deposits to construct a model of the foreign exchange market.
- The foreign exchange market is in equilibrium when deposits of all currencies offer the same expected rate of return: **interest parity**.
  - ❑ interest parity implies that deposits in all currencies are deemed equally desirable assets.
- Interest parity says:

$$R_\$ = R_€ + (E^e_{\$/€} - E_{\$/€})/E_{\$/€}$$

- Why should this condition hold? Suppose it didn't.
  - ❑ Suppose $R_\$ > R_€ + (E^e_{\$/€} - E_{\$/€})/E_{\$/€}$.
  - ❑ Then no investor would want to hold euro deposits, driving down the demand and price of euros.
  - ❑ Then all investors would want to hold dollar deposits, driving up the demand and price of dollars.

- ❑ The dollar would appreciate and the euro would depreciate, increasing the right side until equality was achieved.

- How do changes in the current exchange rate affect expected returns in foreign currency?
- Depreciation of the domestic currency today lowers the expected return on deposits in foreign currency.
  - ❑ A current depreciation of domestic currency will raise the initial cost of investing in foreign currency, thereby lowering the expected return in foreign currency.
- Appreciation of the domestic currency today raises the expected return of deposits in foreign currency.
  - ❑ A current appreciation of the domestic currency will lower the initial cost of investing in foreign currency, thereby raising the expected return in foreign currency.

Expected Returns on Euro Deposits when $E^e_{\$/€}$ = \$1.05 Per Euro

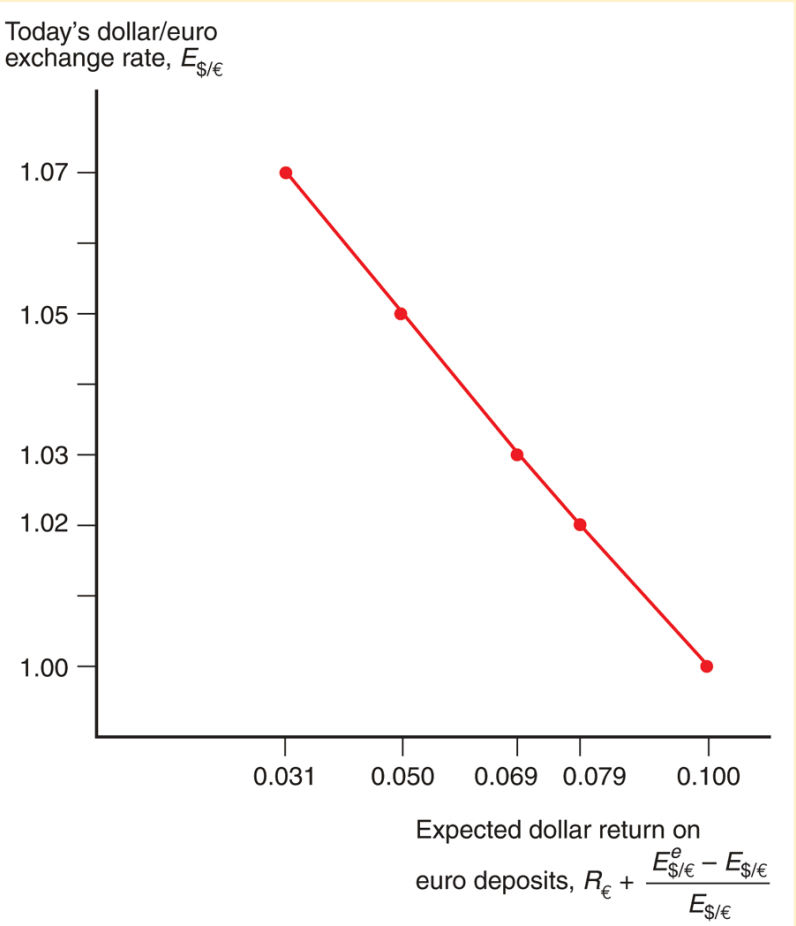
Current exchange rate	Interest rate on euro deposits	Expected rate of dollar depreciation	Expected dollar return on euro deposits
$E_{\$/€}$	$R_€$	$(1.05 - E_{\$/€})/E_{\$/€}$	$R_€ + (1.05 - E_{\$/€})/E_{\$/€}$
1.07	0.05	-0.019	0.031
1.05	0.05	0.000	0.050
1.03	0.05	0.019	0.069
1.02	0.05	0.029	0.079
1.00	0.05	0.050	0.100

The Current Exchange Rate and the Expected Return on Dollar Deposits

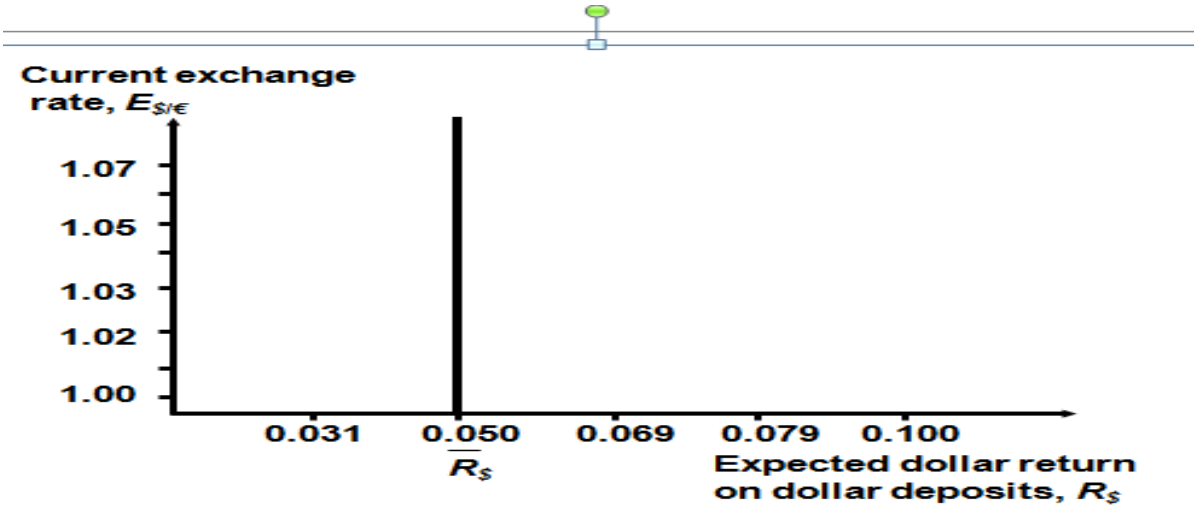
Figure 13-3

The Relation Between the Current Dollar/Euro Exchange Rate and the Expected Dollar Return on Euro Deposits

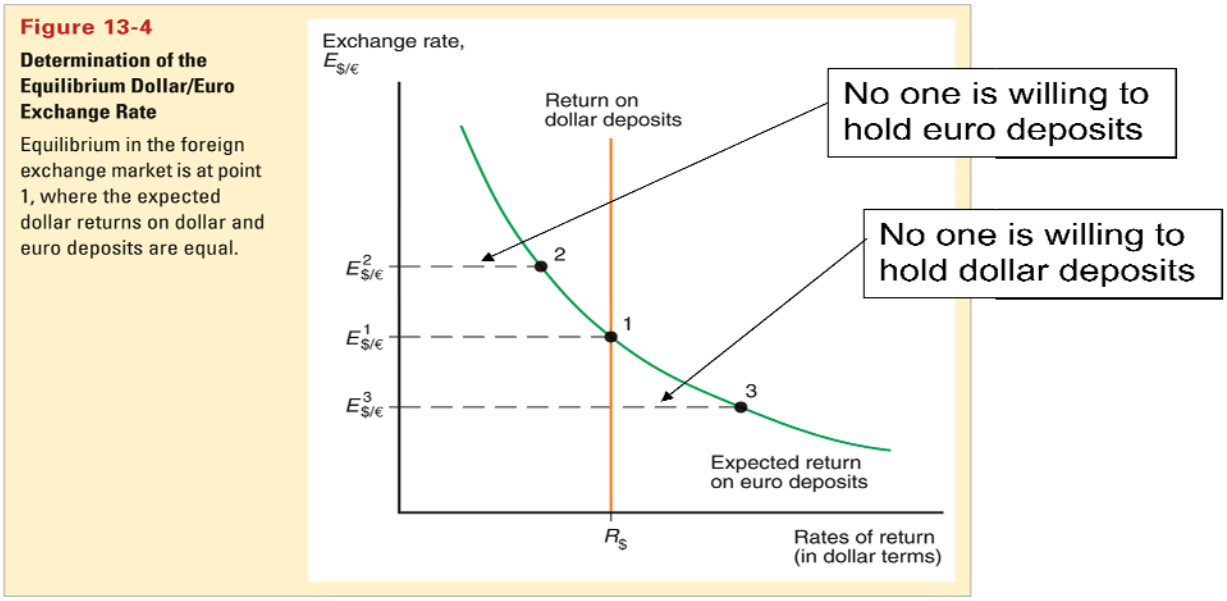
Given $E^e_{\$/€} = 1.05$ and $R_€ = 0.05$, an appreciation of the dollar against the euro raises the expected return on euro deposits, measured in terms of dollars.



The Current Exchange Rate and the Expected Return on Dollar Deposits



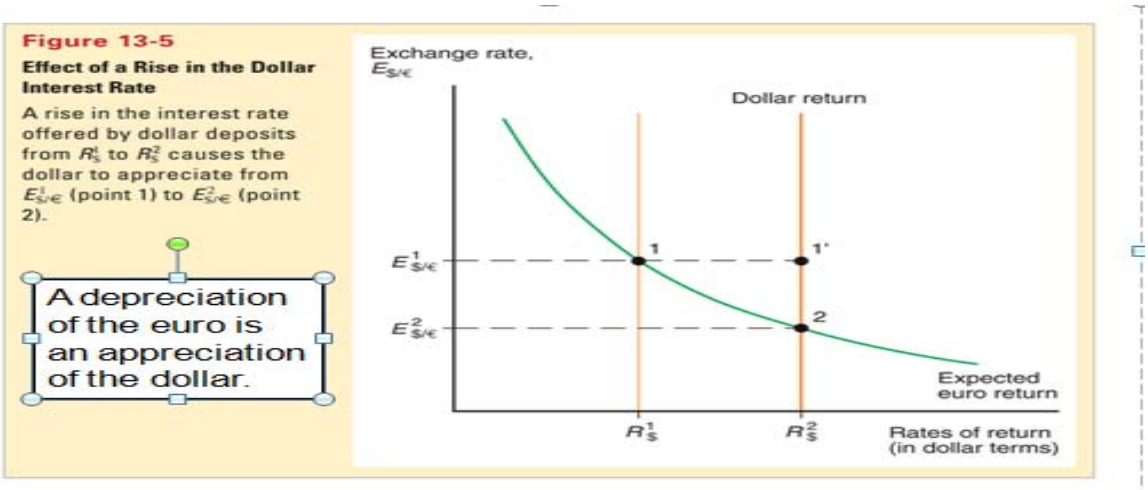
Determination of the Equilibrium Exchange Rate



The Market for Foreign Exchange

- The effects of changing interest rates:
  - ❑ an increase in the interest rate paid on deposits denominated in a particular currency will increase the rate of return on those deposits.
  - ❑ This leads to an appreciation of the currency.
  - ❑ A rise in dollar interest rates causes the dollar to appreciate.
  - ❑ A rise in euro interest rates causes the dollar to depreciate.

The Effect of a Rise in the Dollar Interest Rate

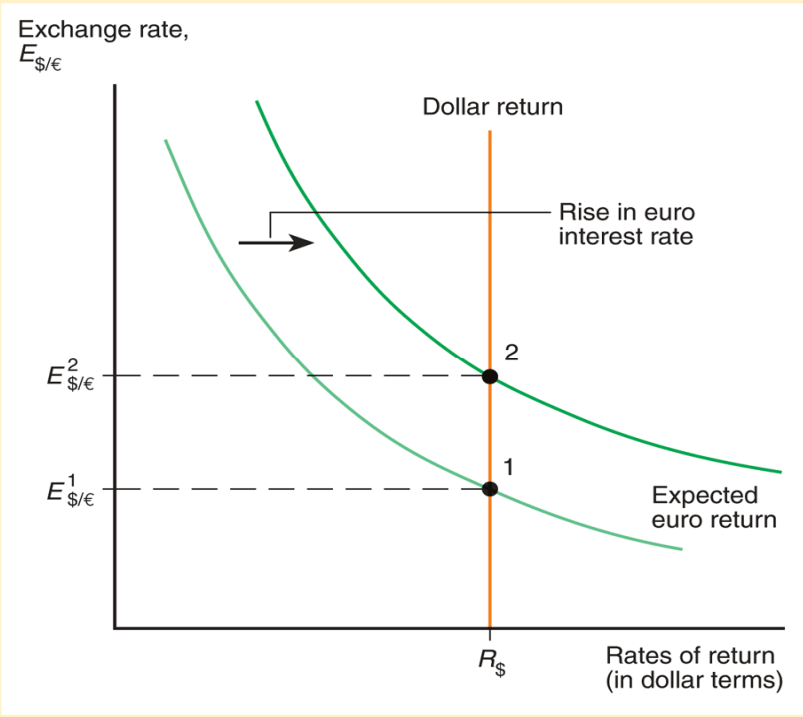


The Effect of a Rise in the Euro Interest Rate

Figure 13-6

Effect of a Rise in the Euro Interest Rate

A rise in the interest rate paid by euro deposits causes the dollar to depreciate from $E^1_{\$/€}$ (point 1) to $E^2_{\$/€}$ (point 2). (This figure also describes the effect of a rise in the expected future \$/€ exchange rate.)

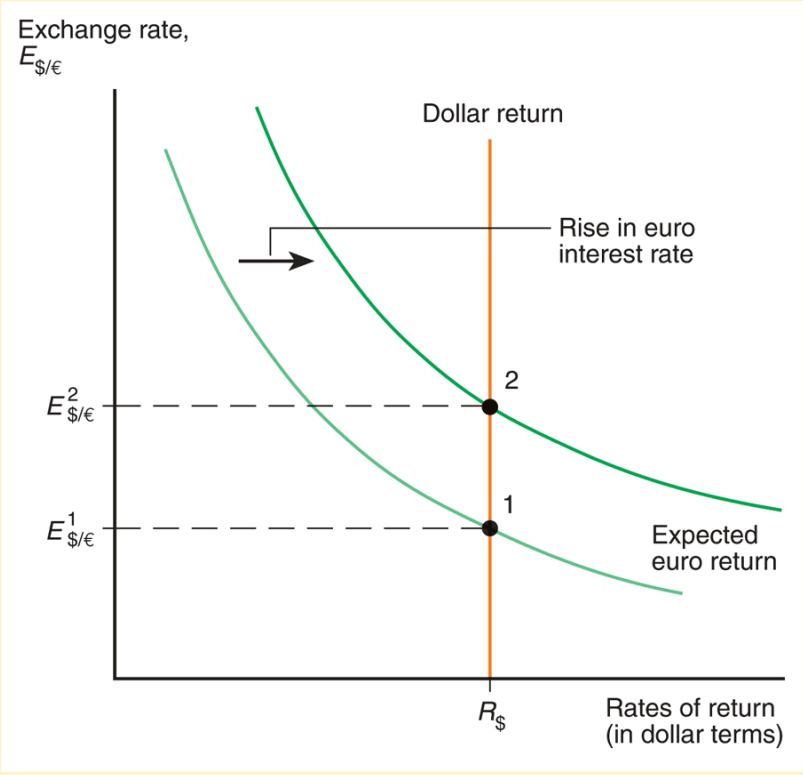


The Effect of an Expected Appreciation of the Euro

Figure 13-6

Effect of a Rise in the Euro Interest Rate

A rise in the interest rate paid by euro deposits causes the dollar to depreciate from $E^1_{\$/€}$ (point 1) to $E^2_{\$/€}$ (point 2). (This figure also describes the effect of a rise in the expected future \$/€ exchange rate.)



- If people expect the euro to appreciate in the future, then investment will pay off in a valuable ("strong") euro, so that these future euros will be able to buy many dollars and many dollar denominated goods.
  - ❑ the expected return on euros therefore increases.
  - ❑ an expected appreciation of a currency leads to an actual appreciation (a self-fulfilling prophecy)
  - ❑ an expected depreciation of a currency leads to an actual depreciation (a self-fulfilling prophecy)

Covered Interest Parity

- Covered interest parity relates interest rates across countries and the rate of change between forward exchange rates and the spot exchange rate:

$$R_{\$} = R_{€} + (F_{\$/€} - E_{\$/€})/E_{\$/€}$$

  where $F_{\$/€}$ is the forward exchange rate.
- It says that rates of return on dollar deposits and "covered" foreign currency deposits are the same.
  - ❑ How could you make easy, risk-free money in the foreign exchange markets if covered interest parity did not hold?
  - ❑ Covered positions using the forward rate involve little risk.

Summary

1. Exchange rates are prices of foreign currencies in terms of domestic currencies, or vice versa.
2. Depreciation of a country's currency means that it is less expensive (valuable) and goods denominated in it are less expensive: exports are cheaper and imports more expensive.
   - ❑ A depreciation will hurt consumers of imports but help producers of exports.

3. Appreciation of a country's currency means that it is more expensive (valuable) and goods denominated in it are more expensive: exports are more expensive and imports cheaper.
    - ❑ An appreciation will help consumers of imports but hurt producers of exports.
4. Commercial banks that invest in deposits of different currencies dominate the foreign exchange market.
    - ❑ Expected rates of return are most important in determining the willingness to hold these deposits.
5. Returns on bank deposits in the foreign exchange market are influenced by interest rates and expected exchange rates.
6. Equilibrium in the foreign exchange market occurs when returns on deposits in domestic currency and in foreign currency are equal: *interest rate parity*.
7. An increase in the interest rate on a currency's deposit leads to an increase in the rate of return and to an appreciation of the currency.
8. An expected appreciation of a currency leads to an increase in the expected rate of return for that currency, and leads to an actual appreciation.
9. Covered interest parity says that rates of return on domestic currency deposits and "covered" foreign currency deposits using the forward exchange rate are the same.

TABLE 13-1 Exchange Rate Quotations

FOREIGN EXCHANGE

WEDNESDAY, NOVEMBER 3,2004

Currency	Foreign Currency in Dollars Wed.	Tue.	Dollars in Foreign Currency Wed.	Tue.
Argentina (Peso)	.3401	.3401	2.9400	2.9400
Australia (Dollar)	.7544	.7454	1.3256	1.3416
Bahrain (Dinar)	2.6525	2.6525	.3770	.3770
Brazil (Real)	.3531	.3507	2.8320	2.8515
Britain (Pound)	1.8474	1.8362	.5413	.5446
30-day fwd	1.8419	1.8327	.5429	.5456
60-day fwd	1.8379	1.8289	.5441	.5468
90-day fwd	1.8336	1.8248	.5454	.5480
Canada (Dollar)	.8275	.8151	1.2084	1.2268
30-day fwd	.8252	.8160	1.2119	1.2255
60-day fwd	.8249	.8157	1.2123	1.2260
90-day fwd	.8245	.8153	1.2129	1.2265
Chile (Peso)	.001646	.001635	607.53	611.62
China (Yuan)	.1208	.1208	8.2781	8.2781
Colombia (Peso)	.000390	.000390	2567.39	2567.39
CzechRep (Koruna)	.0404	.0405	24.73	24.68
Denmark (Krone)	.1720	.1711	5.8133	5.8457
Dominican (Peso)	.0323	.0323	31.00	31.00
Egypt (Pound)	.1605	.1605	6.2301	6.2301
Europe (Euro)	1.2821	1.2674	.7800	.7890
30-day fwd	1.2781	1.2692	.7824	.7879
60-day fwd	1.2786	1.2692	.7821	.7879
90-day fwd	1.2784	1.2691	.7822	.7880
Hong Kong (Dollar)	.1285	.1285	7.7804	7.7815
Hungary (Forint)	.0052	.0052	192.98	192.72
India (Rupee)	.0221	.0220	45.250	45.490
Indnsia (Rupiah)	.000110	.000110	9120.00	9090.00
Israel (Shekel)	.2247	.2250	4.4504	4.4444
Japan (Yen)	.009421	.009399	106.15	106.39
30-day fwd	.009438	.009421	105.96	106.15
60-day fwd	.009455	.009438	105.76	105.95
90-day fwd	.009476	.009459	105.53	105.72
Jordan (Dinar)	1.4104	1.4104	.70902	.70902
Kenya (Shilling)	.0124	.0123	80.78	81.10
Kuwait (Dinar)	3.3944	3.3944	.2946	.2946
Lebanon (Pound)	.000660	.000660	1514.46	1514.46
Malaysia (Ringgit)	.2632	.2632	3.7998	3.7998
Mexico (Peso)	.087474	.087367	11.4320	11.4460
N. Zealand (Dollar)	.6880	.6838	1.4535	1.4624
Norway (Krone)	.1561	.1554	6.4048	6.4341
Pakistan (Rupee)	.0166	.0164	60.42	61.01
Peru (New Sol)	.3013	.3008	3.319	3.325
Philpins (Peso)	.0177	.0178	56.37	56.32
Poland (Zloty)	.2959	.2959	3.38	3.38
a-Russia (Ruble)	.0348	.0347	28.7590	28.7840
SDR (SDR)	1.49632	1.49615	.6683	.6684
Saudi Arab (Riyal)	.2667	.2667	3.7501	3.7500
Singapore (Dollar)	.6004	.5999	1.6656	1.6670
SlovakRep (Koruna)	.0319	.0319	31.37	31.32
So. Africa (Rand)	.1651	.1632	6.0556	6.1260
So. Korea (Won)	.000896	.000897	1116.00	1114.80
Sweden (Krona)	.1411	.1400	7.0868	7.1430
Switzerlnd (Franc)	.8377	.8261	1.1938	1.2105
30-day fwd	.8361	.8285	1.1961	1.2070
60-day fwd	.8372	.8295	1.1945	1.2055
90-day fwd	.8384	.8315	1.1927	1.2027
Taiwan (Dollar)	.0301	.0299	33.25	33.48
Thailand (Baht)	.02435	.02435	41.07	41.07
Turkey (Lira)	.000001	.000001	1470588	1470588
U.A.E. (Dirham)	.2723	.2723	3.6727	3.6728
Uruguay (New Peso)	.0370	.0370	27.0270	27.0270
Venzuel (Bolivar)	.000522	.000522	1915.20	1915.20

a-Russian Central Bank rate.
c-commercial rate, d-free market rate, f-financial rate, y-official rate, z-floating rate.
Prices as of 3:00 p.m. Eastern Time from Moneyline Telerate and other sources.

Source: Data from "Foreign Exchange," *New York Times*, November 3, 2004. © 2005 The New York Times Co.

TABLE 13-2 $/£ Exchange Rates and the Relative Price of American Designer Jeans and British Sweaters

Exchange rate ($/£)	1.25	1.50	1.75
Relative price (pairs of jeans/sweater)	1.39	1.67	1.94

Note: The above calculations assume unchanged money prices of $45 per pair of jeans and £50 per sweater.

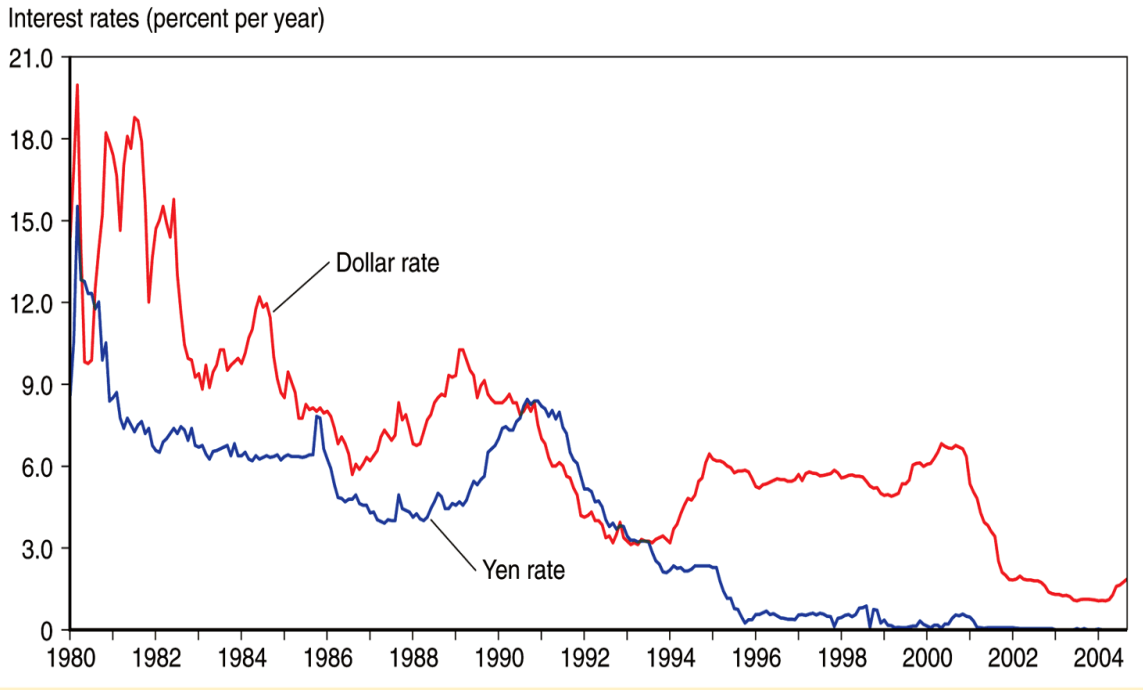


Figure 13-2

Interest Rates on Dollar and Yen Deposits, 1980–2004

Since dollar and yen interest rates are not measured in comparable terms, they can move quite differently over time.

Source: *Datastream.* Three-month interest rates are shown.

TABLE 13-4 Today's Dollar/Euro Exchange Rate and the Expected Dollar Return on Euro Deposits When $E^e_{\$/€} = \$1.05$ per Euro

Today's Dollar/Euro Exchange Rate $E_{\$/€}$	Interest Rate on Euro Deposits $R_€$	Expected Dollar Depreciation Rate Against Euro $\frac{1.05 - E_{\$/€}}{E_{\$/€}}$	Expected Dollar Return on Euro Deposits $R_€ + \frac{1.05 - E_{\$/€}}{E_{\$/€}}$
1.07	0.05	−0.019	0.031
1.05	0.05	0.00	0.05
1.03	0.05	0.019	0.069
1.02	0.05	0.029	0.079
1.00	0.05	0.05	0.10

Chapter 14

Money, Interest Rates, and Exchange Rates

Preview

- What is money?
- Control of the supply of money
- The demand for money
- A model of real money balances and interest rates
- A model of real money balances, interest rates and exchange rates
- Long run effects of changes in money on prices, interest rates and exchange rates

What Is Money?

- Money is an asset that is widely used and accepted as a means of payment.
  - ❑ Different groups of assets may be classified as money.
  - ❑ Currency and checking accounts form a useful definition of money, but bank deposits in the foreign exchange market are excluded from this definition.
- Money is very *liquid*: it can be easily and quickly used to pay for goods and services.
- Money, however, pays *little or no rate of return*.
- Suppose we can group assets into money (liquid assets) and all other assets (illiquid assets).
  - ❑ All other assets are less liquid but pay a higher return.

Money Supply

- Who controls the quantity of money that circulates in an economy, the **money supply**?

- Central banks determine the money supply.
  - ❑ In the US, the central bank is the Federal Reserve System.
  - ❑ The Federal Reserve directly regulates the amount of currency in circulation.
  - ❑ It indirectly controls the amount of checking deposits issued by private banks.

Money Demand

- **Money demand** is the amount of assets that people are willing to hold as money (instead of illiquid assets).
  - ❑ We will consider individual money demand and aggregate money demand.
  - ❑ What influences willingness to hold money?

What Influences Individual Demand for Money?

1. **Expected returns/interest rate** on money relative to the expected returns on other assets.
2. **Risk**: the risk of holding money principally comes from unexpected inflation, thereby unexpectedly reducing the purchasing power of money.
   - ❑ but many other assets have this risk too, so this risk is not very important in money demand
3. **Liquidity**: A need for greater liquidity occurs when either the price of transactions increases or the quantity of goods bought in transactions increases.

What Influences Aggregate Demand for Money?

1. **Interest rates**: money pays little or no interest, so the interest rate is the opportunity cost of holding money instead of other assets, like bonds, which have a higher expected return/interest rate.

- ❑ A higher interest rate means a higher opportunity cost of holding money → lower money demand.

2. **Prices**: the prices of goods and services bought in transactions will influence the willingness to hold money to conduct those transactions.
   - ❑ A higher price level means a greater need for liquidity to buy the same amount of goods and services → higher money demand.
3. **Income**: greater income implies more goods and services can be bought, so that more money is needed to conduct transactions.
   - ❑ A higher real national income (GNP) means more goods and services are being produced and bought in transactions, increasing the need for liquidity → higher money demand.

A Model of Aggregate Money Demand

The aggregate demand for money can be expressed by:

$$M^d = P \; x \; L(R,Y)$$

where P is the price level

Y is real national income

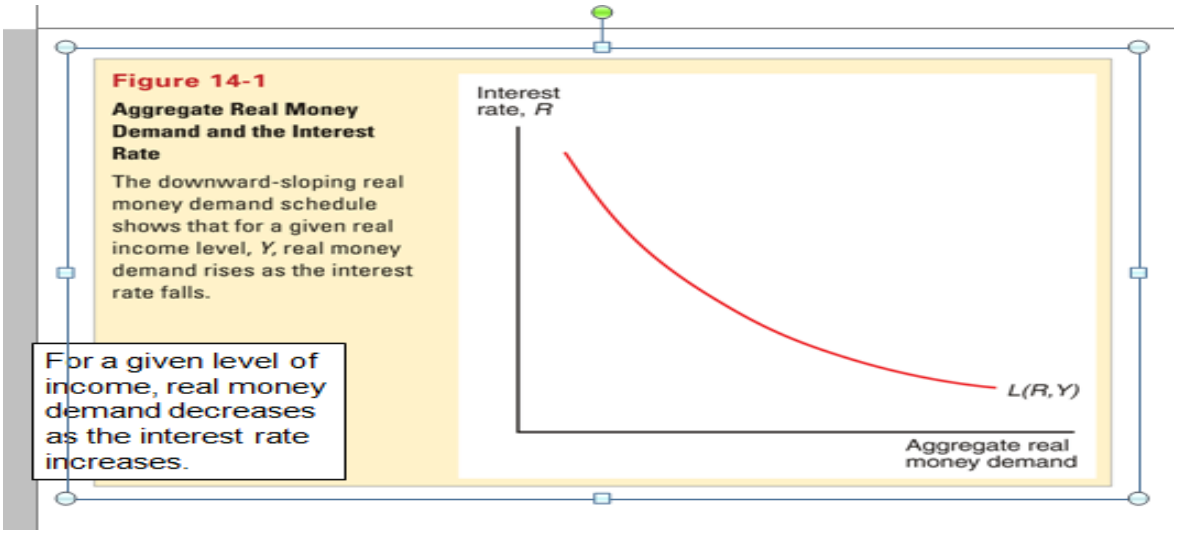
R is a measure of interest rates

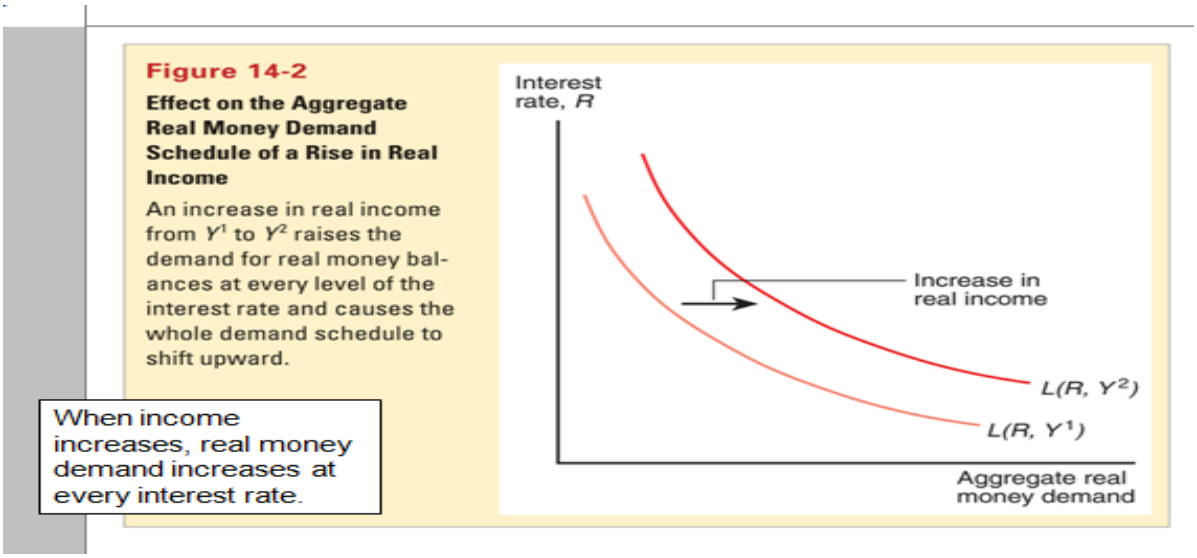
$L(R,Y)$ is the aggregate *real* money demand

Alternatively:

$$M^d/P = L(R,Y)$$

Aggregate real money demand is a function of national income and interest rates.





The Money Market

- The money market uses the (aggregate) money demand and (aggregate) money supply.
- The condition for equilibrium in the money market is:

$$M^s = M^d$$

- Alternatively, we can define equilibrium using the supply of real money and the demand for real money (by dividing both sides by the price level):

$$M^s/P = L(R,Y)$$

- This equilibrium condition will yield an equilibrium interest rate.
- When there is an excess supply of money, there is an excess demand for interest bearing assets.

- People with an excess supply of money are willing to acquire interest bearing assets (by giving up their supply of money) at a lower interest rate.
- Potential money holders are more willing to hold additional quantities of money as the interest rate (the opportunity cost of holding money) falls.

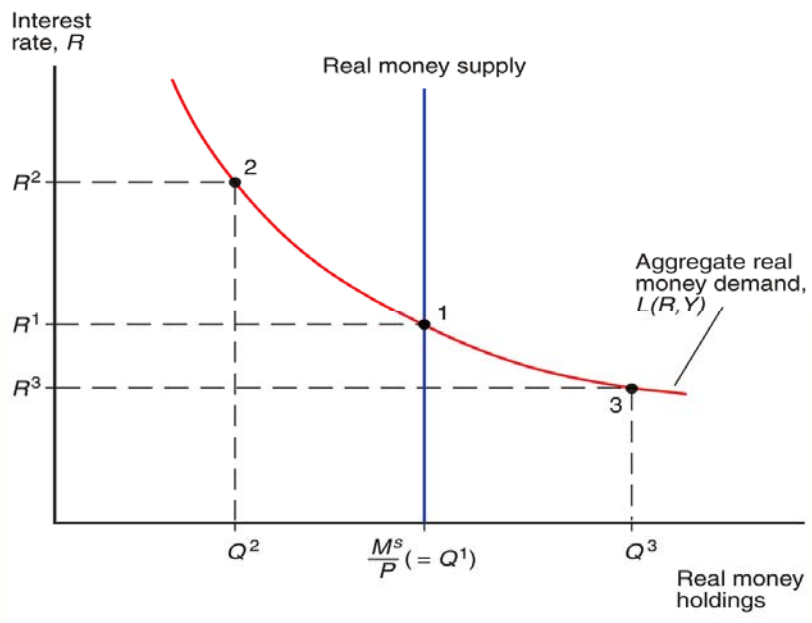
- When there is an excess demand for money, there is an excess supply of interest bearing assets.
  - People who desire money but do not have access to it are willing to sell assets with a higher interest rate in return for the money balances that they desire.
  - Those with money balances are more willing to give them up in return for interest bearing assets as the interest rate on these assets rises and as the opportunity cost of holding money (the interest rate) rises.

Money Market Equilibrium

Figure 14-3

Determination of the Equilibrium Interest Rate

With P and Y given and a real money supply of M^s/P, money market equilibrium is at point 1. At this point aggregate real money demand and the real money supply are equal and the equilibrium interest rate is R^1.



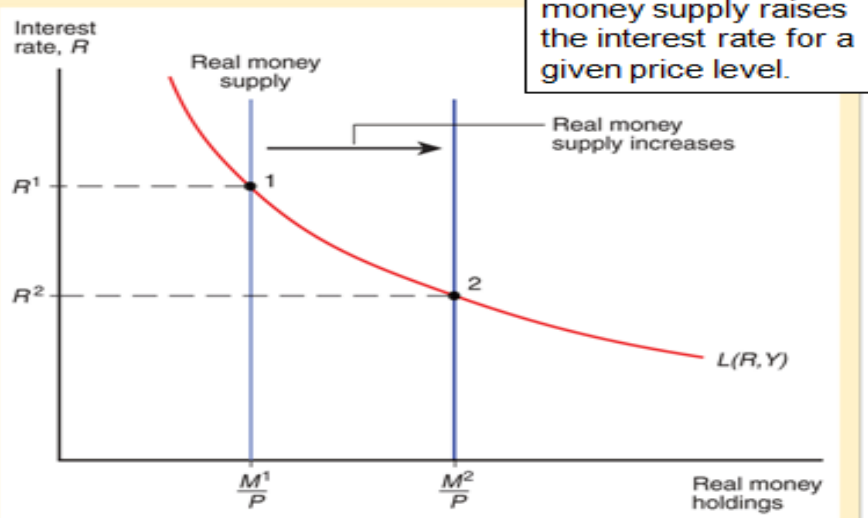
Changes in the Money Supply

Figure 14-4

Effect of an Increase in the Money Supply on the Interest Rate

For a given price level, P, and real income level, Y, an increase in the money supply from M^1 to M^2 reduces the interest rate from R^1 (point 1) to R^2 (point 2).

An increase in the money supply lowers the interest rate for a given price level.



A decrease in the money supply raises the interest rate for a given price level.

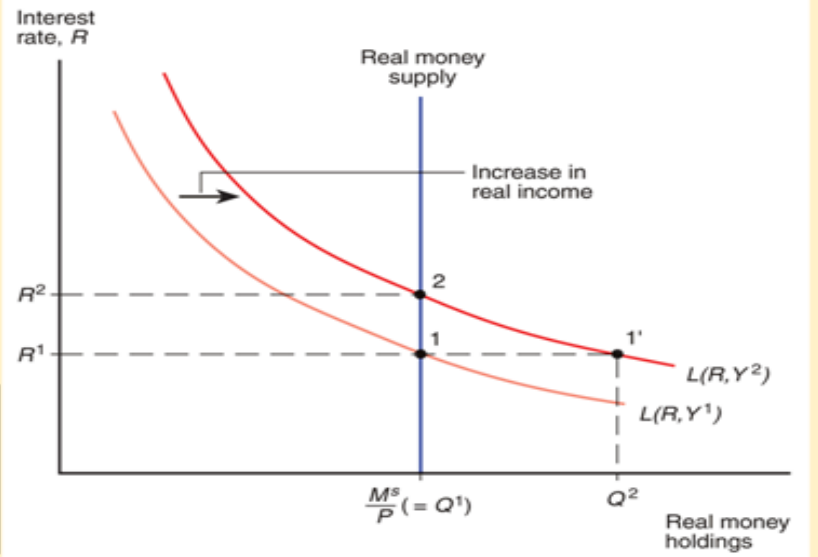
Changes in National Income

Figure 14-5

Effect on the Interest Rate of a Rise in Real Income

Given the real money supply, $M^s/P(= Q^1)$, a rise in real income from Y^1 to Y^2 raises the interest rate from R^1 (point 1) to R^2 (point 2).

An increase in national income increases equilibrium interest rates for a given price level.

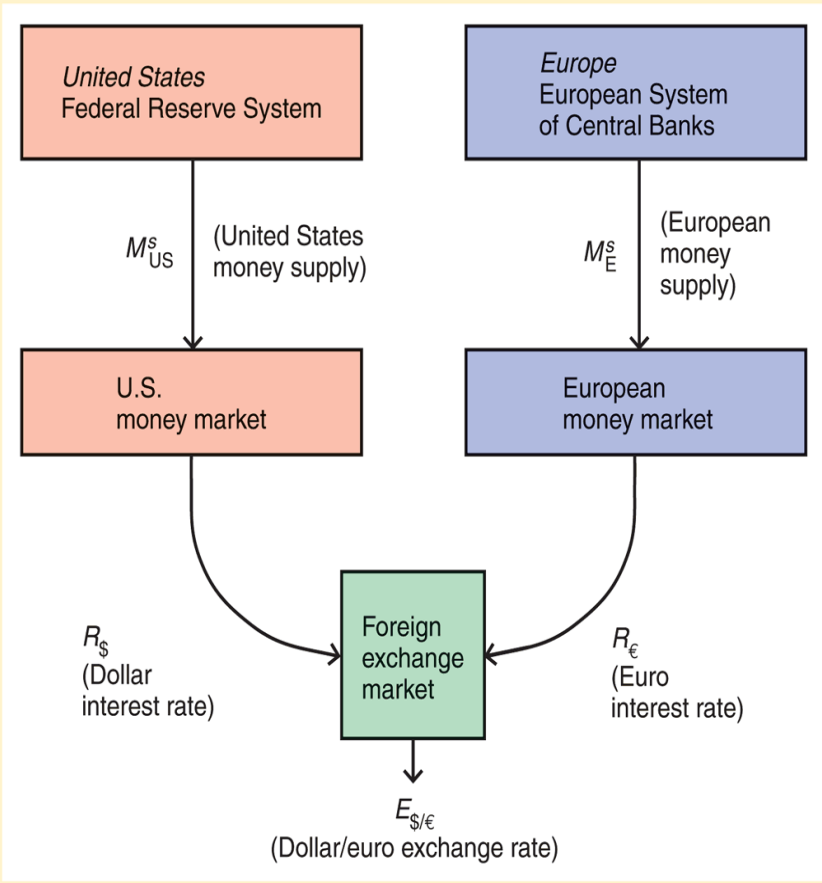


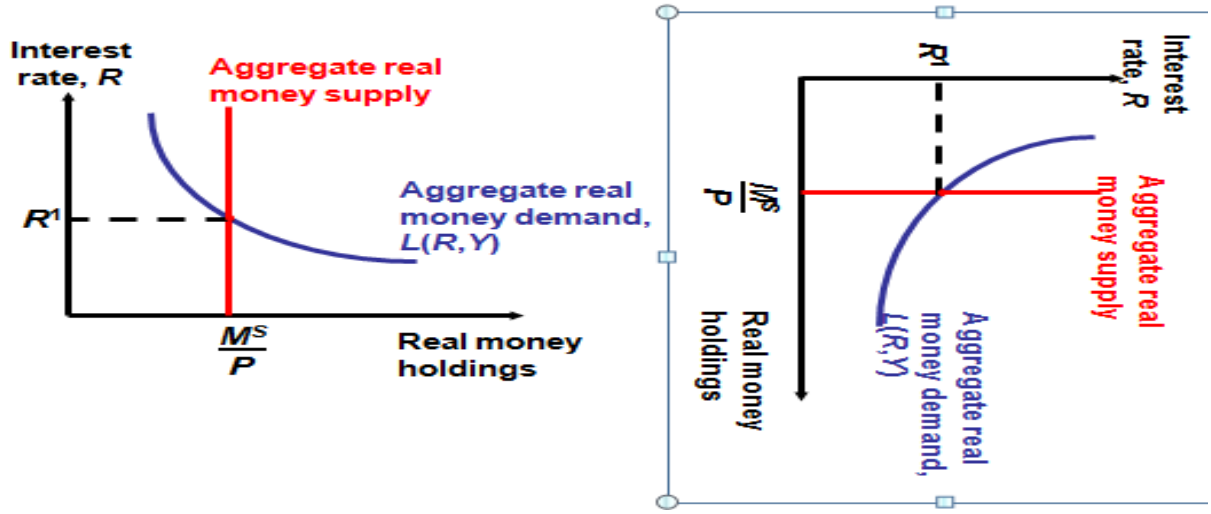
Linking the Money Market to the Foreign Exchange Market

Figure 14-7

Money Market/Exchange Rate Linkages

Monetary policy actions by the Fed affect the U.S. interest rate, changing the dollar/euro exchange rate that clears the foreign exchange market. The ESCB can affect the exchange rate by changing the European money supply and interest rate.





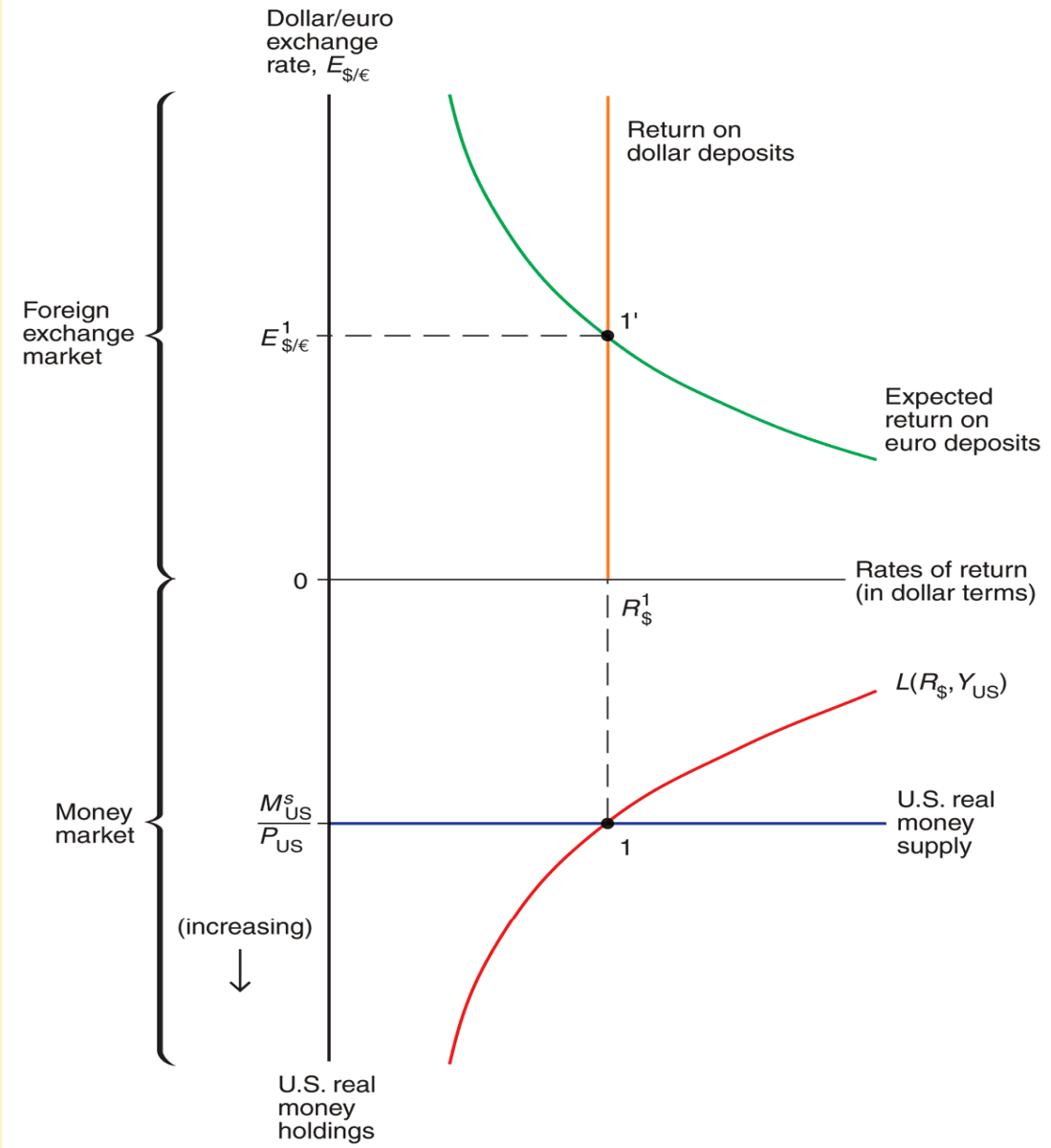


Figure 14-6

Simultaneous Equilibrium in the U.S. Money Market and the Foreign Exchange Market

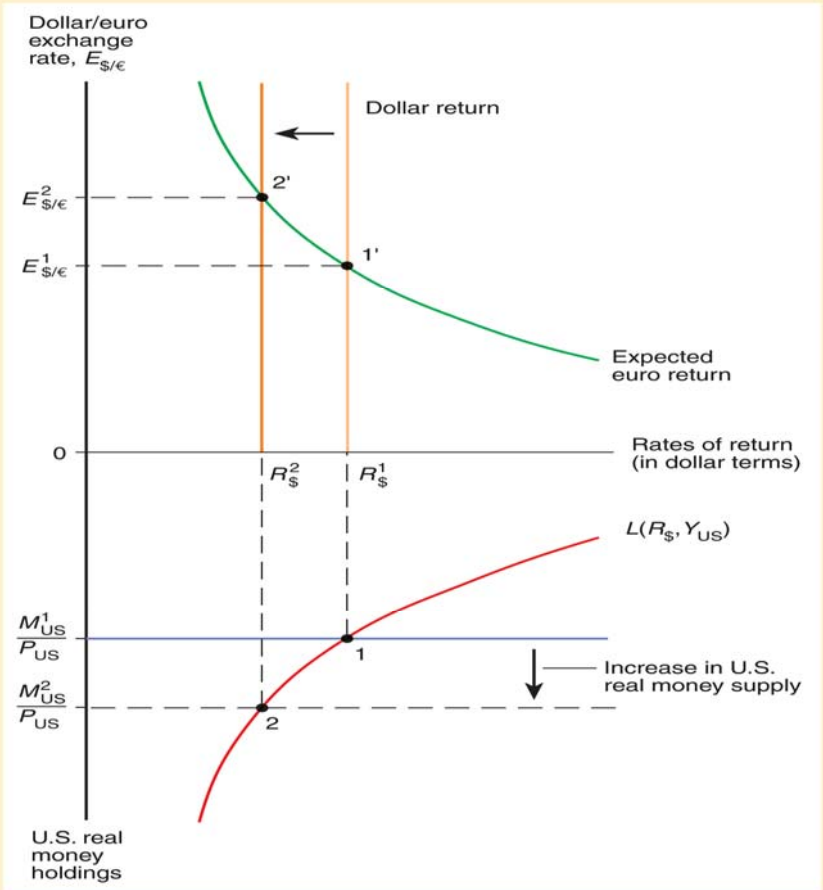
Both asset markets are in equilibrium at the interest rate $R^1_\$$ and exchange rate $E^1_{\$/€}$; at these values money supply equals money demand (point 1) and the interest parity condition holds (point 1′).

Changes in the Domestic Money Supply

Figure 14-8

Effect on the Dollar/Euro Exchange Rate and Dollar Interest Rate of an Increase in the U.S. Money Supply

Given P_{US} and Y_{US}, when the money supply rises from M^1_{US} to M^2_{US}, the dollar interest rate declines (as money market equilibrium is reestablished at point 2) and the dollar depreciates against the euro (as foreign exchange market equilibrium is reestablished at point 2′).



Changes in the Money Supply

- An increase in a country's money supply causes its currency to depreciate.
- A decrease in a country's money supply causes its currency to appreciate.

Changes in the Foreign Money Supply

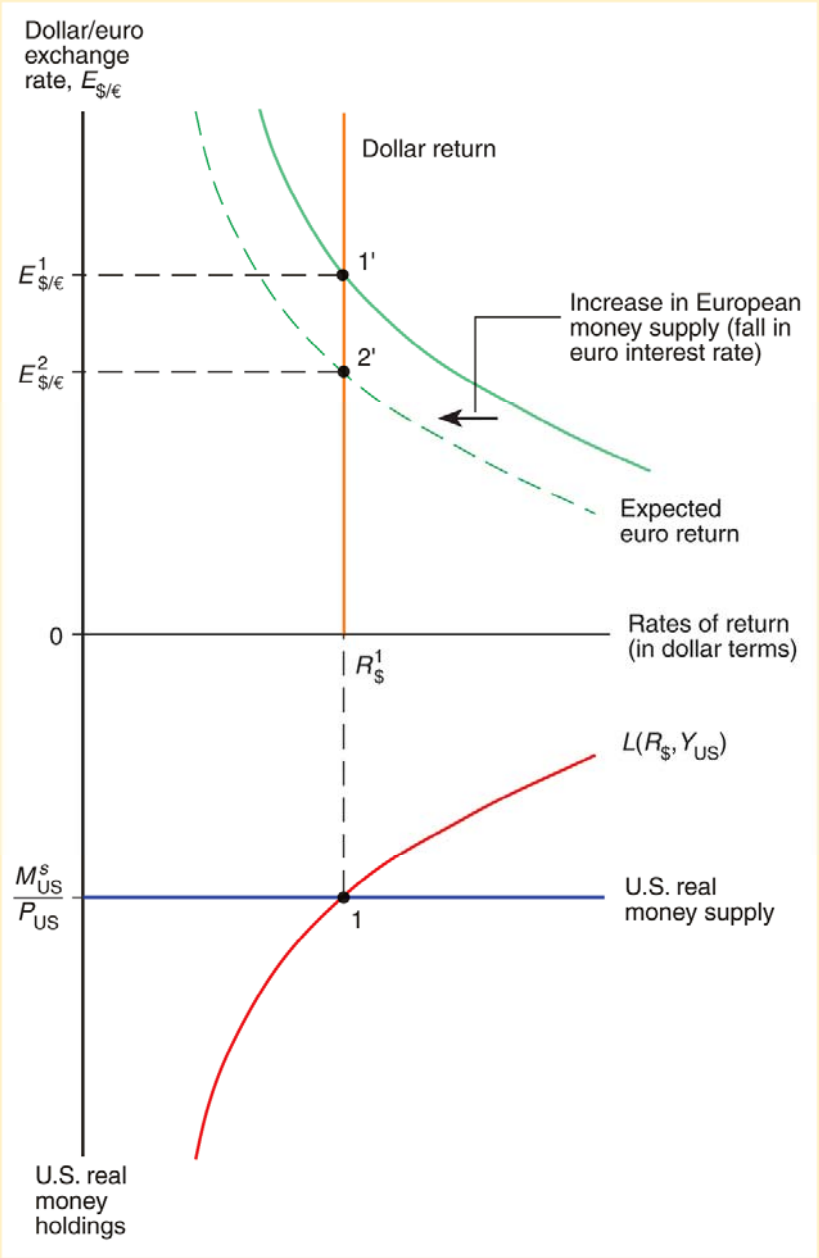
- How would a change in the euro money supply affect the US money market and foreign exchange market?
- An increase in the EU money supply causes a depreciation of the euro (appreciation of the dollar).

- A decrease in the EU money supply causes an appreciation of the euro (a depreciation of the dollar).

Figure 14-9

Effect of an Increase in the European Money Supply on the Dollar/Euro Exchange Rate

By lowering the dollar return on euro deposits (shown as a leftward shift in the expected euro return curve), an increase in Europe's money supply causes the dollar to appreciate against the euro. Equilibrium in the foreign exchange market shifts from point 1′ to point 2′, but equilibrium in the U.S. money market remains at point 1.



- The increase in the EU money supply reduces interest rates in the EU, reducing the expected return on euro deposits.
- This reduction in the expected return on euro deposits leads to a depreciation of the euro.

- The change in the EU money supply does not change the US money market equilibrium.

Long Run and Short Run

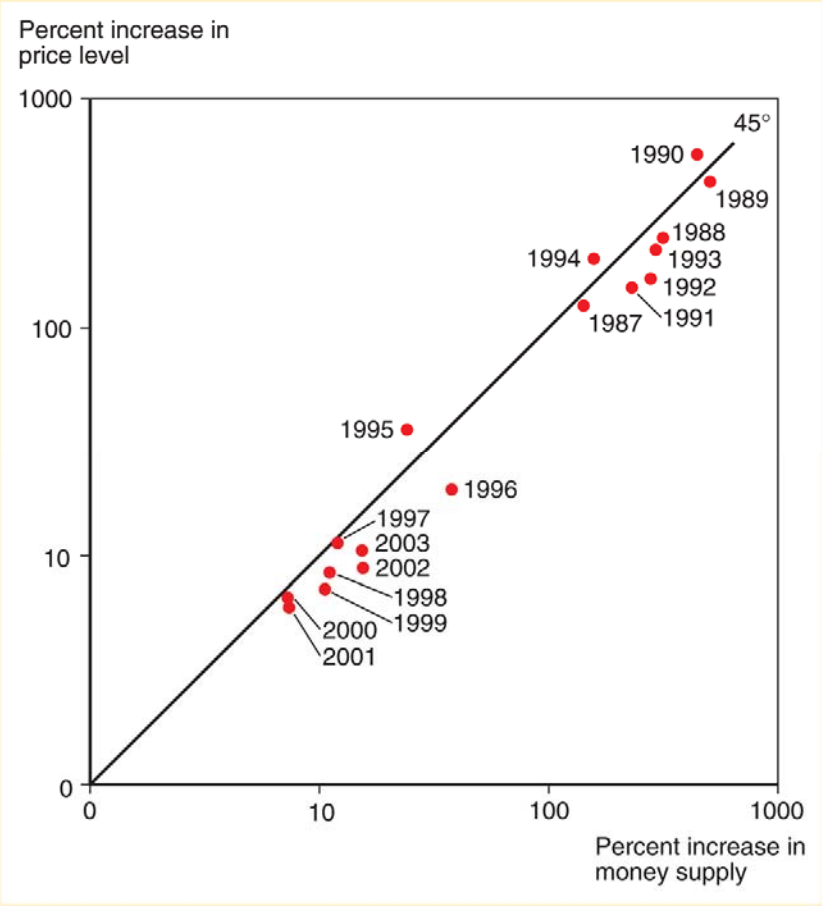
- In the *short run*, the price level is fixed at some level.
  - ❑ the analysis heretofore has been a short run analysis.
- In the *long run*, prices of factors of production and of output are allowed to adjust to demand and supply in their respective markets.
  - ❑ Wages adjust to the demand and supply of labor.
  - ❑ Real output and income are determined by the amount of workers and other factors of production—by the economy's productive capacity—not by the supply of money.
  - ❑ The interest rate depends on the supply of saving and the demand for saving in the economy and the inflation rate—and thus is also independent of the money supply *level*.
- In the long run, the level of the money supply does not influence the amount of real output nor the interest rate.
- But in the long run, prices of output and inputs *adjust proportionally* to changes in the money supply:
  - ❑ Long run equilibrium: $M^s/P = L(R,Y)$
  - ❑ $M^s = P \times L(R,Y)$
  - ❑ increases in the money supply are matched by proportional increases in the price level.
- In the long run, there is a direct relationship between the inflation rate and changes in the money supply.
  - ❑ $M^s = P \times L(R,Y)$
  - ❑ $P = M^s/L(R,Y)$
  - ❑ $\Delta P/P = \Delta M^s/M^s - \Delta L/L$
  - ❑ The inflation rate equals growth rate in money supply minus the growth rate for money demand.

Figure 14-10

Average Money Growth and Inflation in Western Hemisphere Developing Countries, by Year, 1987–2003

Even year by year, there is a strong positive relation between average Latin American money supply growth and inflation. (Both axes have logarithmic scales.)

Source: IMF, *World Economic Outlook,* various issues. Regional aggregates are weighted by shares of dollar GDP in total regional dollar GDP.



Money and Prices in the Long Run

- How does a change in the money supply cause prices of output and inputs to change?

1. **Excess demand**: an increase in the money supply implies that people have more funds available to pay for goods and services.
   - ❑ To meet strong demand, producers hire more workers, creating a strong demand for labor, or make existing employees work harder.
   - ❑ Wages rise to attract more workers or to compensate workers for overtime.
   - ❑ Prices of output will eventually rise to compensate for higher costs.

- ❑ Alternatively, for a fixed amount of output and inputs, producers can charge higher prices and still sell all of their output due to the strong demand.

2. **Inflationary expectations**:
   - ❑ If workers expect future prices to rise due to an expected money supply increase, they will want to be compensated.
   - ❑ And if producers expect the same, they are more willing to raise wages.
   - ❑ Producers will be able to match higher costs if they expect to raise prices.
   - ❑ Result: expectations about inflation caused by an expected money supply increase leads to actual inflation.

Money, Prices and the Exchange Rates and Expectations

- When we consider price changes in the long run, inflationary expectations will have an effect in the foreign exchange market.
- Suppose that expectations about inflation change as people change their minds, but actual adjustment of prices occurs afterwards.

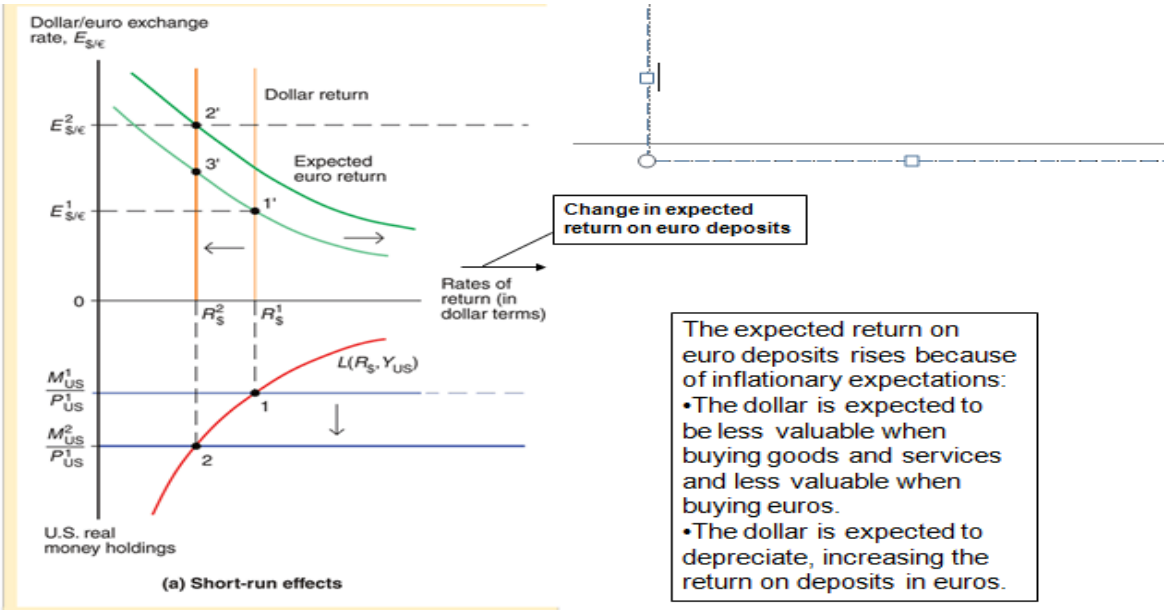
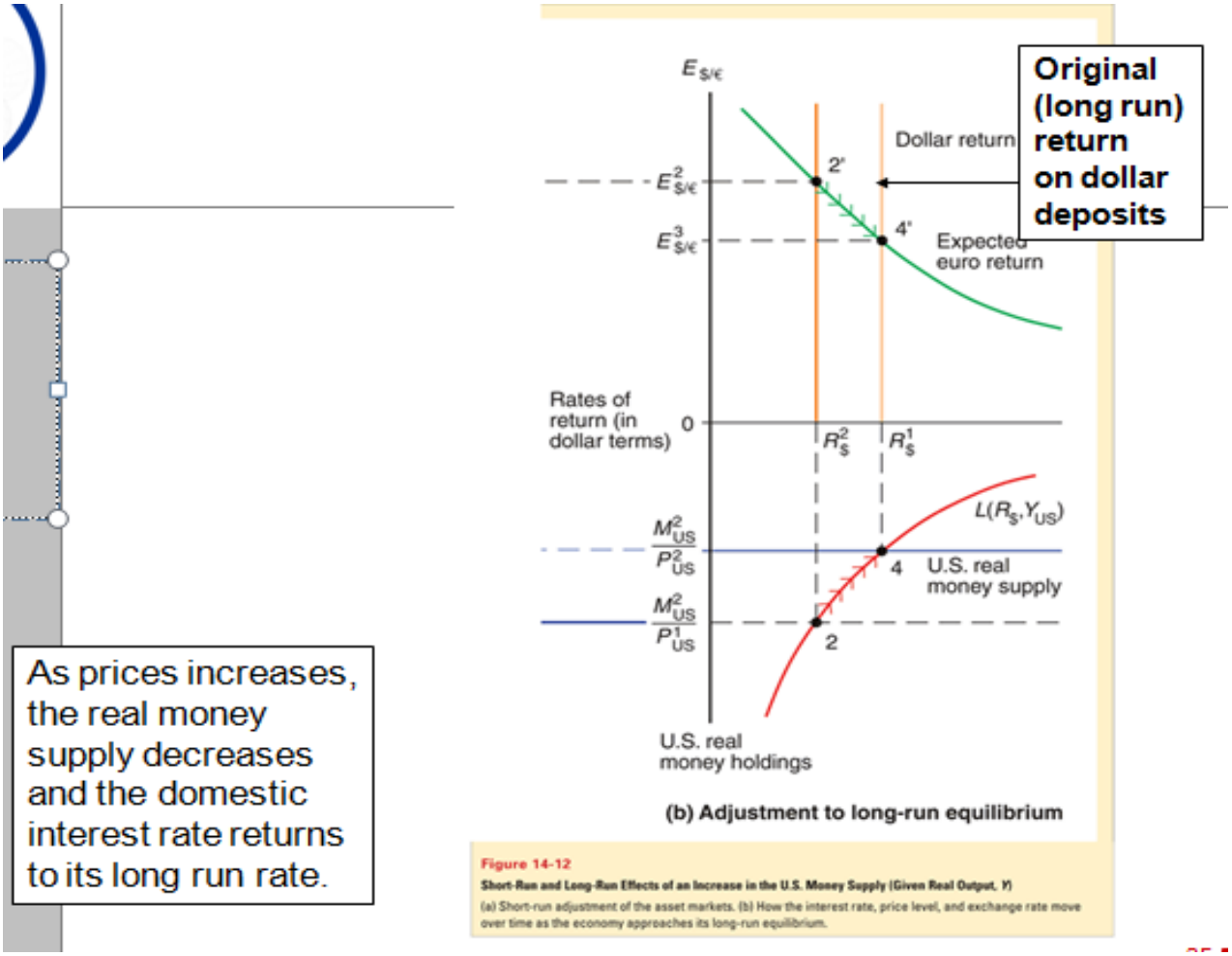


Figure 14-12
Short-Run and Long-Run Effects of an Increase in the U.S. Money Supply (Given Real Output, Y)
(a) Short-run adjustment of the asset markets. (b) How the interest rate, price level, and exchange rate move over time as the economy approaches its long-run equilibrium.

Money, Prices and the Exchange Rates in the Long Run



- A permanent increase in a country's money supply causes a proportional long run depreciation of its currency.
  - ❑ However, the dynamics of the model predict a large depreciation first and a smaller *subsequent appreciation*.
- A permanent decrease in a country's money supply causes a proportional long run appreciation of its currency.
  - ❑ However, the dynamics of the model predict a large appreciation first and a smaller *subsequent depreciation*.

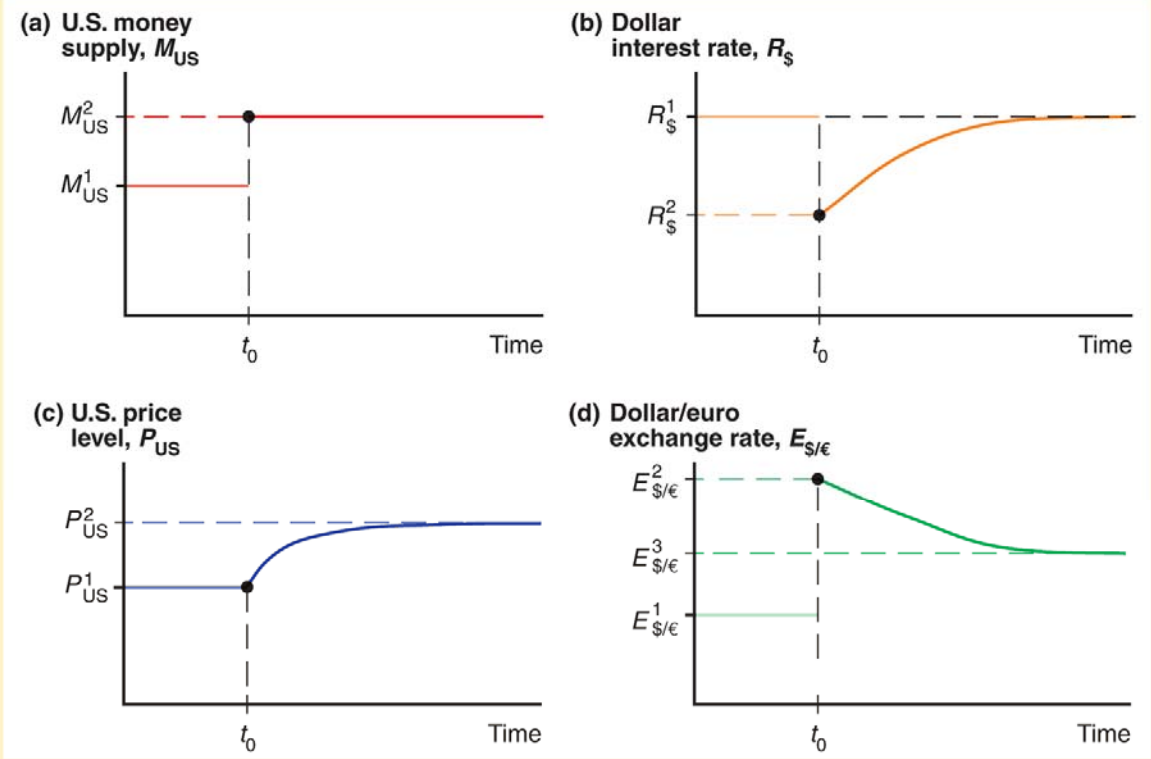


Figure 14-13

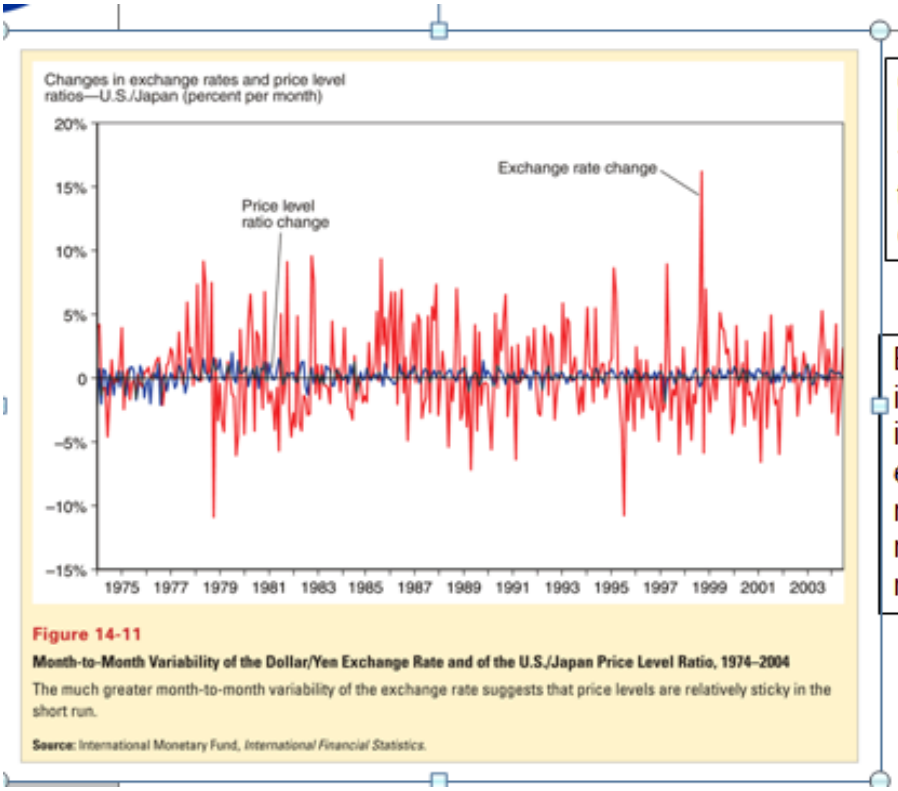
Time Paths of U.S. Economic Variables After a Permanent Increase in the U.S. Money Supply

After the money supply increases at t_0 in panel (a), the interest rate (in panel (b)), price level (in panel (c)), and exchange rate (in panel (d)) move as shown toward their long-run levels. As indicated in panel (d) by the initial jump from $E^1_{\$/€}$ to $E^2_{\$/€}$, the exchange rate overshoots in the short run before settling down to its long-run level, $E^3_{\$/€}$.

Exchange Rate Overshooting

- The exchange rate is said to **overshoot** when its immediate response to a change is greater than its long run response.
  - ❑ We assume that changes in the money supply have immediate effects on interest rates and exchange rates.
  - ❑ We assume that people change their expectations about inflation immediately after a change in the money supply.
- Overshooting helps explain why exchange rates are so *volatile*.
- Overshooting occurs in the model because prices do not adjust quickly, but expectations about prices do.

Exchange Rate Volatility



Summary

1. Money demand on an individual level is determined by interest rates and liquidity, the latter of which is influenced by prices and income.
2. Money demand on an aggregate level is determined by interest rates, the price level and national income.
    - ❑ Aggregate real money demand depends negatively on the interest rate and positively on real national income.
3. Money supply equals money demand—or real money supply equals real money demand—at the equilibrium interest rate in the money market.
4. Short run scenario: changes in the money supply affect the domestic interest rate, as well as the exchange rate.
    - ❑ An increase in the domestic money supply
    - ❑ lowers the domestic interest rate,

- ❑ lowering the rate of return on domestic deposits,
- ❑ causing the domestic currency to depreciate.

5. Long run scenario: changes in the level of the money supply are matched by a proportional change in prices, and do not affect real income and interest rates.
   - ❑ An increase in the money supply
   - ❑ causes expectations about inflation to adjust,
   - ❑ causing the domestic currency to depreciate further,
   - ❑ and causes prices to adjust proportionally in the long run,
   - ❑ causing interest rates return to their long run rate,
   - ❑ and causes a proportional long run depreciation in the exchange rate.
6. Expectations about inflation adjust quickly, but prices adjust only in the long run, which results in overshooting of exchange rate.
   - ❑ Overshooting occurs when the immediate response of the exchange rate due to a change is greater than its long run response.
   - ❑ Overshooting helps explain why exchange rates are so volatile.

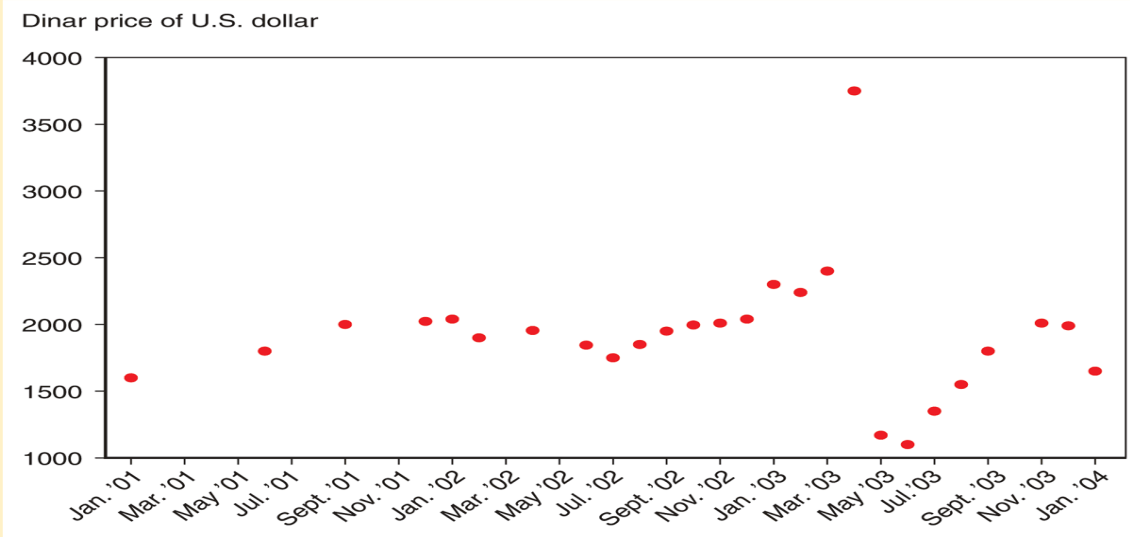


Figure 14-14

The Iraq War and the Exchange Rate of the Dinar

Iraq's dinar appreciated sharply after the first phase of the war ended in the spring of 2003.

Source: United Nations.

Chapter 15

Price Levels and the Exchange Rate in the Long Run

Preview

- Law of one price
- Purchasing power parity
- Long run model of exchange rates: monetary approach
- Relationship between interest rates and inflation: Fisher effect
- Shortcomings of purchasing power parity
- Long run model of exchange rates: real exchange rate approach
- Real interest rates

The Behavior of Exchange Rates

- What models can predict how exchange rates behave?
  - ❑ In last chapter we developed a short run model and a long run model that used movements in the money supply.
  - ❑ In this chapter, we develop 2 more models, building on the long run approach from last chapter.
  - ❑ Long run means that prices of goods and services and factors of production that build those goods and services adjust to supply and demand conditions so that their markets and the money market are in equilibrium.
  - ❑ Because prices are allowed to change, they will influence interest rates and exchange rates in the long run models.
- The long run models are not intended to be completely realistic descriptions about how exchange rates behave, but ways of generalizing how market participants form expectations about future exchange rates.

Law of One Price

- The **law of one price** simply says that the *same* good in different competitive markets must sell for the same price, when transportation costs and barriers between markets are not important.
    - Why? Suppose the price of pizza at one restaurant is $20, while the price of the same pizza at a similar restaurant across the street is $40.
    - What do you predict to happen?
    - Many people would buy the $20 pizza, few would buy the $40.
    - Due to the increased demand, the price of the $20 pizza would tend to increase.
    - Due to the decreased demand, the price of the $40 pizza would tend to decrease.
    - People would have an incentive to adjust their behavior and prices would tend to adjust to reflect this changed behavior until one price is achieved across markets (restaurants).
- Consider a pizza restaurant in Seattle one across the border in Vancouver.
- The law of one price says that the price of the same pizza (using a common currency to measure the price) in the two cities must be the same if barriers between competitive markets and transportation costs are not important:

$P^{pizza}_{US} = (E_{US\$/Canada\$}) \times (P^{pizza}_{Canada})$

P^{pizza}_{US} = price of pizza in Seattle

P^{pizza}_{Canada} = price of pizza in Vancouver

$E_{US\$/Canada\$}$ = US dollar/Canadian dollar exchange rate

Purchasing Power Parity

- **Purchasing power parity** is the application of the law of one price across countries for *all* goods and services, or for representative groups ("baskets") of goods and services.

$P_{US} = (E_{US\$/Canada\$}) \times (P_{Canada})$

P_{US} = price level of goods and services in the US

P_{Canada} = price level of goods and services in Canada

$E_{US\$/Canada\$}$ = US dollar/Canadian dollar exchange rate

- Purchasing power parity implies that

$$E_{US\$/Canada\$} = P_{US}/P_{Canada}$$

  - ❑ The price levels adjust to determine the exchange rate.
  - ❑ If the price level in the US is US$200 per basket, while the price level in Canada is C$400 per basket, PPP implies that the US$/C$ exchange rate should be US$200/C$400 = US$ 1/C$ 2
  - ❑ Purchasing power parity says that each country's currency has the *same purchasing power*: 2 Canadian dollars buy the same amount of goods and services as does 1 US dollar, since prices in Canada are twice as high.

- Purchasing power parity comes in 2 forms:
- **Absolute PPP**: purchasing power parity that has already been discussed. Exchange rates equal price *levels* across countries.

$$E_{\$/€} = P_{US}/P_{EU}$$

- **Relative PPP**: *changes* in exchange rates equal *changes* in prices (inflation) between two periods:

$$(E_{\$/€,t} - E_{\$/€,\,t-1})/E_{\$/€,\,t-1} = \pi_{US,\,t} - \pi_{EU,\,t}$$

where π_t = inflation rate from period *t-1* to *t*

Monetary Approach to Exchange Rates

- **Monetary approach to the exchange rate***:* uses monetary factors to predict how exchange rates adjust in the long run.
  - ❑ It uses the absolute version of PPP.
  - ❑ It assumes that prices adjust in the long run.
  - ❑ In particular, price levels adjust to equate real (aggregate) money supply with real (aggregate) money demand. This implies:

$$P_{US} = M^{s}_{US}/L\ (R_{\$},\ Y_{US})$$

$$P_{EU} = M^{s}_{EU}/L\ (R_{€},\ Y_{EU})$$

- To the degree that PPP holds and to the degree that prices adjust to equate real money supply with real money demand, we have the following prediction:
- The exchange rate is determined in the long run by prices, which are determined by the relative supply of money across countries and the relative real demand of money across countries.

Predictions about changes in:

1. *Money supply*: a permanent rise in the domestic money supply
   - ❑ causes a proportional increase in the domestic price level,
   - ❑ causing a proportional depreciation in the domestic currency (through PPP).
   - ❑ same prediction as long run model without PPP
2. *Interest rates*: a rise in the domestic interest rate
   - ❑ lowers domestic money demand,
   - ❑ increasing the domestic price level,
   - ❑ causing a proportional *depreciation* of the domestic currency (through PPP).
3. *Output level*: a rise in the domestic output level
   - ❑ raises domestic money demand,
   - ❑ decreasing the domestic price level,
   - ❑ causing a proportional appreciation of the domestic currency (through PPP).

- All 3 changes affect money supply or money demand, thereby causing prices to adjust to maintain equilibrium in the money market, thereby causing exchange rates to adjust to maintain PPP.
- A change in the *level* of the money supply results in a change in the price *level*.

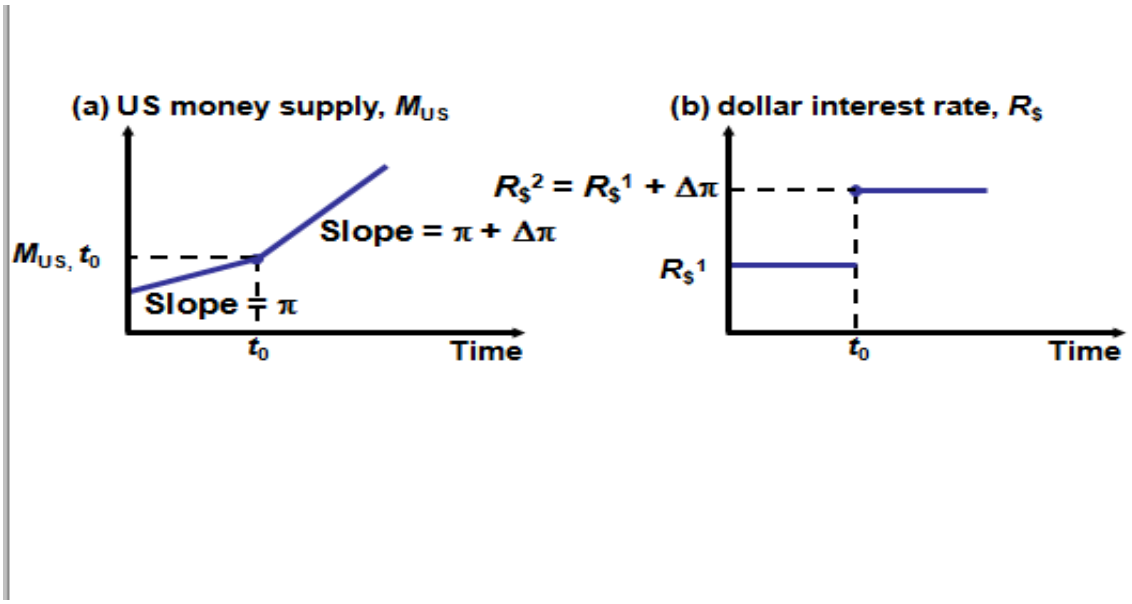
- A change in the money supply *growth rate* results in a change in the *growth rate* of prices (inflation).
    - Other things equal, a constant growth rate in the money supply results in a persistent growth rate in prices (persistent inflation) at the same constant rate.
    - Inflation does not affect the productive capacity of the economy and real income from production in the long run.
    - Inflation, however, does affect nominal interest rates. How?

The Fisher Effect

- The **Fisher effect** (named affect Irving Fisher) describes the relationship between nominal interest rates and inflation.
    - ❑ Derive the Fisher effect from the interest parity condition: $R_{\$} - R_{€} = (E^{e}_{\$/€} - E_{\$/€})/E_{\$/€}$
    - ❑ If financial markets expect (relative) PPP to hold, then expected exchange rate changes will equal expected inflation between countries: $(E^{e}_{\$/€} - E_{\$/€})/E_{\$/€} = \pi^{e}_{US} - \pi^{e}_{EU}$
    - ❑ $R_{\$} - R_{€} = \pi^{e}_{US} - \pi^{e}_{EU}$
    - ❑ The Fisher effect: a rise in the domestic inflation rate causes an equal rise in the interest rate on deposits of domestic currency in the long run, with other things constant.

Monetary Approach to Exchange Rates

- Suppose that the Federal Reserve unexpectedly increases the money supply growth rate at time t_0.
- Suppose also that the inflation rate is π in the US before t_0 and $\pi + \Delta\pi$ after this time. Suppose inflation is consistently 0% in Europe.
- The interest rate adjusts according to the Fisher effect to reflect this higher inflation rate.



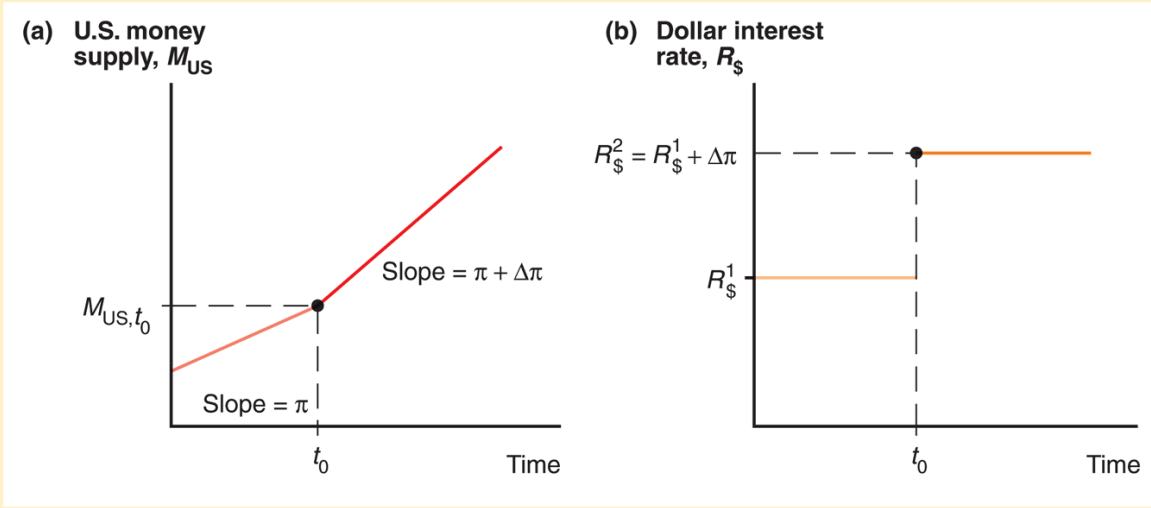
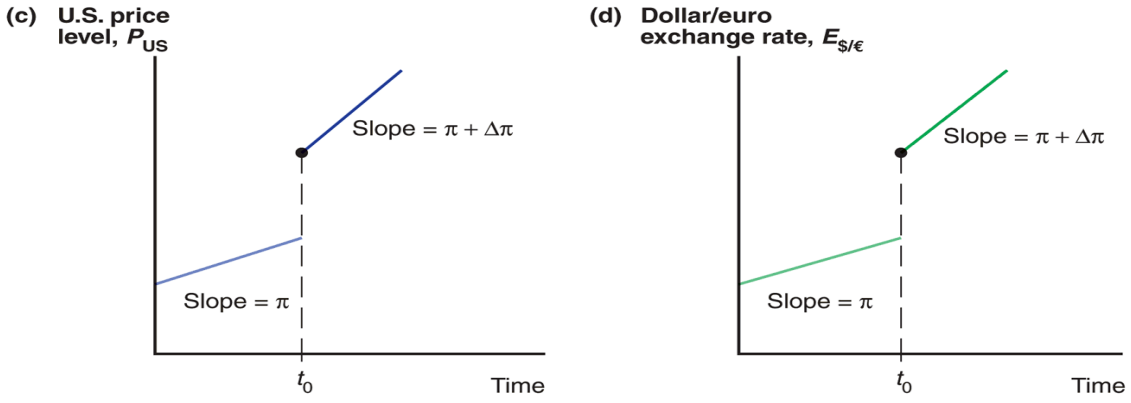


Figure 15-1

Long-Run Time Paths of U.S. Economic Variables After a Permanent Increase in the Growth Rate of the U.S. Money Supply

After the money supply growth rate increases at time t_0 in panel (a), the interest rate (in panel (b)), price level (in panel (c)), and exchange rate (in panel (d)) move to new long-run equilibrium paths. (The money supply, price level, and exchange rate are all measured on a *natural logarithmic* scale, which makes variables that change at constant proportional rates appear as straight lines when they are graphed against time. The slope of the line equals the variable's proportional growth rate.)



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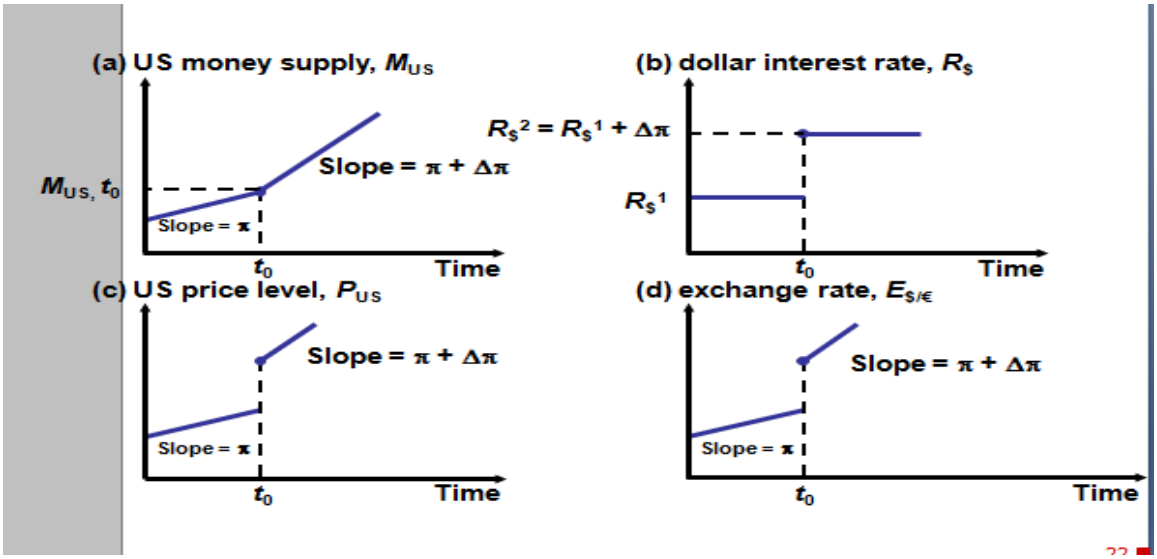
- The increase in nominal interest rates decreases real money demand.
- To maintain equilibrium in the money market, prices must jump so that $P_{US} = M^s_{US}/L\,(R_\$, Y_{US})$.
- To maintain PPP, the exchange rate will then jump (the dollar will depreciate): $E_{\$/€} = P_{US}/P_{EU}$
- Thereafter, the money supply and prices grow at rate $\pi + \Delta\pi$ and the domestic currency depreciates at the same rate.



The Role of Inflation and Expectations

In the model long run model without PPP,

- changes in money supply *levels* lead to changes in price *levels*.
- There is no inflation in the long run, but only during the transition to the long run equilibrium.
- During the transition, inflation causes the nominal interest rate to increase to its long run rate.
- *Expectations of inflation* cause the expected return on foreign currency to increase, making the domestic currency *depreciate* before the transition period.
- In the monetary approach (with PPP), the rate of inflation increases permanently because the *growth rate* of the money supply increases permanently.
- With persistent inflation (above foreign inflation), the monetary approach also predicts an increase in the nominal interest rate.
- *Expectations of higher domestic inflation* cause the purchasing power of foreign currency to increase relative to the purchasing power of domestic currency, thereby making the domestic currency *depreciate*.
- In the long run model without PPP, expectations of inflation cause the exchange rate to overshoot (cause the domestic currency to depreciate more than) its long run value.
- In the monetary approach (with PPP), the price level adjusts with expectations of inflation, causing the domestic currency to depreciate, but with no overshooting.

Shortcomings of PPP

- There is little empirical support for purchasing power parity.

- ❑ The prices of identical commodity baskets, when converted to a single currency, differ substantially across countries.

- Relative PPP is more consistent with data, but it also performs poorly to predict exchange rates.

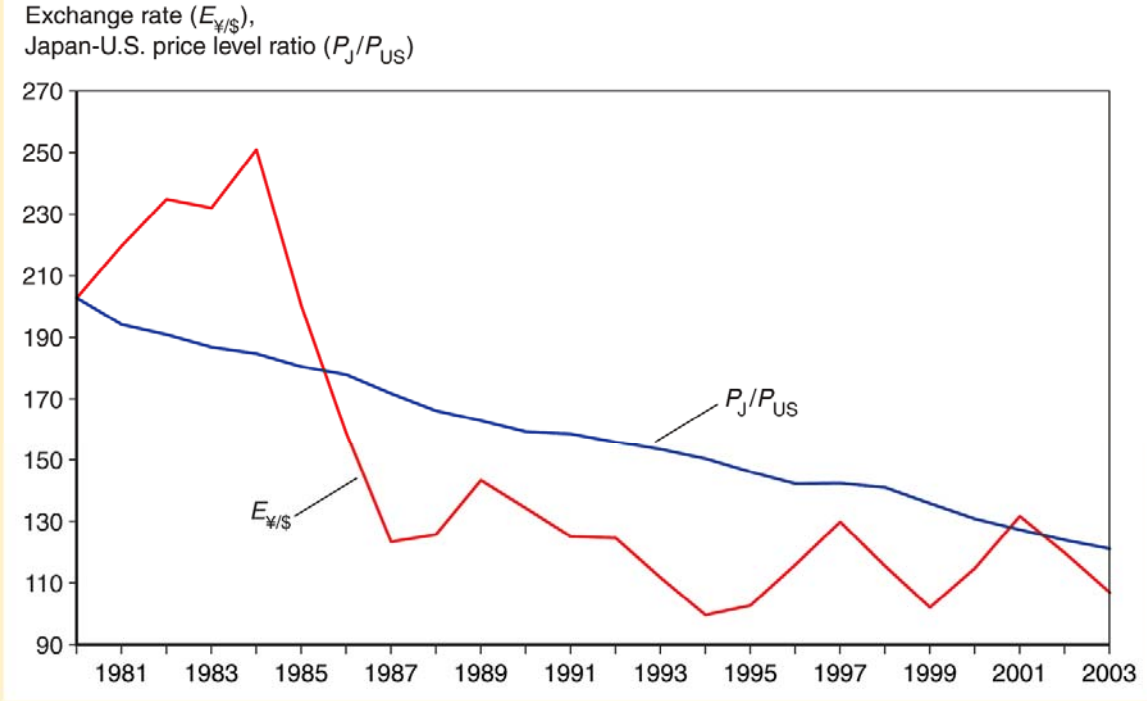


Figure 15-2

The Yen/Dollar Exchange Rate and Relative Japan-U.S. Price Levels, 1980–2003

The graph shows that relative PPP did not explain the yen/dollar exchange rate after 1980.

Source: IMF, *International Financial Statistics*. Exchange rates and price levels are end-of-year data.

Reasons why PPP may not be a good theory:

1. Trade barriers and non-tradable goods and services
2. Imperfect competition
3. Differences in price level measures
4. **Trade barriers and non-tradables**
    1. Transport costs and governmental trade restrictions make trade expensive and in some cases create non-tradable goods or services.
    2. Services are often not tradable: services are generally offered within a limited geographic region (e.g., haircuts).

3. The greater the transport costs, the greater the range over which the exchange rate can deviate from its PPP value.
4. One price need not hold in two markets.

5. **Imperfect competition** may result in price discrimination: "pricing to market".
    1. A firm sells the same product for different prices in different markets to maximize profits, based on expectations about what consumers are willing to pay.
6. **Differences in price level measures**
    1. price levels differ across countries because of the way representative groups ("baskets") of goods and services are measured.
    2. Because measures of goods and services are different, the measure of their prices need not be the same.

The Real Exchange Rate Approach to Exchange Rates

- Because of the shortcomings of PPP, economists have tried to generalize the monetary approach to PPP.
- The **real exchange rate** is the *rate of exchange for real goods and ervices* across countries.
- In other words, it is the relative value/price/cost of goods and services across countries.
- It is the dollar price of a European group of goods and services relative to the dollar price of a American group of goods and services:

$$q_{US/EU} = (E_{\$/€} \text{ x } P_{EU})/P_{US}$$

$$q_{US/EU} = (E_{\$/€} \text{ x } P_{EU})/P_{US}$$

    - If the EU basket costs €100, the US basket costs $120 and the nominal exchange rate is $1.20 per euro, then the real exchange rate is 1 US basket per EU basket.

- ❑ A real depreciation of the value of US goods means a fall in a dollar's purchasing power of EU products relative to a dollar's purchasing power of US products.
- ❑ This implies that US goods become less expensive and less valuable relative to the EU goods.
- ❑ This implies that the value of US goods relative to value of EU goods falls.

$$q_{US/EU} = (E_{\$/€} \text{ x } P_{EU})/P_{US}$$

- ❑ A real appreciation of the value of US goods means a rise in a dollar's purchasing power of EU products relative to a dollar's purchasing power of US products.
- ❑ This implies that US goods become more expensive and more valuable relative to EU goods.
- ❑ This implies that the value of US goods relative to value of EU goods rises.

- According to PPP, exchange rates are determined by relative price ratios:

$$E_{\$/€} = P_{US}/P_{EU}$$

- According to the more general real exchange rate approach, exchange rates may also be influenced by the real exchange rate:

$$E_{\$/€} = q_{US/EU} \text{ x } P_{US}/P_{EU}$$

- What influences the real exchange rate?
- A **change in relative demand** for US products
  - An increase in relative demand for US output causes the value (price) of US goods relative to the value (price) of foreign goods to rise.
  - A real appreciation of the value of US goods: P_{US} rises relative to $E_{\$/€} \text{ x } P_{EU}$

- The real appreciation of the value of US goods makes US exports more expensive and imports into the US less expensive, thereby reducing relative quantity demanded.
- A decrease in relative demand for US output leads to a real depreciation of the value of US goods.

- A **change in relative supply** of US products
  - An increase in relative supply for US output (caused by an increase in US productivity) causes the price/cost of US goods relative to the price/cost of foreign goods to fall.
  - A real depreciation of the value of US goods: P_{US} falls relative to $E_{\$/€}$ x P_{EU}
  - The real depreciation of the value of US goods makes US exports less expensive and imports into the US more expensive, thereby increasing relative demand to match increased relative supply.
  - A decrease in relative supply for US output leads to a real appreciation of the value of US goods.

Determining the Long Run Real Exchange Rate

In the long run, the supply of goods and services in each country depends on factors of production like labor, capital and technology—not prices or exchange rates.

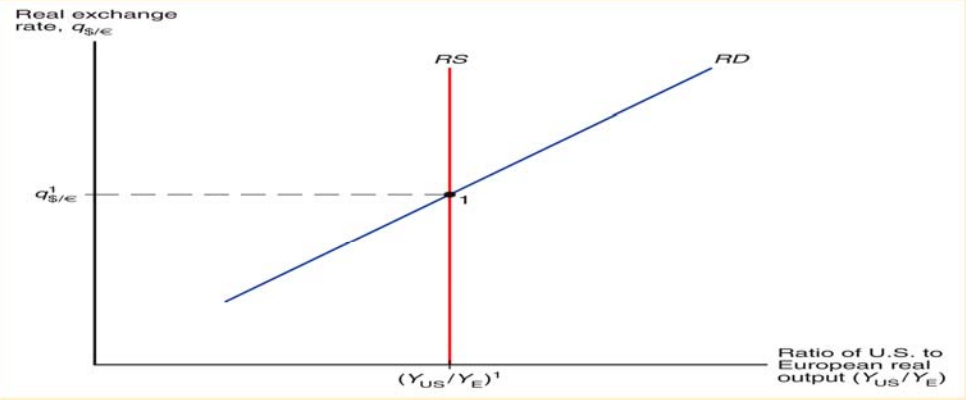


Figure 15-4
Determination of the Long-Run Real Exchange Rate
The long-run equilibrium real exchange rate equates world relative demand to the full-employment level of relative supply.

The demand for US products relative to the demand for EU products depends on the relative price of these products, or the real exchange rate. When the real exchange rate, $q_{US/EU} = (E_{\$/€}P_{EU})/P_{US}$ is high, the relative demand for US products is high.

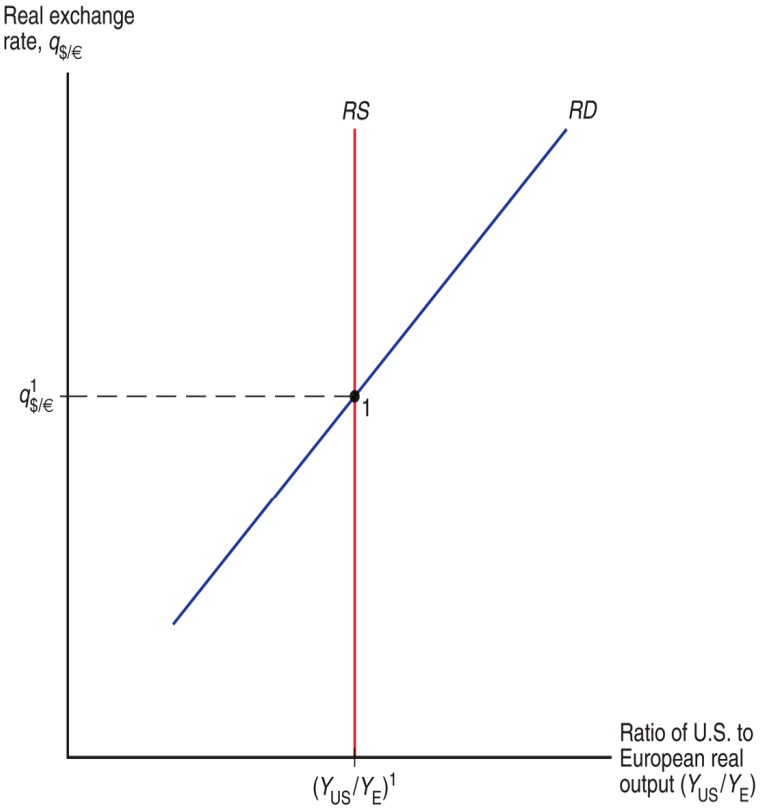


Figure 15-4

Determination of the Long-Run Real Exchange Rate

The long-run equilibrium real exchange rate equates world relative demand to the full-employment level of relative supply.

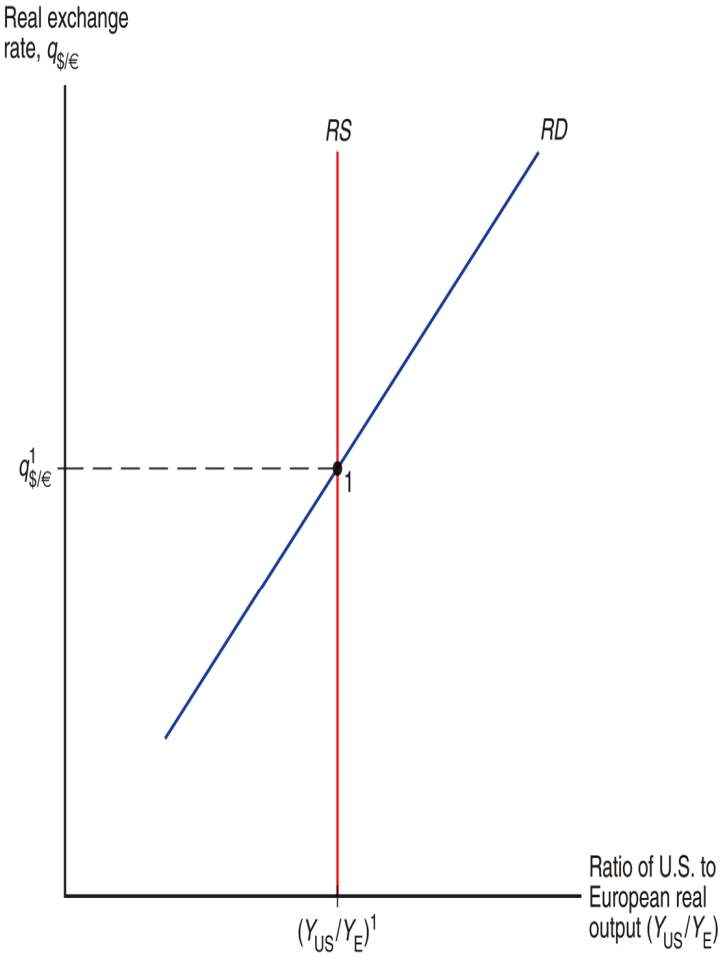


Figure 15-4

Determination of the Long-Run Real Exchange Rate

The long-run equilibrium real exchange rate equates world relative demand to the full-employment level of relative supply.

When the relative supply of US products matches the relative demand for US products, there is no tendency for the price of US products relative to EU products to change.

The Real Exchange Rate Approach to Exchange Rates

- The real exchange rate is a more general approach to explain exchange rates. Both monetary factors and real factors influence nominal exchange rates:

1a. changes in *monetary levels*, leading to temporary inflation and changes in expectations about inflation.

1b. changes in *monetary growth rates*, leading to persistent inflation and changes in expectations about inflation.

2a.changes in *relative demand*: increase in relative demand for domestic products leads to a real appreciation.

2b. changes in *relative supply*: increase in relative supply for domestic products leads to a real depreciation.

- What are the effects on the nominal exchange rate?

$$E_{\$/€} = q_{US/EU} \text{ x } P_{US}/P_{EU}$$

- When only monetary factors change and PPP holds, we have the same predictions as before.
  - ❑ no changes in the real exchange rate occurs
- When factors influencing real output change, the real exchange rate changes.
  - ❑ With an increase in relative demand for domestic products, the real exchange rate adjusts to determine nominal exchange rates.
  - ❑ With an increase in relative supply of domestic products, the situation is more complex…
- With an increase in the relative supply of domestic products, the real exchange rate adjusts to make the price/cost of domestic goods depreciate, but also the relative amount of domestic output increases.
  - ❑ This second effect increases the real money demand in the domestic economy relative to that in the foreign economy:

$$P_{US} = M^{s}_{US}/L\ (R_{\$},\ Y_{US})$$

  - ❑ The domestic price level decreases relative to the foreign price level.
  - ❑ The effect on the nominal exchange rate is ambiguous:

$$E_{\$/€} = q_{US/EU} \text{ x } P_{US}/P_{EU}$$

- When economic changes are influenced only by monetary factors, and when the assumptions of PPP hold, nominal exchange rates are determined by PPP.
- When economic changes are caused by factors that affect real output, exchange rates are not determined by PPP only, but are also influenced by the real exchange rate.

Interest Rate Differences

- A more general equation of differences in nominal interest rates across countries can be derived from:

$$(q^e_{US/EU} - q_{US/EU})/q_{US/EU} = [(E^e_{\$/€} - E_{\$/€})/E_{\$/€}] - (\pi^e_{US} - \pi^e_{EU})$$

$$R_{\$} - R_{€} = (E^e_{\$/€} - E_{\$/€})/E_{\$/€}$$

$$R_{\$} - R_{€} = (q^e_{US/EU} - q_{US/EU})/q_{US/EU} + (\pi^e_{US} - \pi^e_{EU})$$

- The difference in nominal interest rates across two countries is now the sum of:
  - ❑ The expected rate of depreciation in the value of domestic goods relative to foreign goods
  - ❑ The expected inflation difference between the domestic economy and the foreign economy

Real Interest Rates

- Real interest rates are inflation-adjusted interest rates:

$$r^e = R - \pi^e$$

- where π^e represents expected inflation and R represents nominal interest rates.
- Real interest rates are measured in terms of real output: what quantity of real goods and services can you earn in the future by saving real resources today?
- What should be the differences in real interest rates across countries?

- Real interest rate differentials are derived from

$$r^e_{US} - r^e_{EU} = (R_{\$} - \pi^e_{US}) - (R_{€} - \pi^e_{EU})$$

$$R_{\$} - R_{€} = (q^e_{US/EU} - q_{US/EU})/q_{US/EU} + (\pi^e_{US} - \pi^e_{EU})$$

$$r^e_{US} - r^e_{EU} = (q^e_{US/EU} - q_{US/EU})/q_{US/EU}$$

- The last equation is called **real interest parity**.
  - ❑ It says that the differences in real interest rates (return on saving in terms of real resources earned) between countries is equal to the expected change in the value/price/cost of goods and services between countries.

Summary

1. The law of one price says that the same good in different competitive markets must sell for the same price, when transportation costs and barriers between markets are not important.
2. Purchasing power parity applies the law of one price for all goods and services among all countries.
   - ❑ Absolute PPP says that currencies of two countries have the same purchasing power.
   - ❑ Relative PPP says that changes in the nominal exchange rate between two countries equals the difference in the inflation rates between the two countries.
3. The monetary approach to exchange rates uses PPP, real money supply and real money demand.
   - ❑ Changes in the growth rate of the money supply influence inflation and exchange rates.
   - ❑ Expectations about inflation influence the exchange rate.
   - ❑ The Fisher effect shows that differences in nominal interest rates are equal to differences in inflation rates.

4. Empirical support for PPP is weak.
    - ❑ Trade barriers, non-tradable products, imperfect competition and differences in price measures may all have effects on the empirical shortcomings of PPP.
5. The real exchange rate approach to exchange rates generalizes the monetary approach.
    - ❑ It defines the real exchange rate as the value/price/cost of domestic products relative to foreign products.
    - ❑ It allows relative demand and relative supply changes to influence real and nominal exchange rates.
    - ❑ Interest rate differences are explained by a more general concept: expected changes in the value of domestic products relative to the value of foreign products plus the difference of inflation rates between the domestic and foreign economies.
6. Real interest rates are inflation-adjusted interest rates.
7. Real interest parity shows that differences in real interest rates between countries equal expected changes in the real value of goods and services between countries.

Law of One Price for Hamburgers?

Big Mac prices (in U.S. dollars)

United States	2.90	Malaysia	1.33
Argentina	1.48	Mexico	2.08
Australia	2.27	New Zealand	2.65
Brazil	1.70	Peru	2.57
Britain	3.37	Philippines	1.23
Canada	2.33	Poland	1.63
Chile	2.18	Russia	1.45
China	1.26	Singapore	1.92
Czech Republic	2.13	South Africa	1.86
Denmark	4.46	South Korea	2.72
Egypt	1.62	Sweden	3.94
Euro Area	3.28	Switzerland	4.90
Hong Kong	1.54	Taiwan	2.24
Hungary	2.52	Thailand	1.45
Indonesia	1.77	Turkey	2.58
Japan	2.33	Venezuela	1.48

Source: *Economist,* May 27, 2004.

Price Levels and Incomes

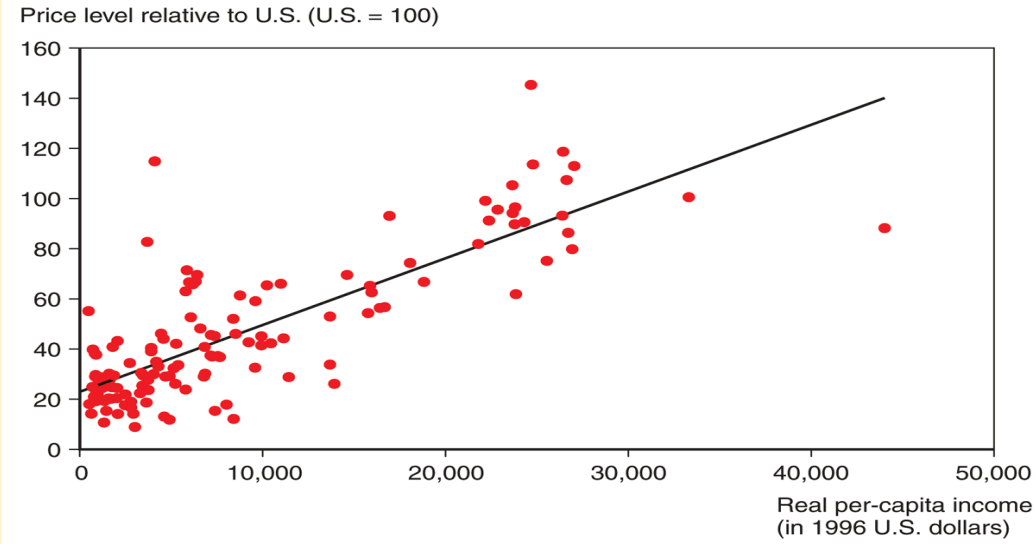


Figure 15-3

Price Levels and Real Incomes, 2000

Countries' price levels tend to rise as their real incomes rise. Each dot represents a country. The straight line indicates a statistician's best prediction of a country's price level relative to the United States based on knowing its real per-capita income.

Source: Penn World Table, Mark 6.1.

TABLE 15-1 Effects of Money Market and Output Market Changes on the Long-Run Nominal Dollar/Euro Exchange Rate, $E_{\$/€}$

Change	Effect on the long-run nominal dollar/euro exchange rate, $E_{\$/€}$
Money market	
1. Increase in U.S. money supply level	Proportional increase (nominal depreciation of $)
2. Increase in European money supply level	Proportional decrease (nominal depreciation of euro)
3. Increase in U.S. money supply growth rate	Increase (nominal depreciation of $)
4. Increase in European money supply growth rate	Decrease (nominal depreciation of euro)
Output market	
1. Increase in demand for U.S. output	Decrease (nominal appreciation of $)
2. Increase in demand for European output	Increase (nominal appreciation of euro)
3. Output supply increase in the United States	Ambiguous
4. Output supply increase in Europe	Ambiguous

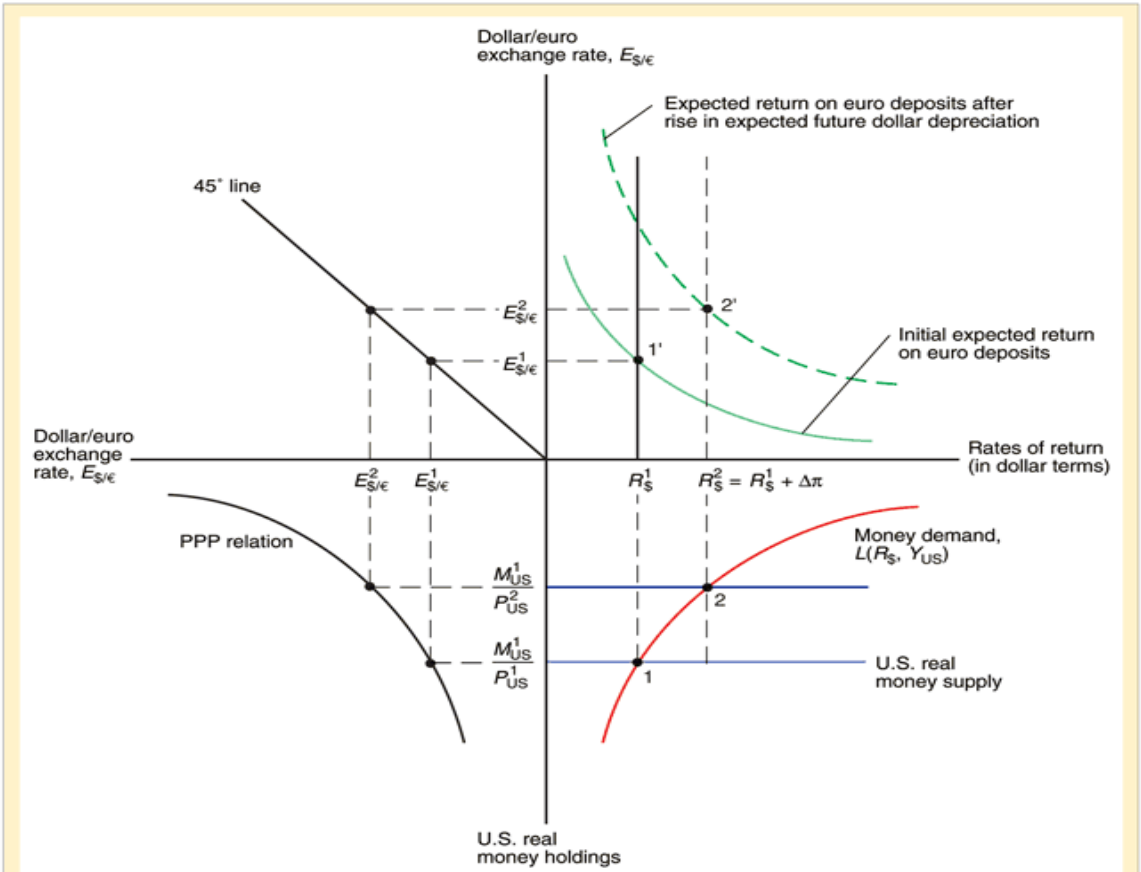


Figure 15A-1

How a Rise in U.S. Monetary Growth Affects Dollar Interest Rates and the Dollar/Euro Exchange Rate When Goods Prices Are Flexible

When goods prices are perfectly flexible, the money market equilibrium diagram (southeast quadrant) shows two effects of an increase, $\Delta\pi$, in the future rate of U.S. money supply growth. The change (i) raises the dollar interest rate from $R^1_\$$ to $R^2_\$ = R^1_\$ + \Delta\pi$, in line with the Fisher effect, and (ii) causes the U.S. price level to jump upward, from P^1_{US} to P^2_{US}. Money market equilibrium therefore moves from point 1 to point 2. (Because M^1_{US} doesn't change immediately, the real U.S. money supply falls to M^1_{US}/P^2_{US}, bringing the real money supply into line with reduced money demand.) The PPP relationship in the southwest quadrant shows that the price level jump from P^1_{US} to P^2_{US} requires a depreciation of the dollar against the euro (the dollar/euro exchange rate moves up, from $E^1_{\$/€}$ to $E^2_{\$/€}$). In the foreign exchange market diagram (northeast quadrant), this dollar depreciation is shown as the move from point 1′ to point 2′. The dollar depreciates despite a rise in $R_\$$ because heightened expectations of future dollar depreciation against the euro cause an outward shift of the locus measuring the expected dollar return on euro deposits.

Chapter 16

Output and the Exchange Rate in the Short Run

Preview

- Determinants of aggregate demand in the short run
- A short run model of output market equilibrium

- A short run model of asset market equilibrium
- A short run model for both output market equilibrium and asset market equilibrium
- Effects of temporary and permanent changes in monetary and fiscal policies.
- Adjustment of the current account over time.
- *IS-LM* model

Introduction

- Long run models are useful when all prices of inputs and outputs have time to adjust.
- In the short run, some prices of inputs and outputs may not have time to adjust, due to labor contracts, costs of adjustment or imperfect information about market demand.
- This chapter builds on the short run and long models of exchange rates to explain how output is related to exchange rates in the short run.
    - ❑ macroeconomic policies affect output, employment and the current account.

Determinants of Aggregate Demand

- Aggregate demand is the aggregate amount of goods and services that people are willing to buy:
    1. consumption expenditure
    2. investment expenditure
    3. government purchases
    4. net expenditure by foreigners: the current account

Determinants of Aggregate Demand

- Determinants of consumption expenditure include:

- **Disposable income**: income from production (Y) minus taxes (T).
- More disposable income means more consumption expenditure, but consumption typically increases less than the amount that disposable income increases.
- Real interest rates may influence the amount of saving and consumption, but we assume that they are relatively unimportant here.
- Wealth may also influence consumption, but we assume that it is relatively unimportant here.

- Determinants of the current account include:
  - **Real exchange rate**: prices of foreign products relative to the prices of domestic products, both measured in domestic currency: EP^*/P
    - As the prices of foreign products rise relative to those of domestic products, expenditure on domestic products rises and expenditure on foreign products falls.
  - **Disposable income**: more disposable income means more expenditure on foreign products (imports)

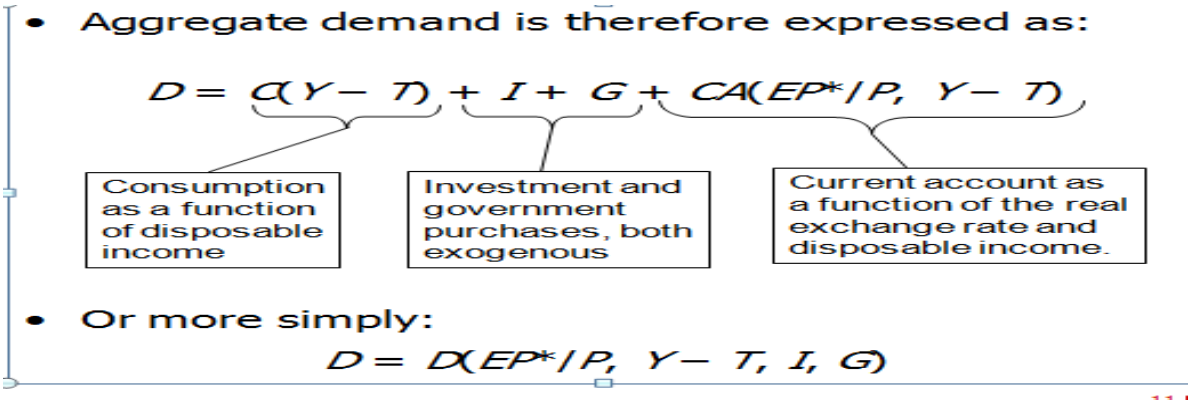
How Real Exchange Rate Changes Affect the Current Account

- The current account measures the value of exports relative to the value of imports: $CA \approx EX - IM$.
  - When the real exchange rate EP^*/P rises, the prices of foreign products rise relative to the prices of domestic products.
  - The **volume** of exports that are bought by foreigners rises.
  - The **volume** of imports that are bought by domestic residents falls.
  - The **value** of imports in terms of domestic products rises: the value/price of imports rises, since foreign products are more valuable/expensive.

- If the volumes of imports and exports do not change much, the *value effect* may dominate the *volume effect* when the real exchange rate changes.
  - ❑ for example, contract obligations to buy fixed amounts of products may cause the volume effect to be small.
- However, evidence indicates that for most countries the volume effect dominates the value effect in 1 year or less.
- Therefore, we assume that a real depreciation leads to an increase in the current account: the volume effect dominates the value effect.

Determinants of Aggregate Demand

- Determinants of the current account include:
  - ❑ **Real exchange rate**: an increase in the real exchange rate increases the current account.
  - ❑ **Disposable income**: an increase in the disposable income decreases the current account.
- For simplicity, we assume that exogenous political factors determine government purchases G and the level of taxes T.
- For simplicity, we currently assume that investment expenditure I is determined exogenously.
  - ❑ A more complicated model shows that investment depends on the cost of borrowing for investment, the interest rate.



- Determinants of aggregate demand include:
  - ❑ **Real exchange rate**: an increase in the real exchange rate increases the current account, and therefore increases aggregate demand for domestic products.
  - ❑ **Disposable income**: an increase in the disposable income increases consumption, but decreases the current account.
  - ❑ Since total consumption expenditure is usually greater than expenditure on foreign products, the first effect dominates the second effect.
  - ❑ As income increases for a given level of taxes, aggregate consumption and aggregate demand increases by less than income.

Short Run Equilibrium for Aggregate Demand and Output

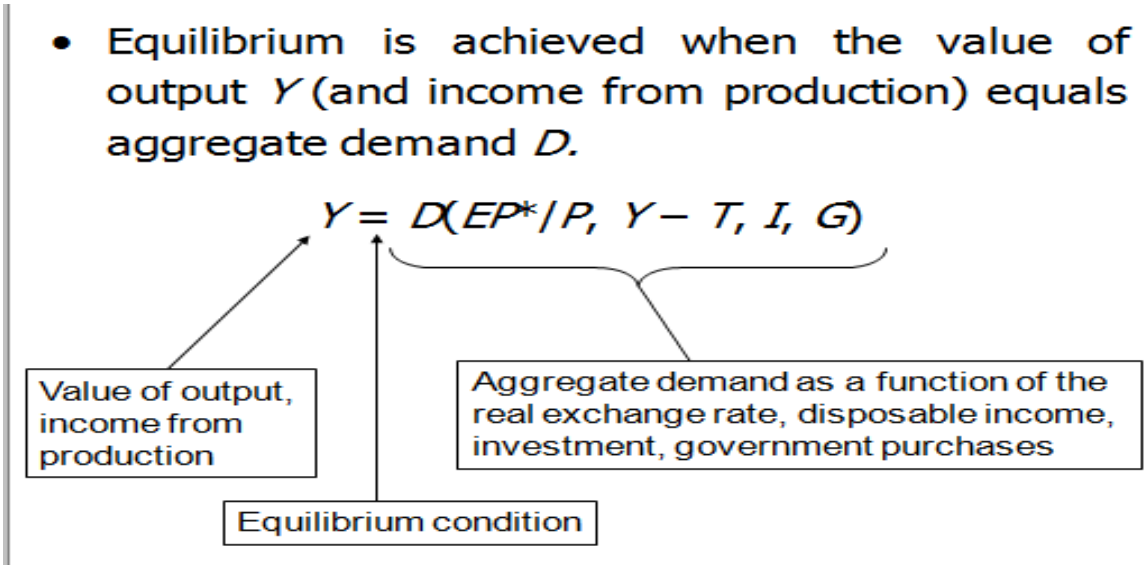
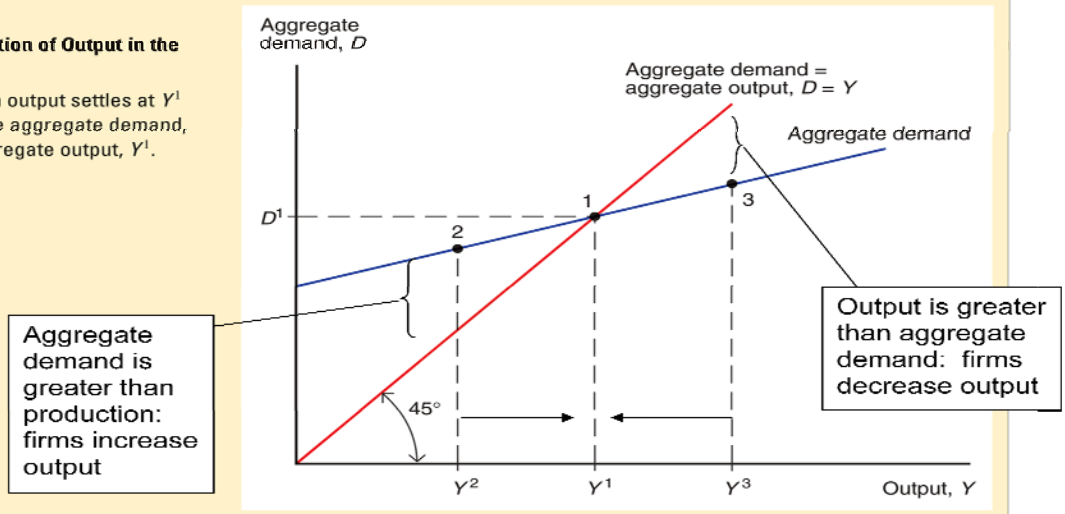


Figure 16-2

The Determination of Output in the Short Run

In the short run output settles at Y^1 (point 1), where aggregate demand, D^1, equals aggregate output, Y^1.



Short Run Equilibrium and the Exchange Rate: *DD* Schedule

- How does the exchange rate affect the short run equilibrium of aggregate demand and output?
- With fixed domestic and foreign price levels, a rise in the nominal exchange rate makes foreign goods and services more expensive relative to domestic goods and services.
- A rise in the exchange rate (a domestic currency depreciation) increases the aggregate demand for domestic products.
- In equilibrium, aggregate demand matches output.

Figure 16-3

Output Effect of a Currency Depreciation with Fixed Output Prices

A rise in the exchange rate from E^1 to E^2 (a currency depreciation) raises aggregate demand to *aggregate demand* (E^2) and output to Y^2, all else equal.

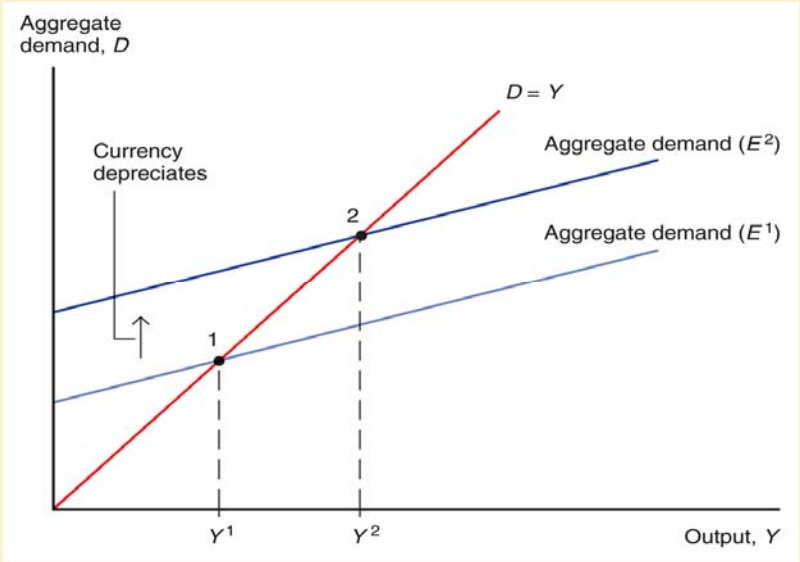
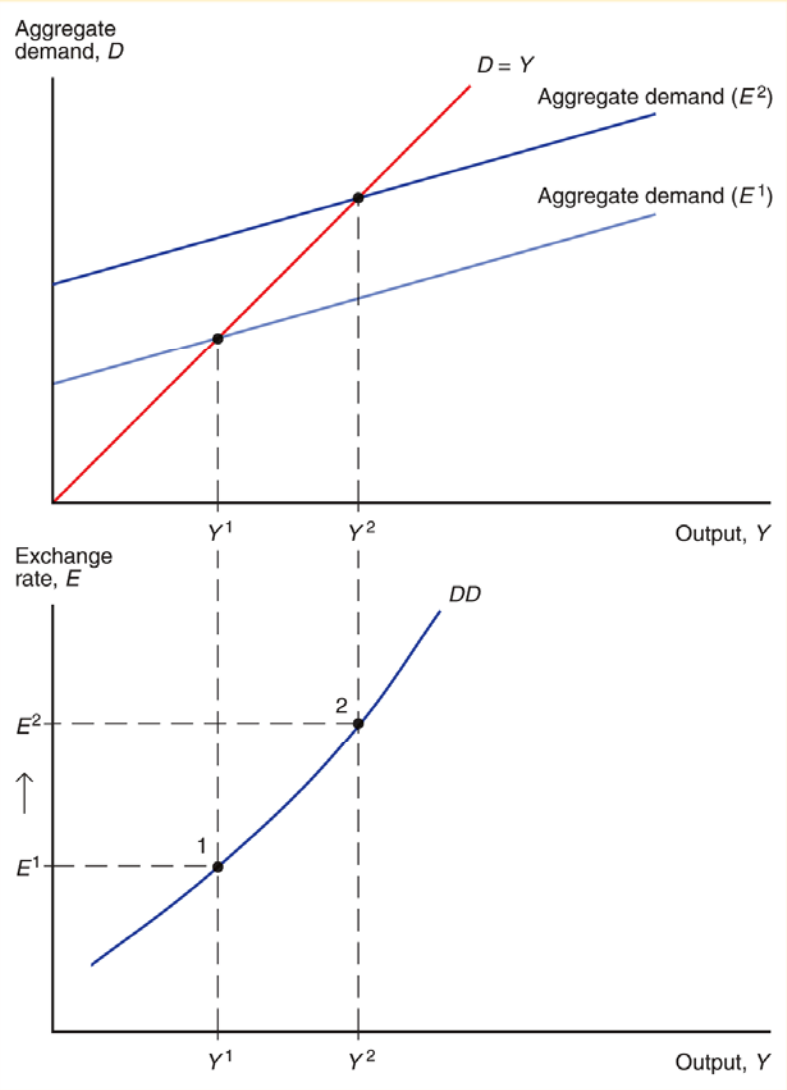


Figure 16-4

Deriving the *DD* Schedule

The *DD* schedule (shown in the lower panel) slopes upward because a rise in the exchange rate from E^1 to E^2, all else equal, causes output to rise from Y^1 to Y^2.



DD schedule

- shows combinations of output and the exchange rate at which the output market is in short run equilibrium (aggregate demand = aggregate output).
- slopes upward because a rise in the exchange rate causes aggregate demand

  and aggregate output to rise.

Shifting the *DD* Curve

- Changes in the exchange rate cause movements along a DD curve. Other changes cause it to shift:

1. **Changes in *G***: more government purchases cause higher aggregate demand and output in equilibrium. Output increases for every exchange rate: the *DD* curve shifts right.

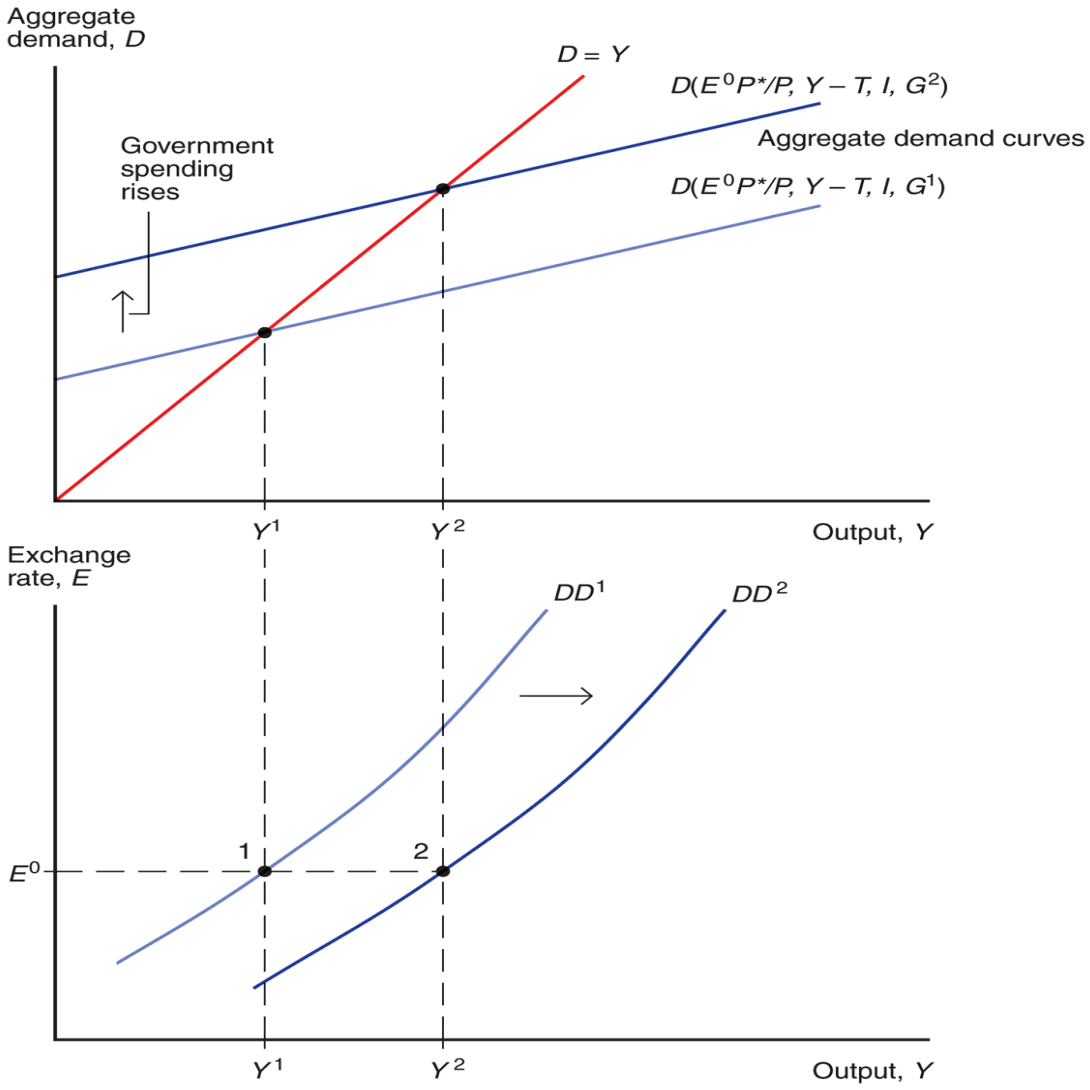


Figure 16-5

Government Demand and the Position of the *DD* Schedule

A rise in government demand from G^1 to G^2 raises output at every level of the exchange rate. The change therefore shifts *DD* to the right.

2. **Changes in *T***: lower taxes generally increase consumption expenditure, increasing aggregate demand and output for every exchange rate: the *DD* curve shifts right.
3. **Changes in *I***: higher investment demand shifts the *DD* curve right.

4. **Changes in *P* relative to *P****: lower domestic prices relative to foreign prices shift the *DD* curve right.
5. **Changes in *C***: willingness to consume more and save less shifts the *DD* curve right.
6. **Changes in demand for domestic goods relative to foreign goods**: willingness to consume more domestic goods relative to foreign goods shifts the *DD* curve right.

Short Run Equilibrium for Assets

- We consider two asset markets when considering asset market equilibrium:

1. Foreign exchange market
   - ❑ interest parity determines equilibrium: $R = R^* + (E^e - E)/E$
2. Money market
   - ❑ real money supply and demand determine equilibrium: $M^s/P=L(R,\gamma)$
   - ❑ A rise in income and output causes real money demand to increase.
3. When income and output increase,
   - ❑ money demand increases,
   - ❑ leading to an increase in the domestic interest rate,
   - ❑ leading to an appreciation of the domestic currency.
4. An appreciation of the domestic currency is a fall in *E*.
5. When income and output decrease, the domestic currency depreciates and *E* rises.
6. When income and output increase,
   - ❑ money demand increases,
   - ❑ leading to an increase in the domestic interest rate,
   - ❑ leading to an appreciation of the domestic currency.
7. An appreciation of the domestic currency is a fall in *E*.

8. When income and output decrease, the domestic currency depreciates and *E* rises.

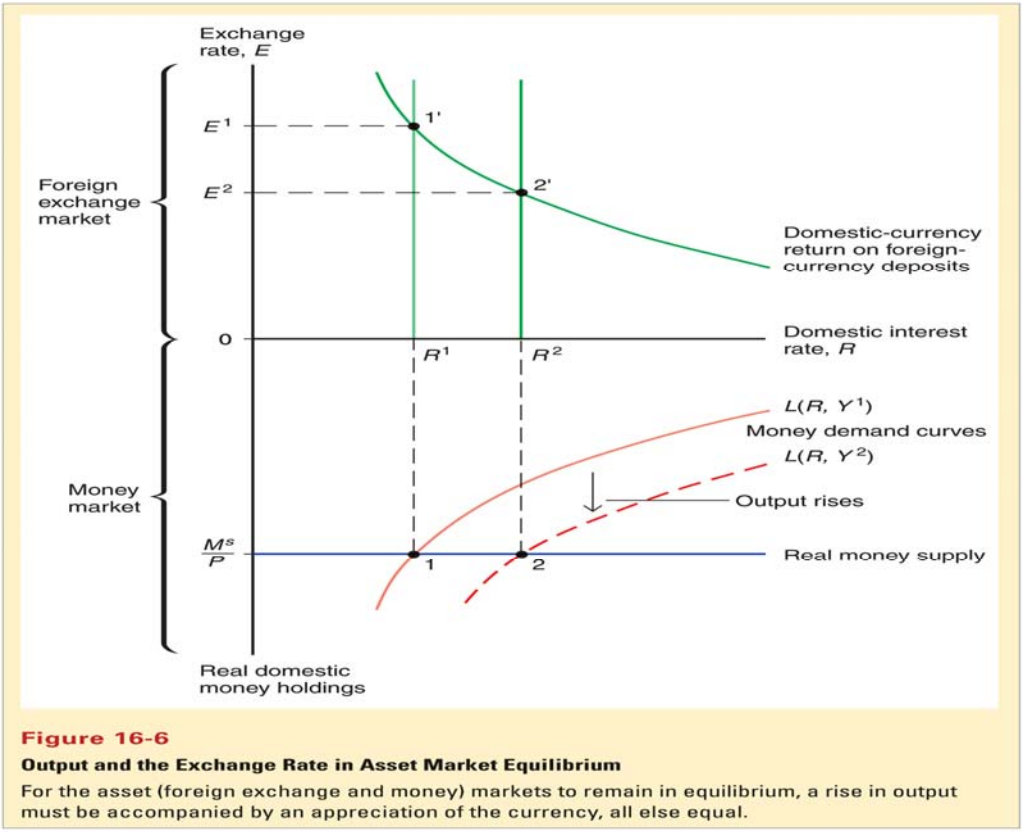


Figure 16-6

Output and the Exchange Rate in Asset Market Equilibrium

For the asset (foreign exchange and money) markets to remain in equilibrium, a rise in output must be accompanied by an appreciation of the currency, all else equal.

- When income and output increase,
  - ❑ money demand increases,
  - ❑ leading to an increase in the domestic interest rate,
  - ❑ leading to an appreciation of the domestic currency.
- An appreciation of the domestic currency is a fall in *E*.
- When income and output decrease, the domestic currency depreciates and *E* rises.

Short Run Equilibrium for Assets: *AA* Curve

- The inverse relationship between output and exchange rates needed to keep the foreign exchange market and money market in equilibrium is summarized as the *AA* curve.

Shifting the AA Curve

1. **Changes in M^s**: an increase in the money supply reduces interest rates, causing the domestic currency to depreciate (a rise in E) for every Y: the AA curve shifts up (right).

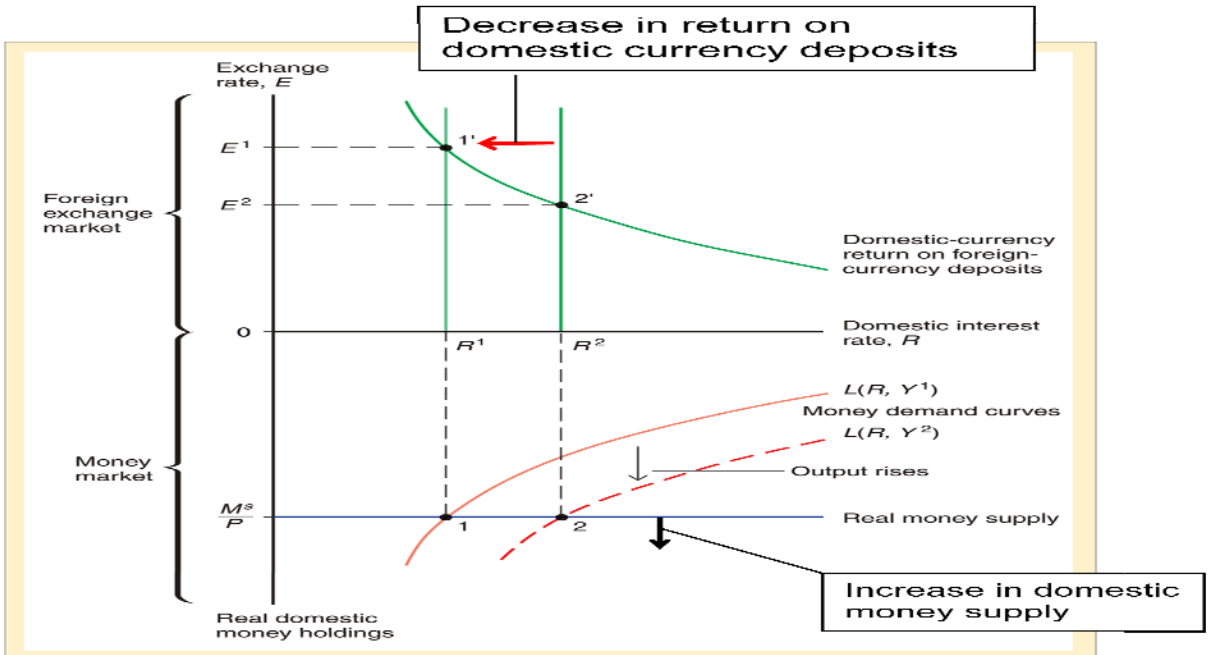


Figure 16-6

Output and the Exchange Rate in Asset Market Equilibrium

For the asset (foreign exchange and money) markets to remain in equilibrium, a rise in output must be accompanied by an appreciation of the currency, all else equal.

2. **Changes in *P***: An increase in the domestic price level decreases the real money supply, increasing interest rates, causing the domestic currency to appreciate (a fall in *E*): the *AA* curve shifts down (left).
3. **Changes in real money demand**: if domestic residents are willing to hold lower real money balances, interest rates fall, leading to a depreciation of the domestic currency (a rise in *E*): the *AA* curve shifts up (right).
4. **Changes in *R****: An increase in the foreign interest rates makes foreign currency deposits more attractive, leading to a depreciation of the domestic currency (a rise in *E*): the *AA* curve shifts up (right).
5. **Changes in E^e**: if market participants expect the domestic currency to depreciate in the future, foreign currency deposits become more attractive, causing the domestic currency to depreciate (a rise in *E*): the *AA* curve shifts up (right).

Putting the Pieces Together: the *DD* and *AA* Curves

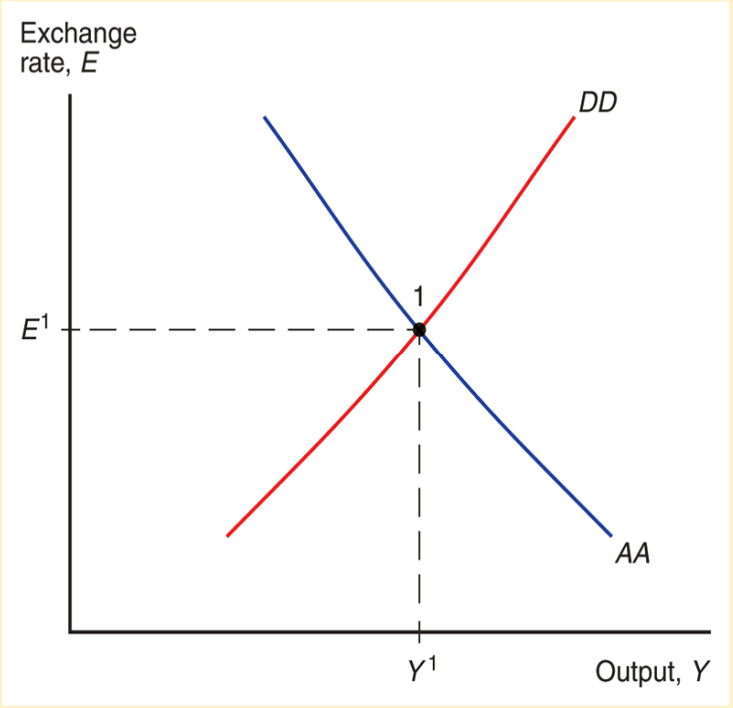
- A short run equilibrium means the *nominal exchange rate* and level of *output* such that:

1. equilibrium in the output markets holds: aggregate demand equals aggregate output.
2. equilibrium in the foreign exchange markets holds: interest parity holds.
3. equilibrium in the money market holds: real money supply equals real money demand.
4. A short run equilibrium occurs at the intersection of the *DD* and *AA* curves
    1. output market equilibrium holds on the DD curve
    2. asset market equilibrium holds on the AA curve

Figure 16-8

Short-Run Equilibrium: The Intersection of *DD* and *AA*

The short-run equilibrium of the economy occurs at point 1, where the output market (whose equilibrium points are summarized by the *DD* curve) and asset market (whose equilibrium points are summarized by the *AA* curve) simultaneously clear.

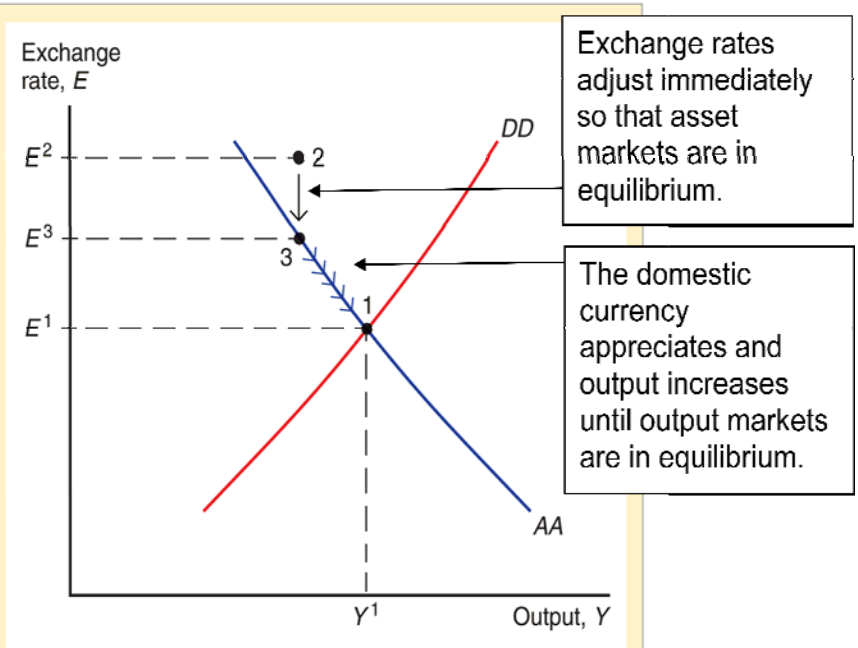


How the Economy Reaches Equilibrium in the Short Run

Figure 16-9

How the Economy Reaches Its Short-Run Equilibrium

Because asset markets adjust very quickly, the exchange rate jumps immediately from point 2 to point 3 on AA^1. The economy then moves to point 1 along AA^1 as output rises to meet aggregate demand.



Temporary Changes in Monetary and Fiscal Policy

- **Monetary policy:** policy in which the central bank influences the money supply.
  - ❑ Monetary policy primarily influences asset markets.
- **Fiscal policy:** policy in which governments (fiscal authorities) influence the amount of government purchases and taxes.
  - ❑ Fiscal policy primarily influences aggregate demand and output.

Temporary policy changes are expected to be reversed in the near future and thus do not affect expectations about exchange rates in the long run.

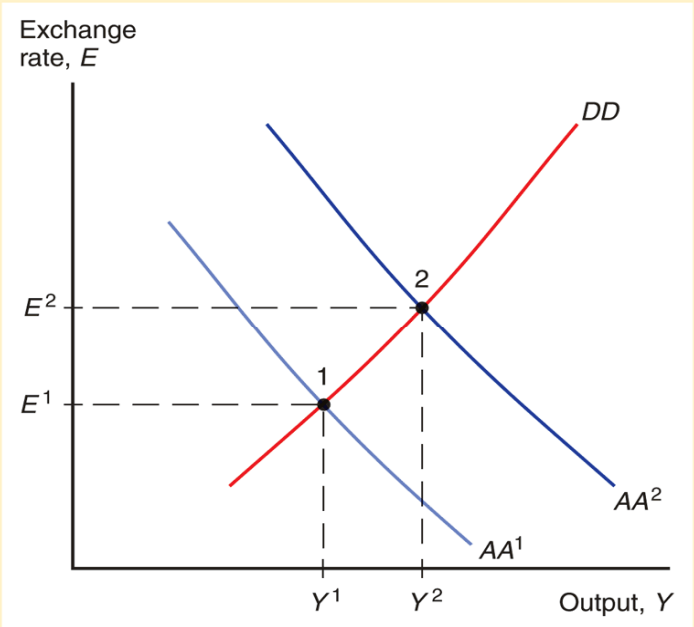
Temporary Changes in Monetary Policy

- An increase in the level of money lowers interest rates, causing the domestic currency to depreciate (a rise in E).
  - ❑ The AA shifts up (right).
  - ❑ Domestic products are cheaper so that aggregate demand and output increase until a new short run equilibrium is achieved.

Figure 16-10

Effects of a Temporary Increase in the Money Supply

By shifting AA^1 upward, a temporary increase in the money supply causes a currency depreciation and a rise in output.



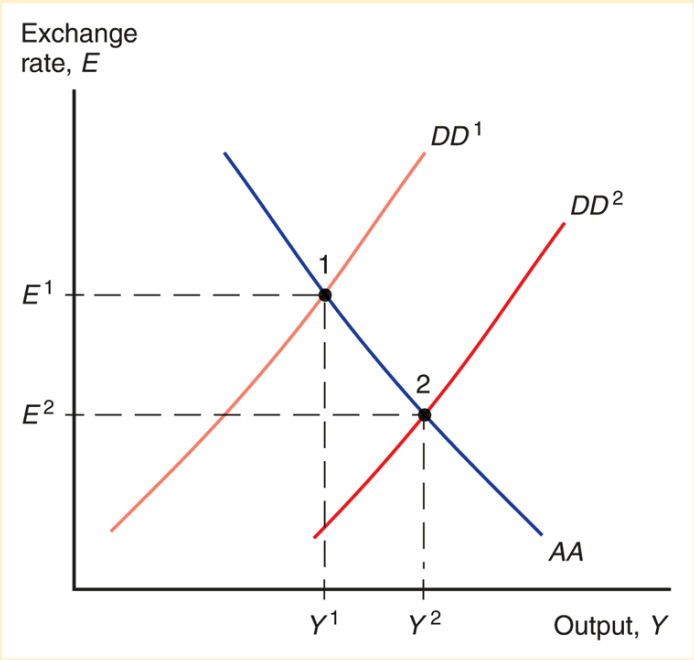
Temporary Changes in Fiscal Policy

- An increase in government purchases or a decrease in taxes increases aggregate demand and output.
  - ❑ The *DD* curve shifts right.
  - ❑ Higher output increases real money demand,
  - ❑ thereby increasing interest rates,
  - ❑ causing the domestic currency to appreciate (a fall in *E*).

Figure 16-11

Effects of a Temporary Fiscal Expansion

By shifting DD^1 to the right, a temporary fiscal expansion causes a currency appreciation and a rise in output.



Policies to Maintain Full Employment

- Resources used in the production process can either be over-employed or under-employed.
- When resources are employed at their *normal* (or *long run*) level, the economy operates at "full employment".
  - ❑ When employment is below full employment, labor is under-employed: high unemployment, few hours worked, lower than normal output produced.

- When employment is above full employment, labor is over-employed: low unemployment, many overtime hours, higher than normal output produced.

- Policies to maintain full employment may seem easy in theory, but are hard in practice.

1. We have assumed that prices and expectations do not change, but people may anticipate the effects of policy changes and modify their behavior.
    - ❑ workers may require higher wages if they expect overtime and easy employment, and producers may raise prices if they expect high wages and strong demand due to monetary and fiscal policies.
    - ❑ fiscal and monetary policies may therefore create price changes and inflation thereby preventing high output and employment: **inflationary bias**
2. Economic data are hard to measure and hard to understand.
    - ❑ Policy makers can not interpret data about asset markets and aggregate demand with certainty, and sometimes they make mistakes.
3. Changes in policies take time to be implemented and take time to affect the economy.
    - ❑ Because they are slow, policies may affect the economy after the effects of a shock have dissipated.
4. Policies are sometimes influenced by political or bureaucratic interests.

Permanent Changes in Monetary and Fiscal Policy

- Permanent policy changes modify people's expectations about exchange rates in the long run.

Permanent Changes in Monetary Policy

- A permanent increase in the level of the money supply
    - ❑ lowers interest rates and it makes people expect a future depreciation of the domestic currency, increasing the expected return of foreign currency deposits.

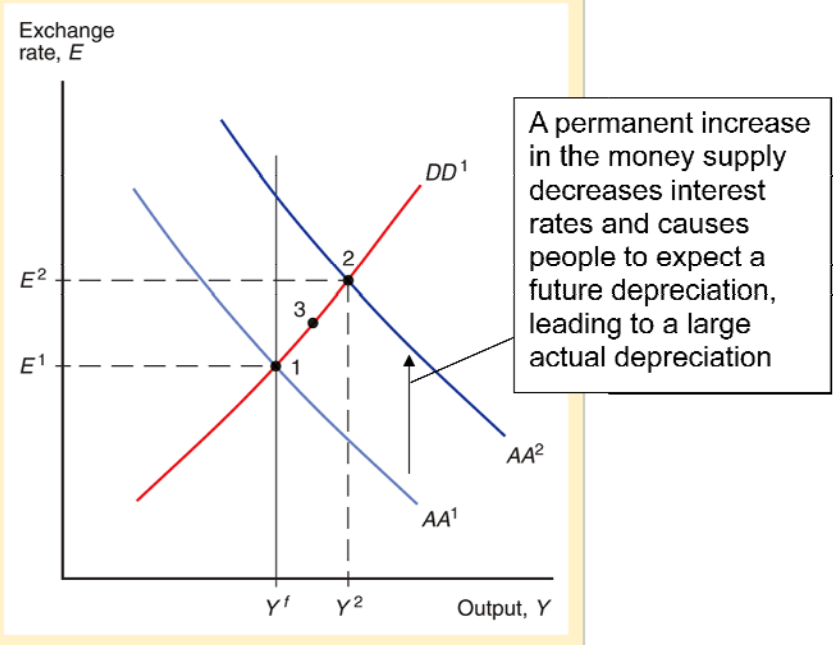
- ❑ The domestic currency depreciates more than (*E* rises more than) the case when expectations are constant (Chapter 14 results).
- ❑ The *AA* curve shifts up (right) more than the case when expectations are held constant.

Effects of Permanent Changes in Monetary Policy in the Short Run

Figure 16-14

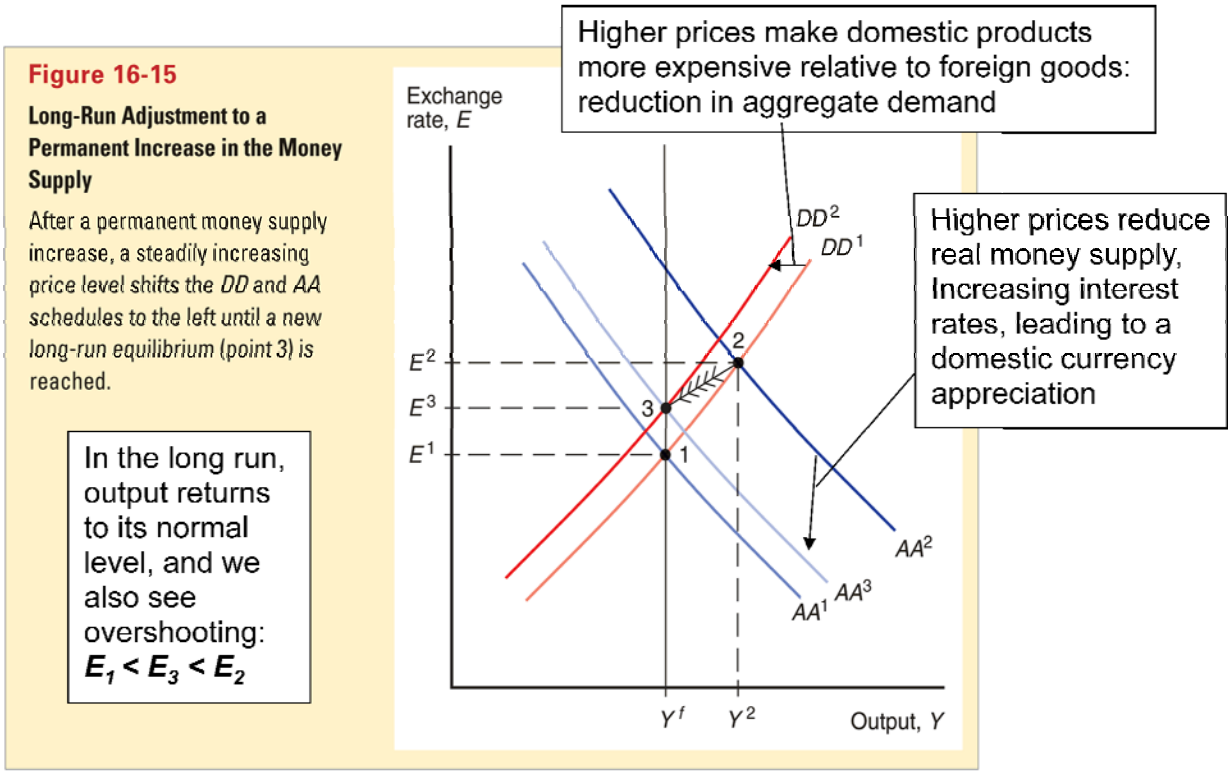
Short-Run Effects of a Permanent Increase in the Money Supply

A permanent increase in the money supply, which shifts AA^1 to AA^2 and moves the economy from point 1 to point 2, has stronger effects on the exchange rate and output than an equal temporary increase, which moves the economy only to point 3.



Effects of Permanent Changes in Monetary Policy in the Long Run

- With employment and hours above their normal levels, there is a tendency for wages to rise over time.
- With strong demand for output and with increasing wages, producers have an incentive to raise output prices over time.
- Both higher wages and higher output prices are reflected in a higher price level.
- What are the effects of rising prices?



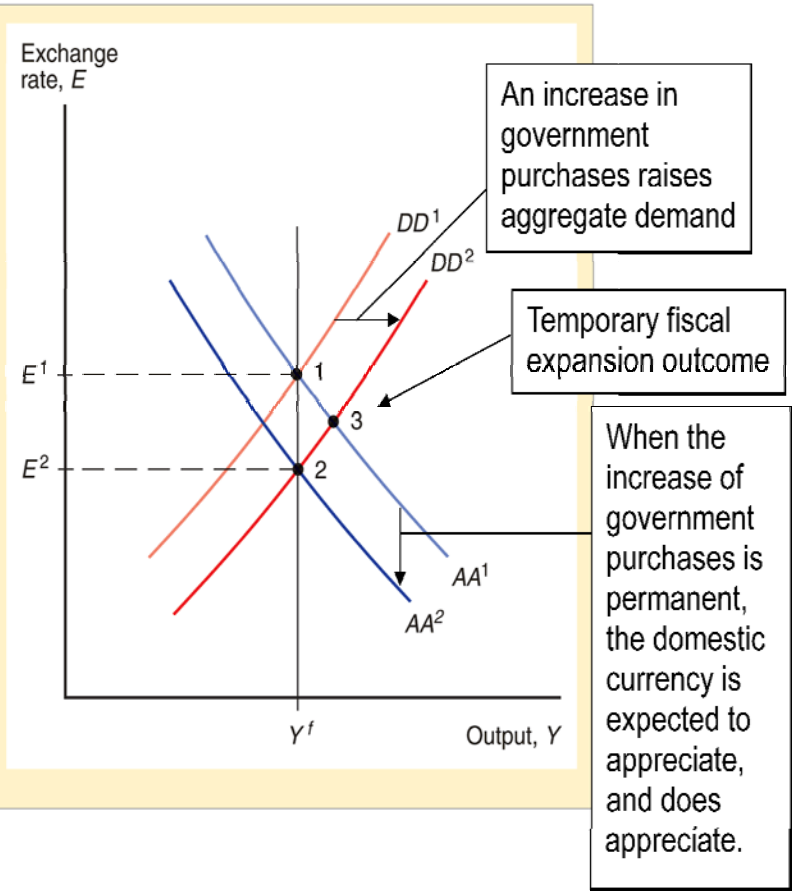
Effects of Permanent Changes in Fiscal Policy

- A permanent increase in government purchases or reduction in taxes
  - ❑ increases aggregate demand
  - ❑ makes people expect a domestic currency appreciation in the short run due to increased aggregate demand, thereby reducing the expected return on foreign currency deposits, making the domestic currency appreciate.
- The first effect increases aggregate demand for domestic products, the second effect decreases aggregate demand for domestic products (by making them more expensive).
- If the change in fiscal policy is expected to be permanent, the first and second effects exactly offset each other, so that output remains at its normal or long run level.
- We say that an increase in government purchases completely **crowds out** net exports, due to the effect of the appreciated domestic currency.

Figure 16-16

Effects of a Permanent Fiscal Expansion

Because a permanent fiscal expansion changes exchange rate expectations, it shifts AA^1 leftward as it shifts DD^1 to the right. The effect on output (point 2) is nil if the economy starts in long-run equilibrium. A comparable *temporary* fiscal expansion, in contrast, would leave the economy at point 3.



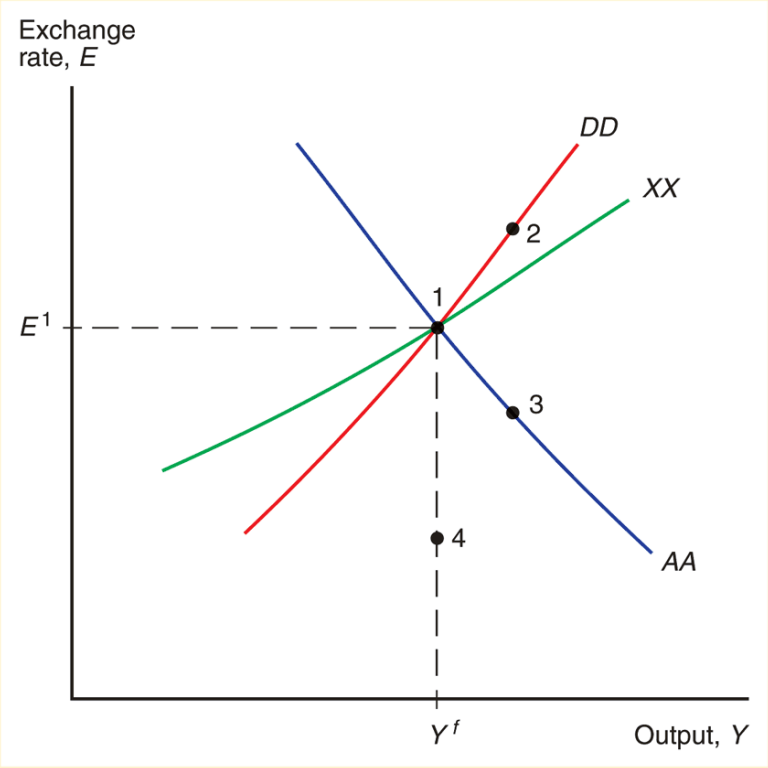
Macroeconomic Policies and the Current Account

- To determine the effect of monetary and fiscal policies on the current account,
  - ❑ derive the *XX* curve to represent the combinations of output and exchange rates at which the current account is at its desired level.
- As income and output increase, the current account decreases, all other factors held constant.
- To keep the current account at its desired level, the domestic currency must depreciate as income and output increase: the *XX* curve should slope upward.

Figure 16-17

How Macroeconomic Policies Affect the Current Account

Along the curve *XX*, the current account is constant at the level $CA = X$. Monetary expansion moves the economy to point 2 and thus raises the current account balance. Temporary fiscal expansion moves the economy to point 3 while permanent fiscal expansion moves it to point 4; in either case the current account balance falls.



- The *XX* curve slopes upward but is flatter than the *DD* curve.
  - ❑ *DD* represents equilibrium values of aggregate demand and domestic output.
  - ❑ As domestic income and output increase, domestic saving increases, which means that aggregate demand (willingness to spend) *by domestic residents* does not rise as rapidly as income and output.
  - ❑ As domestic income and output increase, the currency must depreciate to entice foreigners to increase their demand for domestic output in order to keep the current account (only one component of aggregate demand) at its desired level—on the *XX* curve.
  - ❑ As domestic income and output increase, the currency must depreciate *more rapidly* to entice foreigners to increase their demand for domestic output in order to keep *aggregate* demand (by

domestic residents and foreigners) equal to output—on the *DD* curve.

- Policies affect the current account through their influence on the value of the domestic currency.
  - ❑ A money supply increase depreciates the domestic currency and often increases the current account in the short run.
  - ❑ An increase in government purchases or decrease in taxes appreciates the currency and often decreases the current account.

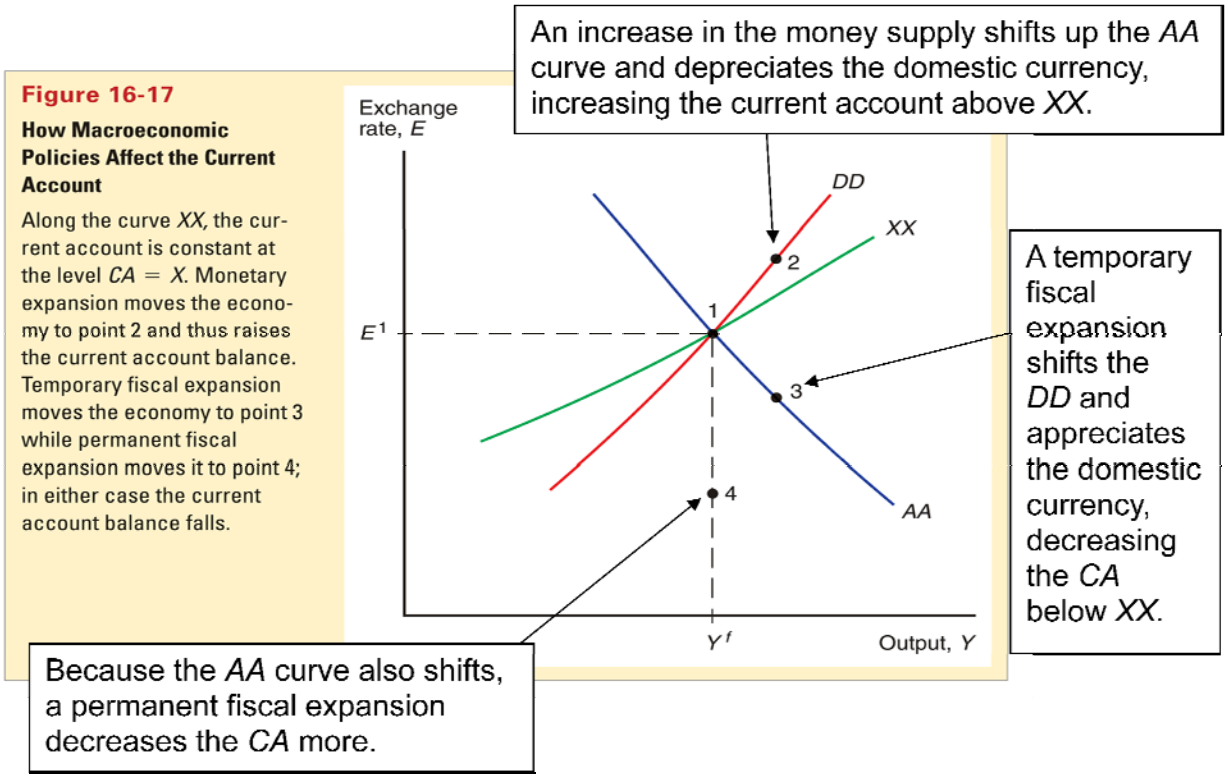


Figure 16-17

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Along the curve *XX*, the current account is constant at the level $CA = X$. Monetary expansion moves the economy to point 2 and thus raises the current account balance. Temporary fiscal expansion moves the economy to point 3 while permanent fiscal expansion moves it to point 4; in either case the current account balance falls.

Value Effect, Volume Effect and the J-curve

- If the volume of imports and exports is fixed in the short run, a depreciation of the domestic currency
  - ❑ will not affect the volume of imports or exports,
  - ❑ but will increase the value/price of imports in domestic currency and decrease the current account: $CA \approx EX - IM$.
  - ❑ The value of exports in domestic currency does not change.

- The current account could immediately decrease after a currency depreciation, then increase gradually as the volume effect begins to dominate the value effect.

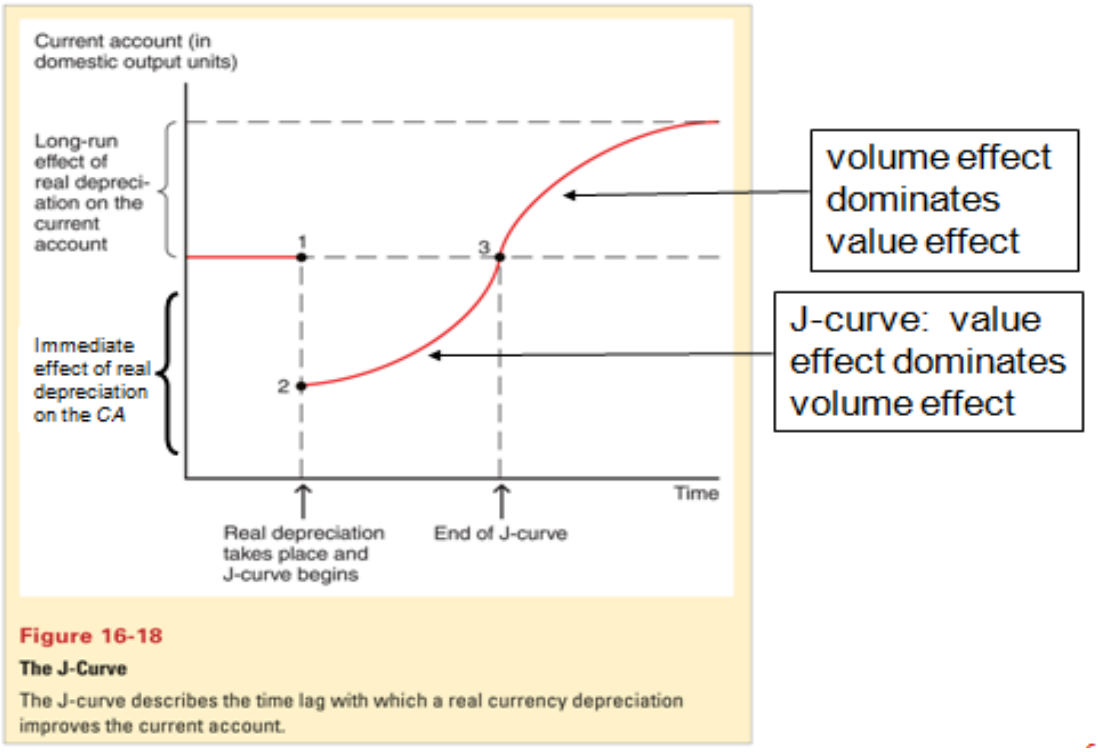


Figure 16-18

The J-Curve

The J-curve describes the time lag with which a real currency depreciation improves the current account.

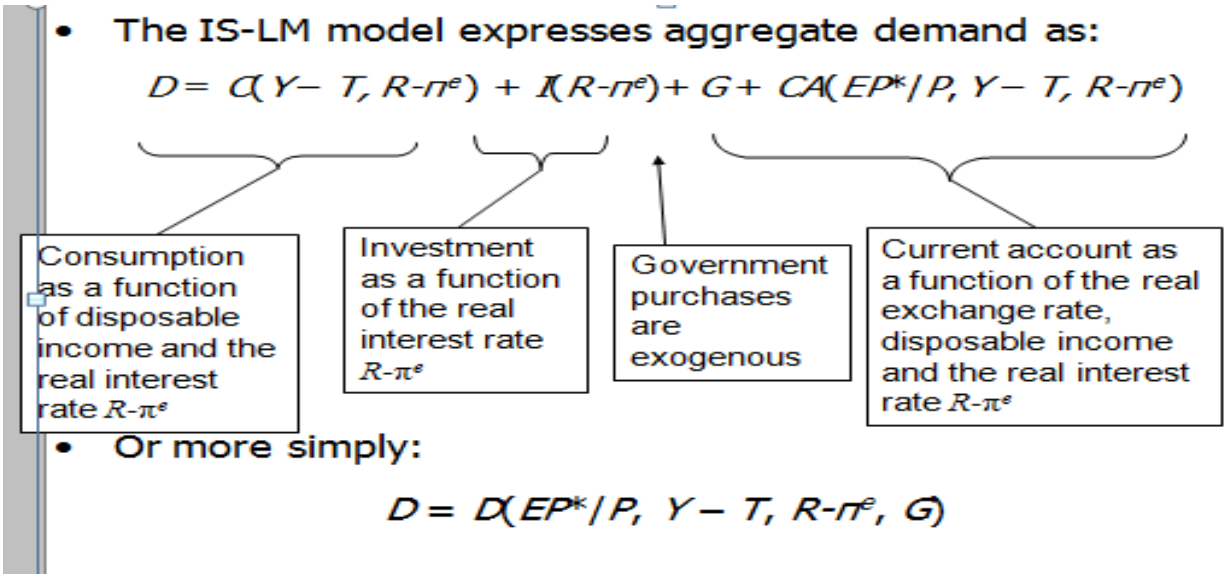
- **Pass through** from the exchange rate to import prices measures the percentage by which import prices rise when the domestic currency depreciates by 1%.
- In the *DD-AA* model, the pass through rate is 100%: import prices in domestic currency exactly match a depreciation of the domestic currency.
- In reality, pass through may be less than 100% due to price discrimination in different countries.
    - ❑ firms that set prices may decide not to match changes in the exchange rate with changes in prices of foreign products denominated in domestic currency.
- If prices of foreign products in domestic currency do not change much because of a pass through rate less than 100%, then the

- ❑ value of imports will not rise much after a domestic currency depreciation, and the current account will not fall much, making the J-curve effect smaller.
- ❑ volume of imports and exports will not adjust much over time since domestic currency prices do not change much.

- Pass through less than 100% dampens the effect of depreciation or appreciation on the current account.

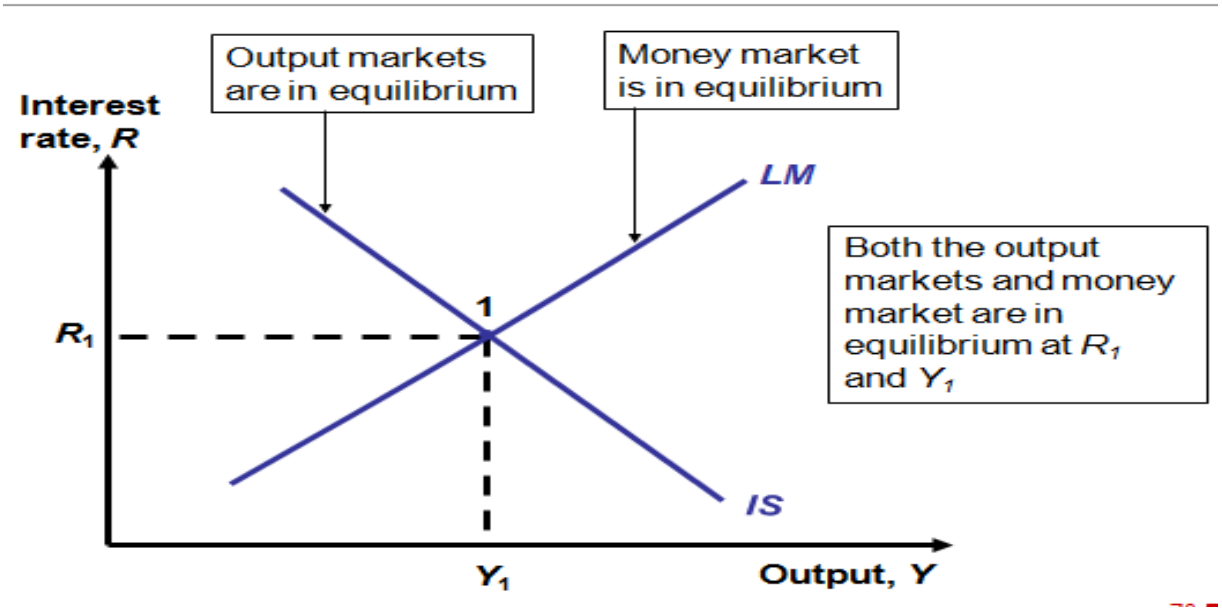
IS-LM Model

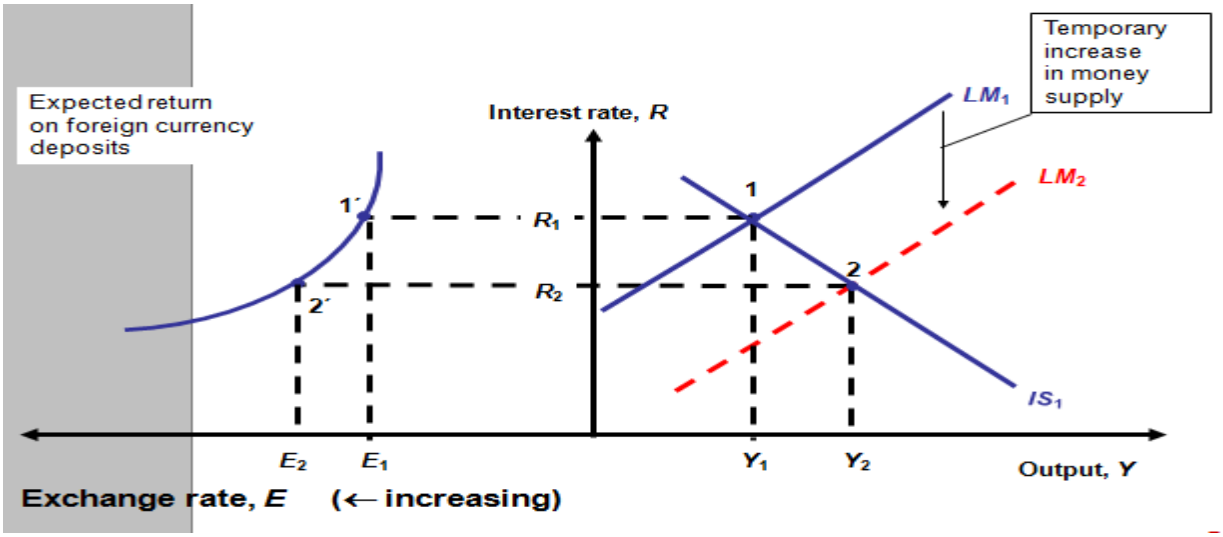
- In the *DD-AA* model, we assumed that investment expenditure is exogenous.
- In reality, the amount of investment expenditure depends on the interest rate.
  - ❑ investment projects often use borrowed funds, and the interest rate is the cost of borrowing.
  - ❑ a higher interest rate means less investment expenditure.
- In the *IS-LM* model says that investment expenditure is inversely related to the interest rate.
- The *IS-LM* model also allows for consumption expenditure and expenditure on imports to depend on the interest rate.
  - ❑ A higher interest rate makes saving more attractive and consumption less attractive.
  - ❑ However, the effect of the interest rate is much larger on investment than it is on consumption and imports.



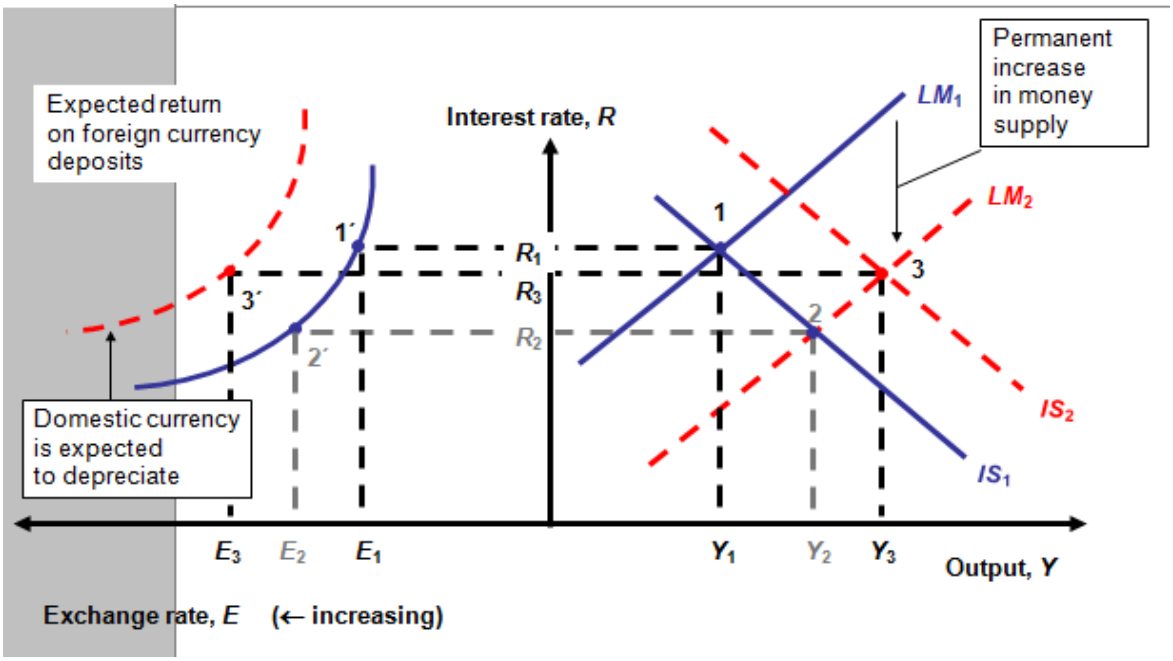
- Instead of relating exchange rates and output, the *IS-LM* relates interest rates and output.
- In equilibrium, aggregate output = aggregate demand
  - $Y = D(EP^*/P, Y - T, R-\pi^e, G)$
- In equilibrium, interest parity holds
  - $R = R^* + (E^e-E)/E$
  - $E(1+R) = ER^* + E^e$
  - $E(1+R-R^*) = E^e$
  - $E = E^e/(1+R-R^*)$
- $Y = D(E^eP^*/P(1+R-R^*) , Y - T, R-\pi^e, G)$
  - This equation describes the *IS* curve: combinations of interest rates and output such that aggregate demand equals output, given values of exogenous variables E^e,P^*,P, R^*,T, π^e, and G.
  - Lower interest rates increase investment demand (and consumption and import demand), leading to higher aggregate demand and higher output in equilibrium.
  - The *IS* curve slopes down.
- In equilibrium, real money supply equals real money demand: $M^s/P = L(R,Y)$

- This equation describes the *LM* curve: combinations of interest rates and output such that the money market is in equilibrium, given values of exogenous values P and M^s.
- Higher income leads to higher real money demand and higher interest rates in the money market.
- The *LM* curve slopes up.

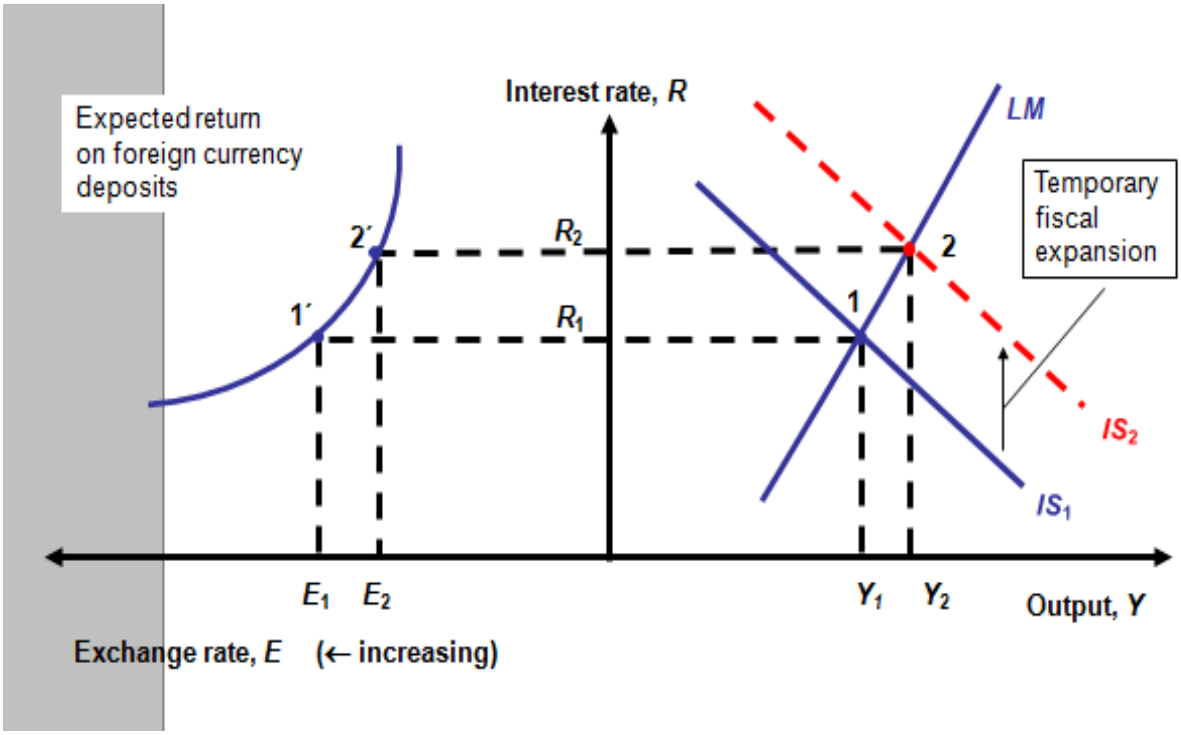




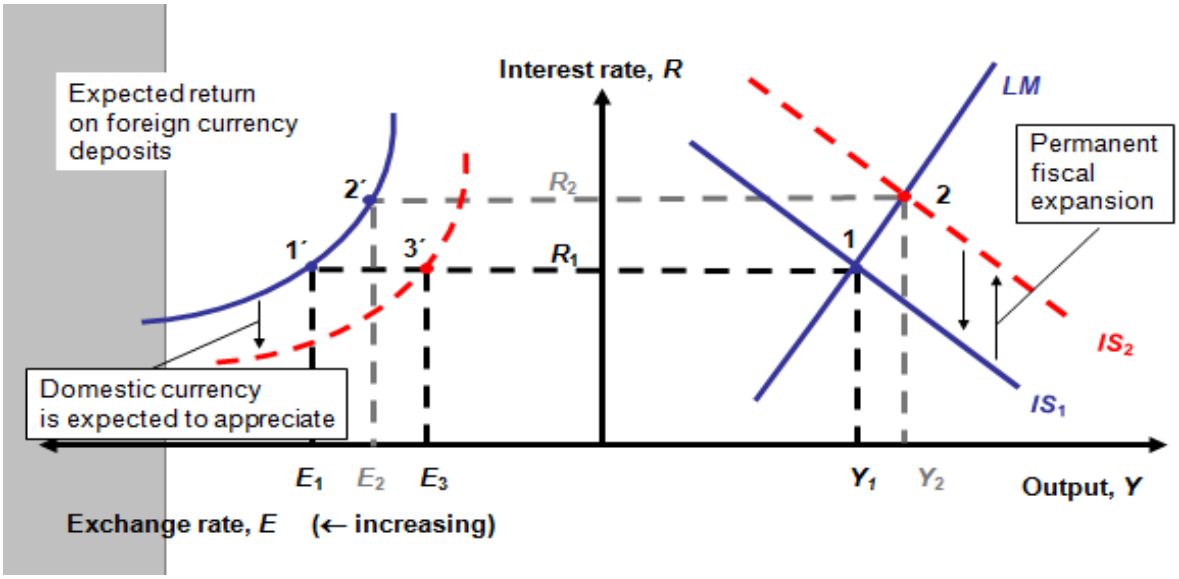
Effects of Permanent Changes in the Money Supply in the Short Run



Effects of Temporary Changes in Fiscal Policy



Effects of Permanent Changes in Fiscal Policy



Summary

1. Aggregate demand is influence by disposable income and the real exchange rate.
2. The *DD* curve shows combinations of exchange rates and output where aggregate demand = output.
3. The *AA* curve shows combinations of exchange rates and output where the foreign exchange market and money market are in equilibrium.
4. In the *DD-AA* model, we assume that a depreciation of the domestic currency leads to an increase in the current account and aggregate demand.
5. But reality is more complicated, and the J-curve shows that the value effect at first dominates the volume effect.
6. A temporary increase in the money supply increases output and depreciates the domestic currency.
7. A permanent increase does both to a larger magnitude in the short run, but in the long run output returns to its normal level.

8. A temporary increase in government purchases increases output and appreciates the domestic currency.
9. A permanent increase in government purchases completely crowds out net exports, and therefore has no effect on output.
10. The *IS-LM* model compares interest rates with output.
11. The *IS* curve shows combinations of interest rates and output where aggregate demand = output.
12. The *LM* curve shows combinations of interest rates and output where the money market is in equilibrium.
13. The *IS-LM* model can be used with the model of the foreign exchange market to compare output, interest rates and exchange rates.

Trade Elasticities

TABLE 16A2-1 Estimated Price Elasticities for International Trade in Manufactured Goods

	η			η^*		
Country	**Impact**	**Short-run**	**Long-run**	**Impact**	**Short-run**	**Long-run**
Austria	0.39	0.71	1.37	0.03	0.36	0.80
Belgium	0.18	0.59	1.55	—	—	0.70
Britain	—	—	0.31	0.60	0.75	0.75
Canada	0.08	0.40	0.71	0.72	0.72	0.72
Denmark	0.82	1.13	1.13	0.55	0.93	1.14
France	0.20	0.48	1.25	—	0.49	0.60
Germany	—	—	1.41	0.57	0.77	0.77
Italy	—	0.56	0.64	0.94	0.94	0.94
Japan	0.59	1.01	1.61	0.16	0.72	0.97
Netherlands	0.24	0.49	0.89	0.71	1.22	1.22
Norway	0.40	0.74	1.49	—	0.01	0.71
Sweden	0.27	0.73	1.59	—	—	0.94
Switzerland	0.28	0.42	0.73	0.25	0.25	0.25
United States	0.18	0.48	1.67	—	1.06	1.06

Note: Estimates are taken from Jacques R. Artus and Malcolm D. Knight, *Issues in the Assessment of the Exchange Rates of Industrial Countries*. Occasional Paper 29. Washington, D.C.: International Monetary Fund, July 1984, table 4. Unavailable estimates are indicated by dashes.

TABLE 16-1 Factors Determining the Current Account

Change	Effect on current account, CA
Real exchange rate, $EP^*/P\uparrow$	$CA\uparrow$
Real exchange rate, $EP^*/P\downarrow$	$CA\downarrow$
Disposable income, $Y^d\uparrow$	$CA\downarrow$
Disposable income, $Y^d\downarrow$	$CA\uparrow$

Figure 16-1

Aggregate Demand as a Function of Output

Aggregate demand is a function of the real exchange rate (EP^*/P), disposable income ($Y - T$), investment demand (I), and government spending (G). If all other factors remain unchanged, a rise in output (real income), Y, increases aggregate demand. Because the increase in aggregate demand is less than the increase in output, the slope of the aggregate demand function is less than 1 (as indicated by its position within the 45-degree angle).

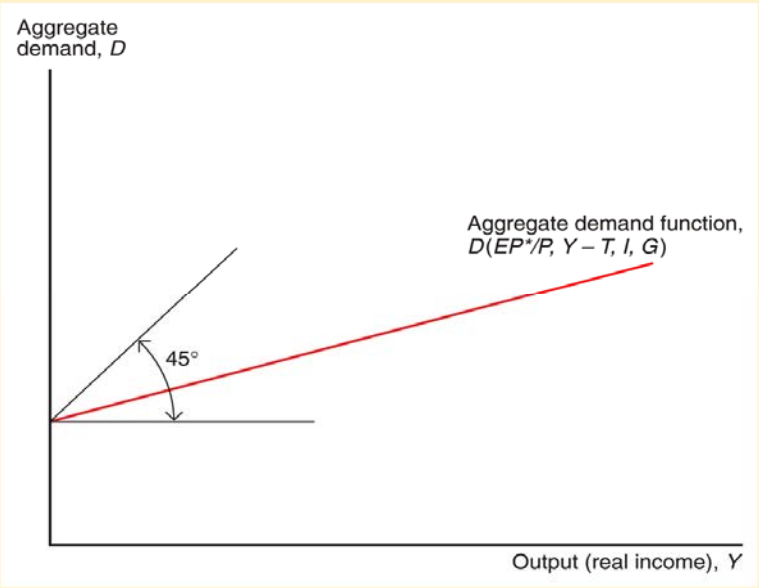
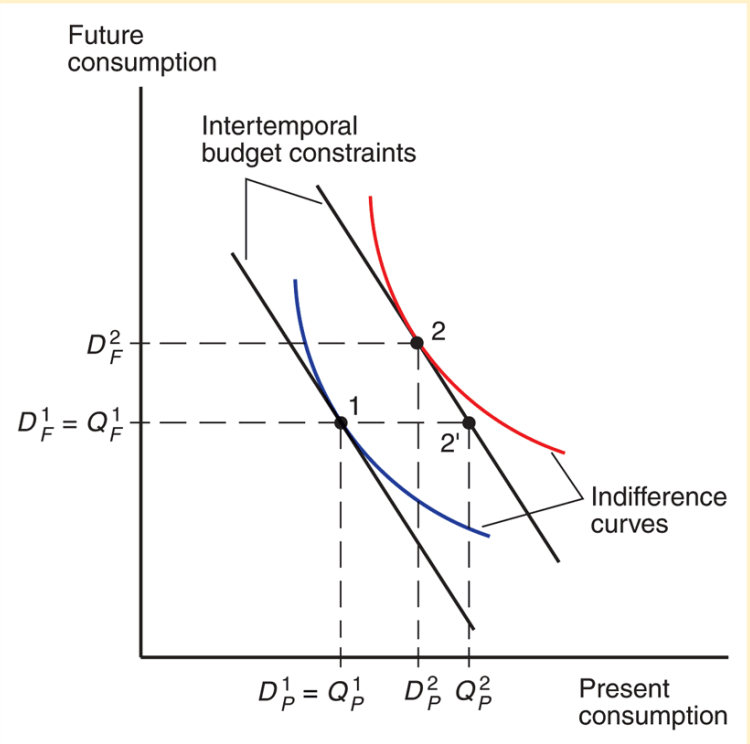


Figure 16A1-1

Change in Output and Saving

A one-period increase in output raises saving.



Chapter 17

Fixed Exchange Rates and Foreign Exchange Intervention

Preview

- Balance sheets of central banks
- Intervention in the foreign exchange market and the money supply
- How the central bank fixes the exchange rate
- Monetary and fiscal policies under fixed exchange rates
- Financial market crises and capital flight
- Types of fixed exchange rates: reserve currency and gold standard systems
- Zero interest rates, deflation and liquidity traps

Introduction

- Many countries try to fix or "peg" their exchange rate to a currency or group of currencies by intervening in the foreign exchange market.
- Many with a flexible or "floating" exchange rate in fact practice a **managed floating exchange rate**.
  - ❑ The central bank "manages" the exchange rate from time to time by buying and selling currency and assets, especially in periods of exchange rate volatility.
- How do central banks intervene in the foreign exchange market?

Central Bank Intervention and the Money Supply

- To study the effects of central bank intervention in the foreign exchange market, first construct a simplified balance sheet for the central bank.
  - ❑ This records the assets and liabilities of a central bank.

- Balance sheets use double booking keeping: each transaction enters the balance sheet twice.

Central Bank's Balance Sheet

- Assets
  - Foreign government bonds (official international reserves)
  - Gold (official international reserves)
  - Domestic government bonds
  - Loans to domestic banks (called discount loans in US)
- Liabilities
  - Deposits of domestic banks
  - Currency in circulation (previously central banks had to give up gold when citizens brought currency)
- Assets = Liabilities + Net worth
  - If we assume that net worth of the central bank always equals zero then assets = liabilities.
  - An increase in assets leads to an equal increase in liabilities.
  - A decrease in assets leads to an equal decrease in liabilities.
- Changes in the central bank's balance sheet lead to changes in currency in circulation or changes in bank deposits, which lead to changes in the money supply.
  - If their deposits at the central bank increase, banks typically have more funds available to lend to customers, so that the amount of money in circulation increases.

Assets, Liabilities and the Money Supply

- A <u>purchase</u> of any asset will be paid for with currency or a check from the central bank,
  - both of which are denominated in domestic currency, and

- ❑ both of which increase the supply of money in circulation.
- ❑ The transaction leads to equal increases of assets and liabilities.

- When the central bank buys *domestic bonds or foreign bonds*, the domestic money supply increases.
- A sale of any asset will be paid for with currency or a check given to the central bank,
  - ❑ both of which are denominated in domestic currency.
  - ❑ The central bank puts the currency into its vault or reduces the amount of bank deposits,
  - ❑ causing the supply of money in circulation to shrink.
  - ❑ The transaction leads to equal decreases of assets and liabilities.
- When the central bank sells *domestic bonds or foreign bonds*, the domestic money supply decreases.

Foreign Exchange Markets

- Central banks trade foreign government bonds in the foreign exchange markets.
  - ❑ Foreign currency deposits and foreign government bonds are often substitutes: both are fairly liquid assets denominated in foreign currency.
  - ❑ Quantities of both foreign currency deposits and foreign government bonds that are bought and sold influence the exchange rate.

Sterilization

- Because buying and selling of foreign bonds in the foreign exchange market affects the domestic money supply, a central bank may want to offset this effect.
- This offsetting effect is called **sterilization**.

- If the central bank sells foreign bonds in the foreign exchange market, it can buy domestic government bonds in bond markets—hoping to leave the amount of money in circulation unchanged.

Fixed Exchange Rates

- To fix the exchange rate, a central bank influences the quantities supplied and demanded of currency by trading domestic and foreign assets, so that the exchange rate (the price of foreign currency in terms of domestic currency) stays constant.
- The foreign exchange market is in equilibrium when

$$R = R^* + (E^e - E)/E$$

- When the exchange rate is fixed at some level E_0 and the market expects it to stay fixed at that level, then

$$R = R^*$$

- To fix the exchange rate, the central bank must trade foreign and domestic assets until $R = R^*$.
- In other words, it adjusts the money supply until the domestic interest rate equals the foreign interest rate, given the price level and real output, until:

$$M^s/P = L(R^*, Y)$$

- Suppose that the central bank has fixed the exchange rate at E_0 but the level of output rises, raising the demand for real money.
- This leads to higher interest rates and upward pressure on the value of the domestic currency.
- How should the central bank respond if it wants to fix exchange rates?
- The central bank must buy foreign assets in the foreign exchange market,
    - thereby increasing the money supply,
    - thereby reducing interest rates.
    - Alternatively, by demanding (buying) assets denominated in foreign currency and by supplying (selling) domestic currency, the

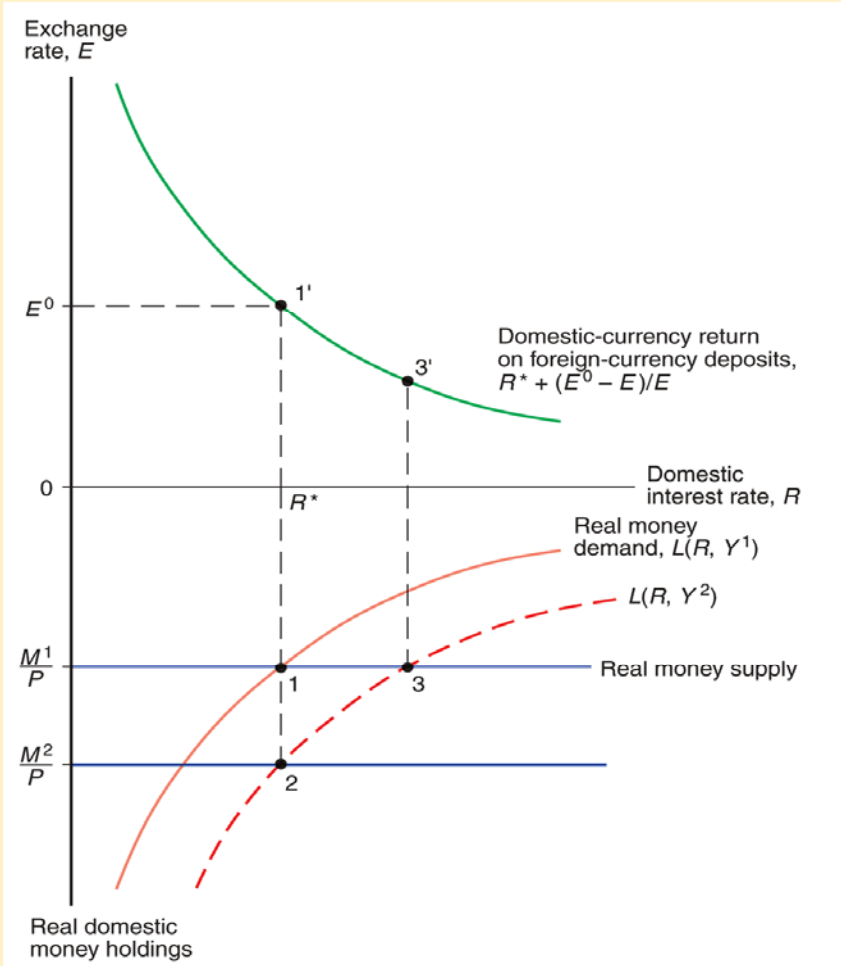
price/value of foreign currency is increased and the price/value of domestic currency is decreased.

Fixed Exchange Rates

Figure 17-1

Asset Market Equilibrium with a Fixed Exchange Rate, E^0

To hold the exchange rate fixed at E^0 when output rises from Y^1 to Y^2, the central bank must purchase foreign assets and thereby raise the money supply from M^1 to M^2.



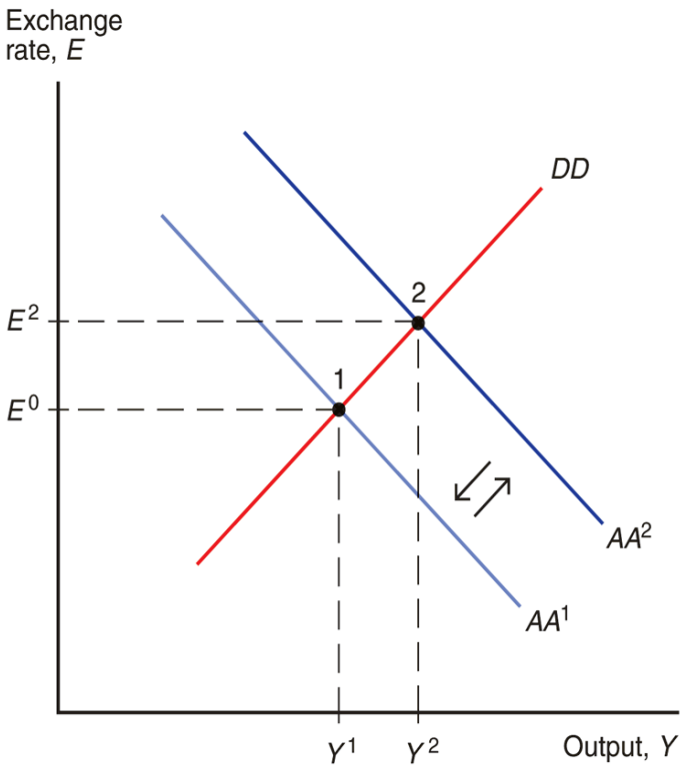
Monetary Policy and Fixed Exchange Rates

- Because the central bank must buy and sell foreign assets to keep the exchange rate fixed, monetary policy is *ineffective* in influencing output and employment.

Figure 17-2

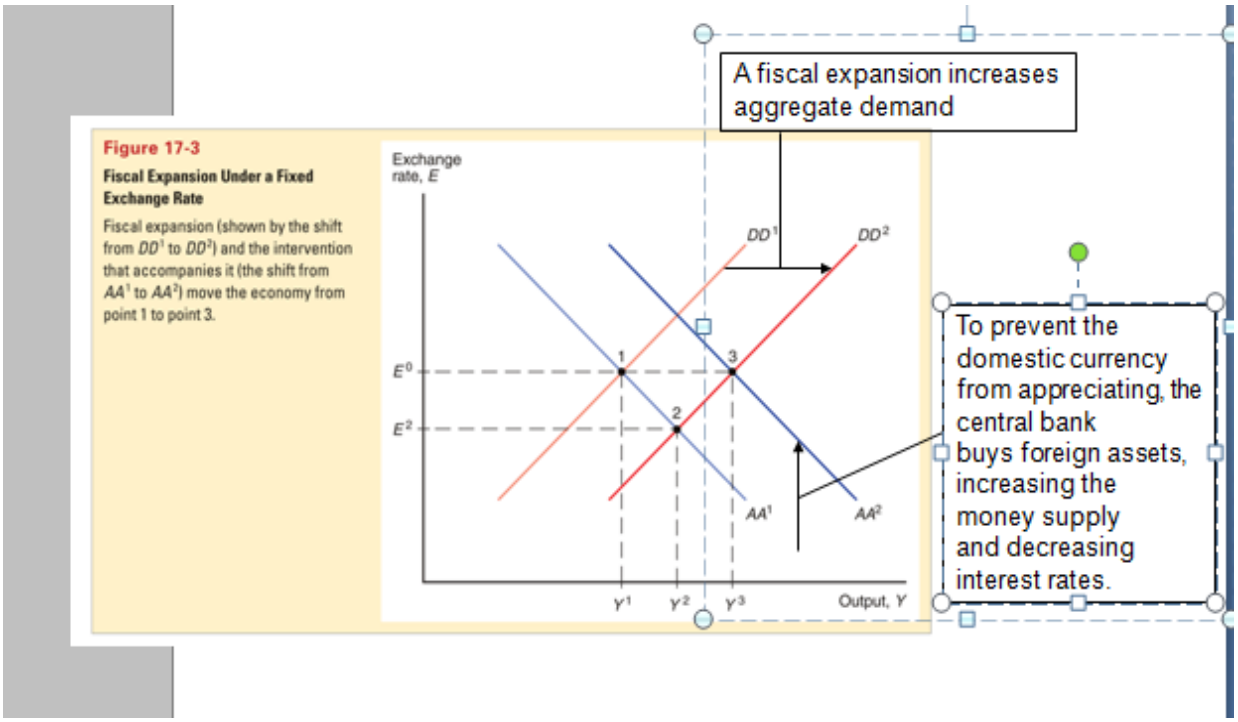
Monetary Expansion Is Ineffective Under a Fixed Exchange Rate

Initial equilibrium is shown at point 1, where the output and asset markets simultaneously clear at a fixed exchange rate of E^0 and an output level of Y^1. Hoping to increase output to Y^2, the central bank decides to increase the money supply by buying domestic assets and shifting AA^1 to AA^2. Because the central bank must maintain E^0, however, it has to sell foreign assets for domestic currency, an action that decreases the money supply immediately and returns AA^2 back to AA^1. The economy's equilibrium therefore remains at point 1, with output unchanged at Y^1.



Fiscal Policy and Fixed Exchange Rates in the Short Run

- Because the central bank must buy and sell foreign assets to keep the exchange rate fixed, temporary fiscal policy is *more effective* in influencing output and employment in the short run.
  - ❑ The rise in output due to expansionary fiscal policy raises money demand, putting upward pressure on interest rates and upward pressure on the value of the domestic currency.
  - ❑ To prevent an appreciation of the domestic currency, the central bank must buy foreign assets, thereby increasing the money supply.



Fiscal Policy and Fixed Exchange Rates in the Long Run

- When the exchange rate is fixed, there is no real appreciation of the value of domestic products in the short run.
- But when output is above its normal (long run) level, wages and prices tend to rise.
- A rising price level makes domestic products more expensive: a *real* appreciation (EP^*/P falls).
  - ❑ Aggregate demand and output decrease as prices rise: *DD* curve shifts left.
  - ❑ Prices tend to rise until employment, aggregate demand and output fall to their normal levels.
- In the long run prices increase proportionally to the increase in the money supply caused by central bank intervention in the foreign exchange market.
  - ❑ *AA* curve shifts down (left) as prices rise.

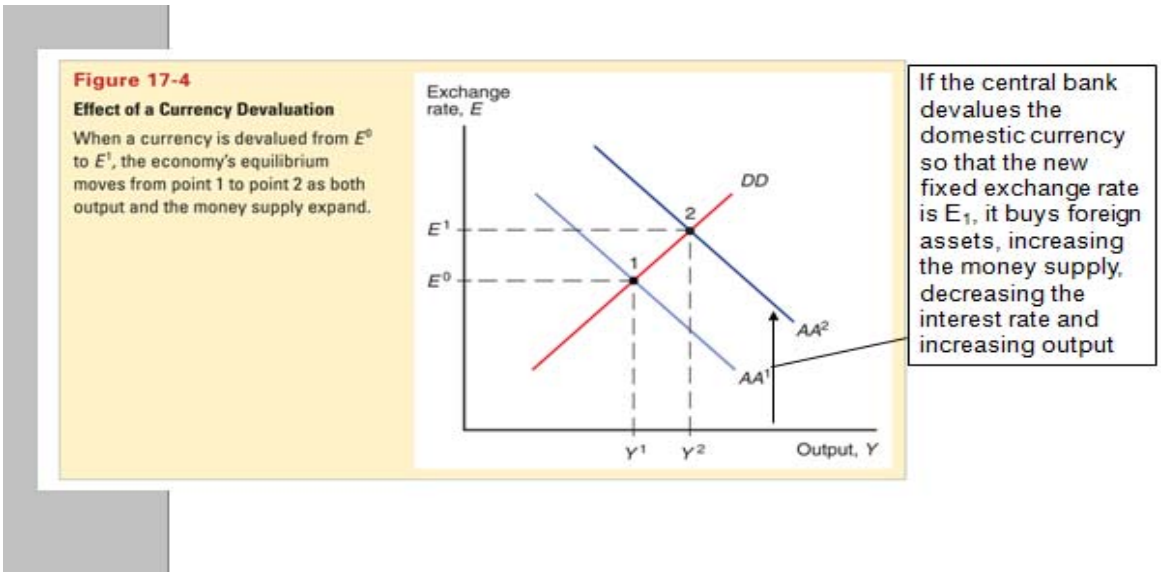
- Nominal exchange rates will be constant (as long as the fixed exchange rate is maintained), but the real exchange rate will be lower (a real appreciation).

Devaluation and Revaluation

- Depreciation and appreciation refer to changes in the value of a currency due to market changes.
- **Devaluation** refers to a change in a fixed exchange rate caused by the central bank.
  - a unit of domestic currency is made less valuable, so that more nits must be exchanged for 1 unit of foreign currency.
- **Revaluation** is also a change in a fixed exchange rate caused by the central bank.
  - a unit of domestic currency is made more valuable, so that fewer units need to be exchanged for 1 unit of foreign currency.

Devaluation

- For devaluation to occur, the central bank buys foreign assets, so that the domestic money supply increases, and interest rates fall, causing a fall in the return on domestic currency assets.
  - Domestic goods are cheaper, so aggregate demand and output increase.
  - Official international reserve assets (foreign bonds) increase.

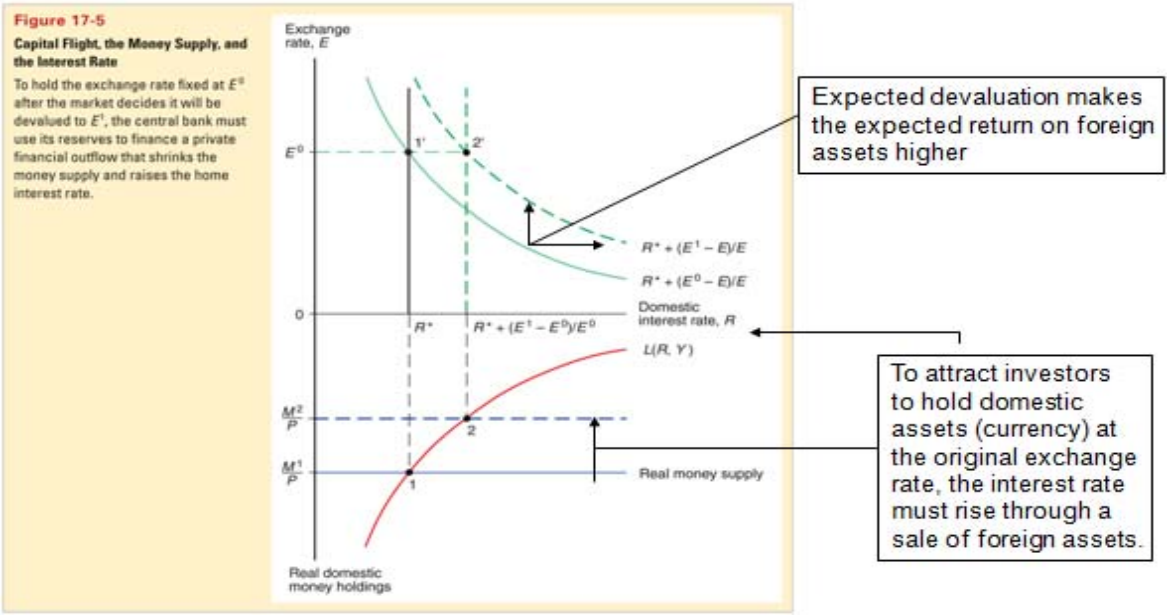


Financial Crises and Capital Flight

- When a central bank does not have enough official international reserve assets to maintain a fixed exchange rate, a **balance of payments crisis** results.
  - ❑ To sustain a fixed exchange rate, the central bank must have enough foreign assets to sell in order to satisfy the demand for them at the fixed exchange rate.
- Investors may expect that the domestic currency will be devalued, causing them to want foreign assets instead of domestic assets, whose value is expected to fall soon.

1. This expectation or fear only makes the balance of payments crisis worse:
   - ❑ investors rush to change their domestic assets into foreign assets, depleting the stock of official international reserve assets more quickly.
2. As a result, financial capital is quickly moved from domestic assets to foreign assets: **capital flight**.
   - ❑ The domestic economy has a shortage of financial capital for investment and has low aggregate demand.

3. To avoid this outcome, domestic assets must offer a high interest rates to entice investors to hold them.
    - ❑ The central bank can push interest rates higher by reducing the money supply (by selling foreign assets).
4. As a result, the domestic economy may face high interest rates, reduced money supply, low aggregate demand, low output and low employment.



- Expectations of a balance of payments crisis only worsen the crisis and hasten devaluation.
    - ❑ What causes expectations to change?
    - ❑ Expectations about the central bank's ability and willingness to maintain the fixed exchange rate.
    - ❑ Expectations about the economy: shrinking demand for domestic products relative to foreign products means that the domestic currency should become less valuable.
- In fact, expectations of devaluation can cause a devaluation: **self-fulfilling crisis**.

- What happens if the central bank runs out of official international reserves (foreign assets)?
- It must devalue the domestic currency so that it takes more domestic currency (assets) to exchange for 1 unit of foreign currency (asset).
  - ❑ This will allow the central bank to replenish its foreign assets by buying them back at a devalued rate,
  - ❑ increasing the money supply,
  - ❑ reducing interest rates,
  - ❑ reducing the value of domestic products,
  - ❑ increasing aggregate demand, output, employment over time.
- In a balance of payments crisis,
  - ❑ the central bank may buy domestic bonds and sell domestic currency (to increase the money supply) to prevent high interest rates, but this only depreciates the domestic currency more.
  - ❑ the central bank generally can not satisfy the goals of low interest rates and fixed exchange rates simultaneously.

Interest Rate Differentials

- For many countries, the expected rates of return are not the same: $R > R^*+(E^e - E)/E$. Why?
- **Default risk**:

The risk that the country's borrowers will default on their loan repayments. Lenders require a higher interest rate to compensate for this risk.

- **Exchange rate risk**:

If there is a risk that a country's currency will depreciate or be devalued, then domestic borrowers must pay a higher interest rate to compensate foreign lenders.

- Because of these risks, domestic assets and foreign assets are not treated the same.

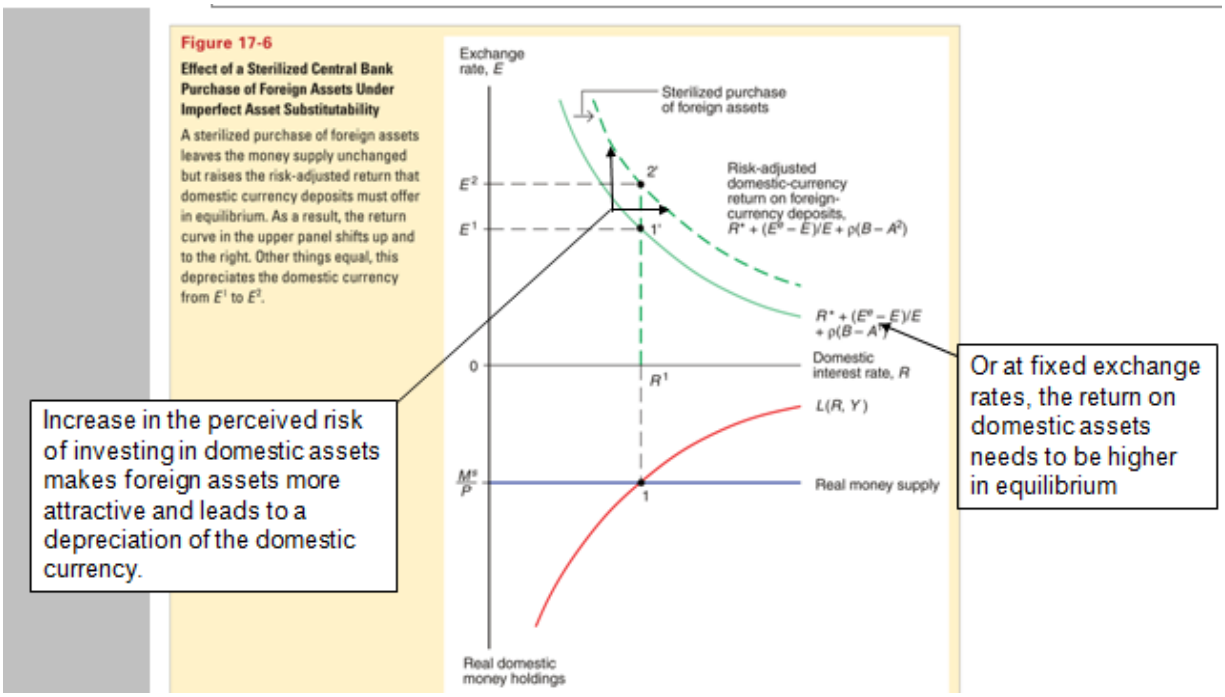
- ❑ Previously, we assumed that foreign and domestic currency deposits were **perfect substitutes**: deposits everywhere were *treated as the same* type of investment, because risk and liquidity of the assets were assumed to be the same.
- ❑ In general, foreign and domestic assets may *differ* in the amount of risk that they carry: they may be **imperfect substitutes**.
- ❑ Investors consider this risk, as well as rates of return on the assets, when deciding whether to invest.

- A difference in the risk of domestic and foreign assets is one reason why expected returns are not equal across countries:

$$R = R^* + (E^e - E)/E + \rho$$

where ρ is called a **risk premium**, an additional amount needed to compensate investors for investing in risky domestic assets.

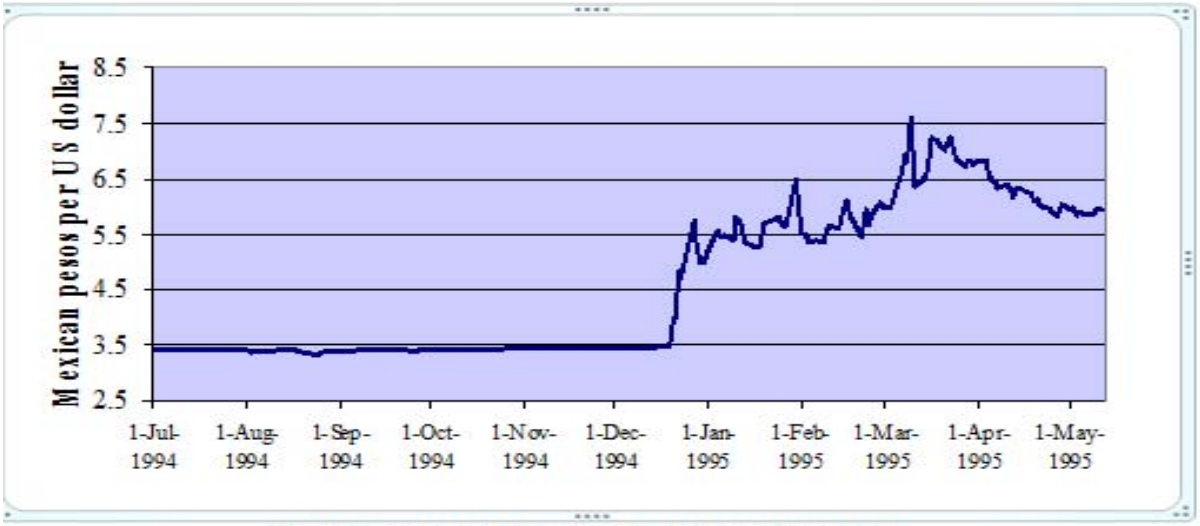
- The risk could be caused by default risk or exchange rate risk.



CASE STUDY: The Mexican Peso Crisis, 1994–1995

- In late 1994, the Mexican central bank devalued the value of the peso relative to the US dollar.

- This action was accompanied by high interest rates, capital flight, low investment, low production and high unemployment.
- What happened?



Source: Saint Louis Federal Reserve

Understanding the Crisis

- In the early 1990s, Mexico was an attractive place for foreign investment, especially from NAFTA partners.
- During 1994, political developments caused an increase in Mexico's risk premium (ρ) due to increases in default risk and exchange rate risk:
  - ❑ peasant uprising in Chiapas
  - ❑ assassination of leading presidential candidate from PRI
- Also, the Federal Reserve raised US interest rates during 1994 to prevent US inflation. (So, R^* !)
- These events put downward pressure on the value of the peso.
- Mexico's central bank had promised to maintain the fixed exchange rate.
- To do so, it sold dollar denominated assets, decreasing the money supply and increasing interest rates.
- To do so, it needed to have adequate reserves of dollar denominated assets. Did it?

US Dollar Denominated International Reserves of the Mexican Central Bank

January 1994	$27 billion
October 1994	$17 billion
November 1994	$13 billion
December 1994	$ 6 billion

During 1994, Mexico's central bank hid the fact that its reserves were being depleted. Why?

Understanding the Crisis

- 20 Dec 1994: Mexico devalues the peso by 13%. It fixes E at 4.0 pesos/dollar instead of 3.4 pesos/dollar.
- Investors expect that the central bank has depleted its reserves.
- ρ ! further due to exchange rate risk: investors expect that the central bank to devalue again and they sell Mexican assets, putting more downward pressure on the value of the peso.
- 22 Dec 1994: with reserves nearly gone, the central bank abandons the fixed rate.
- In a week, the peso falls another 30% to about 5.7 pesos/dollar.

The Rescue Package: Reducing ρ

- The US & IMF set up a $50 billion fund to guarantee the value of loans made to Mexico's government,
  - ❑ reducing default risk,
  - ❑ and reducing exchange rate risk, since foreign loans could act as official international reserves to stabilize the exchange rate if necessary.
- After a recession in 1995, Mexico began a recovery from the crisis.

- Mexican goods were relatively cheap.
- Stronger demand for Mexican products reduced negative effects of exchange rate risk.

Types of Fixed Exchange Rate Systems

1. **Reserve currency system**: one currency acts as official international reserves.
   - The US dollar was the currency that acted as official international reserves from under the fixed exchange rate system from 1944–1973.
   - All countries but the US held US dollars as the means to make official international payments.
2. **Gold standard**: gold acts as official international reserves that all countries use to make official international payments.

Reserve Currency System

- From 1944–1973, each central bank fixed the value of its currency relative to the US dollar by buying or selling domestic assets in exchange for dollar assets.
- Arbitrage ensured that exchange rates between any two currencies remained fixed.
  - Suppose Bank of Japan fixed the exchange rate at 360¥/US$1 and the Bank of France fixed the exchange rate at 5 Ffr/US$1
  - The yen/franc rate would be 360¥/US$1 / 5Ffr/US$1 = 72¥/1Ffr
  - If not, then currency traders could make an easy profit by buying currency where it is cheap and selling it where it is expensive.
- Because most countries maintained fixed exchange rates by trading dollar denominated (foreign) assets, they had ineffective monetary policies.

- The Federal Reserve, however, did not have to intervene in foreign exchange markets, so it could conduct monetary policy to influence aggregate demand, output and employment.
  - ❑ The US was in a special position because it was able to use monetary policy as it wished.
- In fact, the monetary policy of the US influenced the economies of other countries.
- Suppose the US increased its money supply.
  - ❑ This would lower US interest rates, putting downward pressure on the value of the US dollar.
  - ❑ If other central banks maintained their fixed exchange rates, they would have needed to buy dollar denominated (foreign) assets, increasing their money supplies.
  - ❑ In effect, the monetary policies of other countries had to follow that of the US, which was not always optimal for their levels of output and employment.

Gold Standard

- Under the gold standard from 1870–1914 and after 1918 for some countries, each central bank fixed the value of its currency relative to a quantity of gold (in ounces or grams) by trading domestic assets in exchange for gold.
  - ❑ For example, if the price of gold was fixed at $35 per ounce by the Federal Reserve while the price of gold was fixed at £14.58 per ounce by the Bank of England, then the $/£ exchange rate must have been fixed at $2.40 per pound.
  - ❑ Why?
- The gold standard did not give the monetary policy of the US or any other country a privileged role.

- If one country lost official international reserves (gold) and thereby decreased its money supply, then another country gained them and thereby increased its money supply.
- The gold standard also acted as an automatic restraint on increasing money supplies too quickly, preventing inflationary monetary policies.
- But restraints on monetary policy restrained central banks from increasing the money supply to encourage aggregate demand, increasing output and employment.
- And the price of gold relative to other goods and services varied, depending on the supply and demand of gold.
    - ❑ A new supply of gold made gold abundant (cheap), and prices of other goods and services rose because the currency price of gold was fixed.
    - ❑ Strong demand for gold jewelry made gold scarce (expensive), and prices of other goods and services fell because the currency price of gold was fixed.
- A reinstated gold standard would require new discoveries of gold to increase the money supply as economies and populations grow.
- A reinstated gold standard may give Russia, South Africa, the US or other gold producers inordinate influence in international financial and macroeconomic conditions.

Gold Exchange Standard

- **The gold exchange standard**: a system of official international reserves in both a group of currencies (with fixed prices of gold) and gold itself.
    - ❑ allows more flexibility in the growth of international reserves, depending on macroeconomic conditions, because the amount of currencies held as reserves could change.

- ❑ does not constrain economies as much to the supply and demand of gold
- ❑ The fixed exchange rate system from 1944–1973 used gold, and so operated more like a gold exchange standard than a currency reserve system.

Gold and Silver Standard

- **Bimetallic standard**: the value of currency is based on both silver and gold.
- The US used a bimetallic standard from 1837–1861.
- Banks coined specified amounts of gold or silver into the national currency unit.
  - ❑ 371.25 grains of silver or 23.22 grains of gold could be turned into a silver or a gold dollar.
  - ❑ So gold was worth 371.25/23.22 = 16 times as much as silver.
  - ❑ See http://www.micheloud.com/FXM/MH/index.htm for a fun description of the bimetallic standard, the gold standard after 1873 ("Crime of 1873") and the Wizard of Oz!

Summary

1. Changes in a central bank's balance sheet lead to changes in the domestic money supply.
   - ❑ Buying domestic or foreign assets increases the domestic money supply.
   - ❑ Selling domestic or foreign assets decreases the domestic money supply.

2. When markets expect exchange rates to be fixed, domestic and foreign assets have equal expected returns if they are treated as perfect substitutes.
3. Monetary policy is ineffective in influencing output or employment under fixed exchange rates.
4. Temporary fiscal policy is more effective in influencing output and employment under fixed exchange rates, compared to under flexible exchange rates.
5. A balance of payments crisis occurs when a central bank does not have enough official international reserves to maintain a fixed exchange rate.
6. Capital flight can occur if investors expect a devaluation, which may occur if they expect that a central bank can no longer maintain a fixed exchange rate: self-fulfilling crises can occur.
7. Domestic and foreign assets may not be perfect substitutes due to differences in default risk or due to exchange rate risk.
8. Under a reserve currency system, all central banks but the one who controls the supply of the reserve currency trade the reserve currency to maintain fixed exchange rates.
9. Under a gold standard, all central banks trade gold to maintain fixed exchange rates.

Interest Rates, Exchange Rates and a Liquidity Trap

- A liquidity trap occurs when nominal interest rates fall to zero and the central bank cannot encourage people to hold more liquid assets (money).
    - ❑ Nominal interest rates can not fall below zero: depositors would have to pay to put their money in banks.
    - ❑ At a zero interest rate market equilibrium, people are indifferent between holding money and interest bearing assets, and the central bank can not encourage people to hold more money.

A Liquidity Trap for Japan?

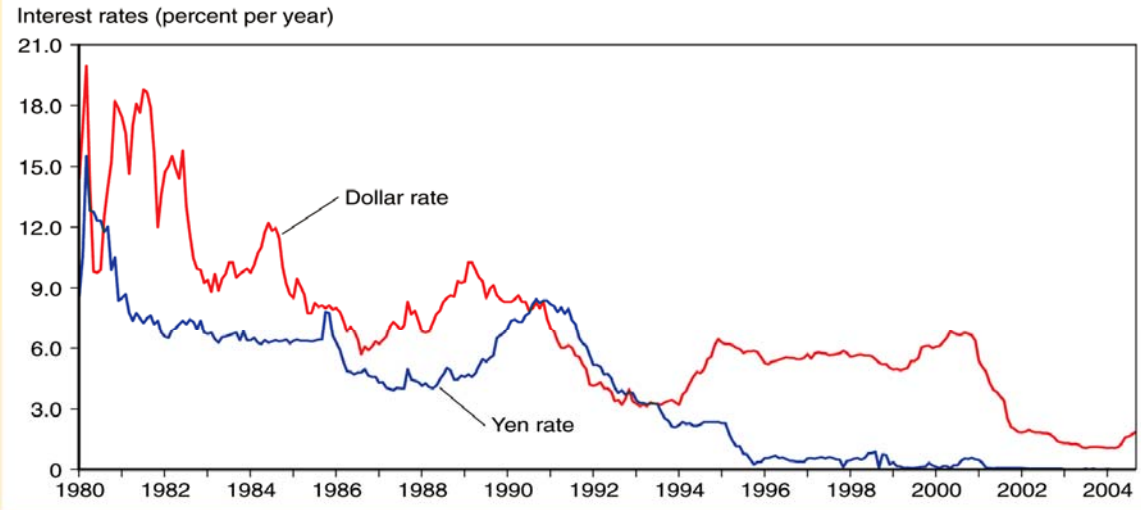


Figure 13-2

Interest Rates on Dollar and Yen Deposits, 1980–2004

Since dollar and yen interest rates are not measured in comparable terms, they can move quite differently over time.

Source: *Datastream*. Three-month interest rates are shown.

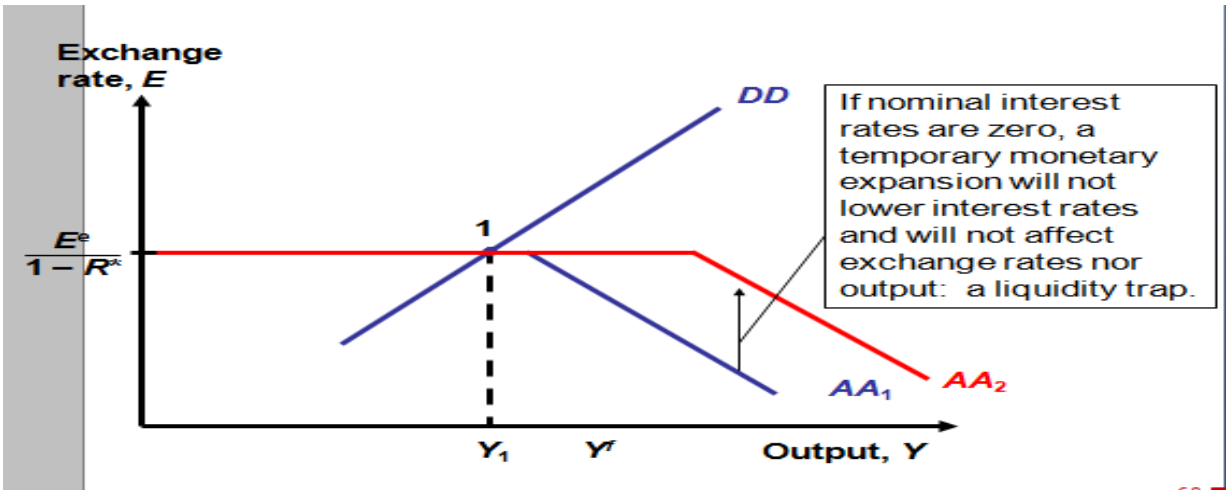
Interest Rates, Exchange Rates and a Liquidity Trap

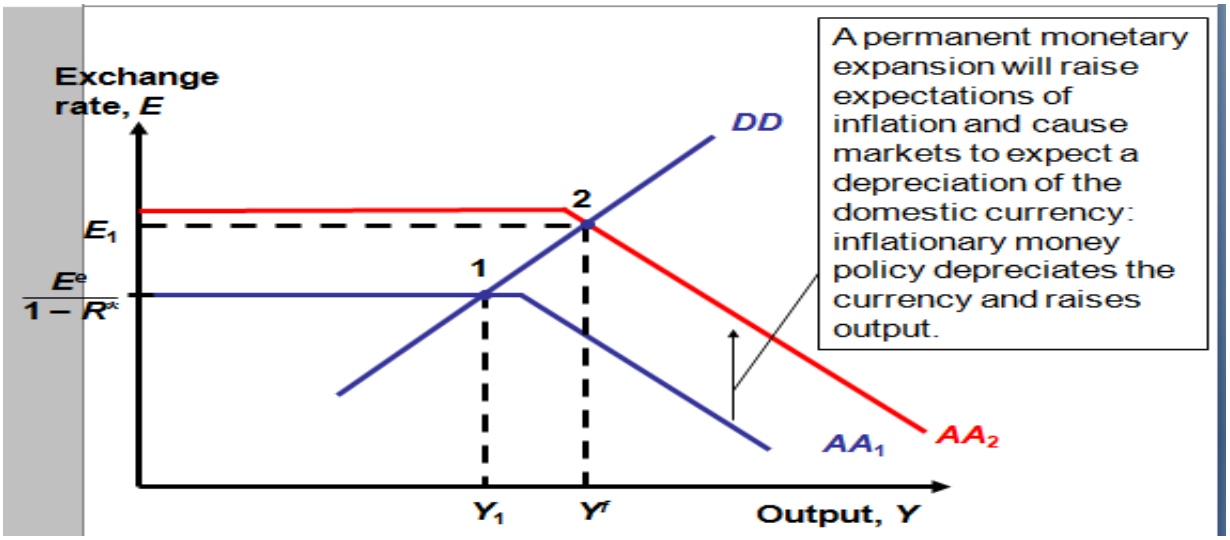
- If interest rates are stuck at zero, then

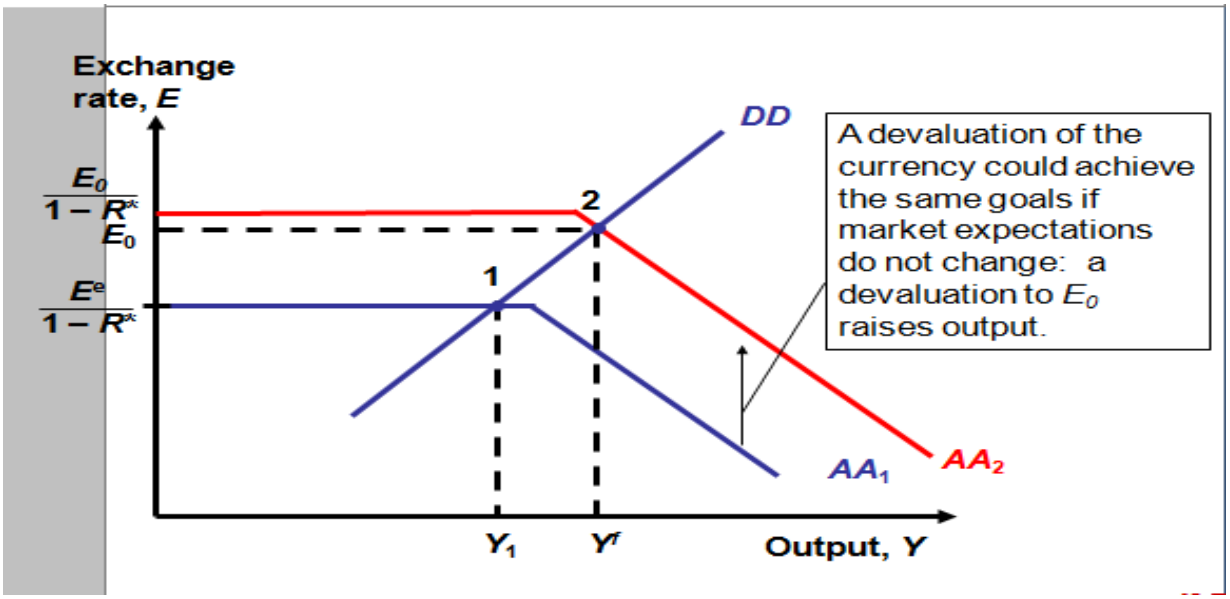
$$R = 0 = R^* + (E^e - E)/E$$

  - $-ER^* = E^e - E$
  - $E(1 - R^*) = E^e$
  - $E = E^e/(1 - R^*)$

- With fixed expectations about the exchange rate (and inflation) and fixed foreign interest rates, the exchange rate is fixed.
  - A purchase of domestic assets by the central bank does not lower the interest rate, nor does it change the exchange rate.







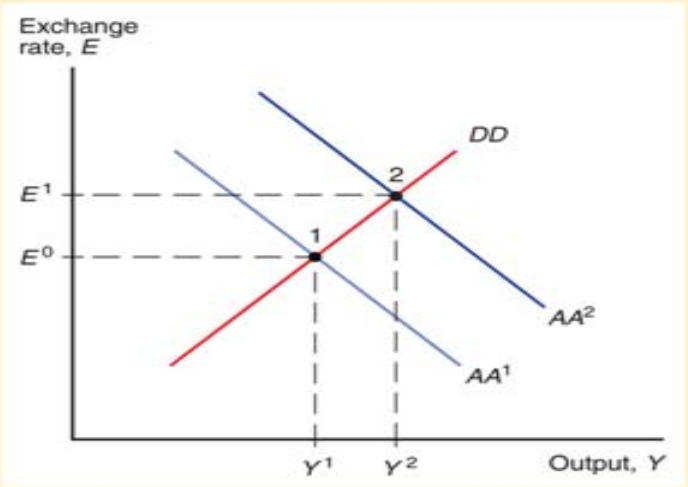
- Will Japan adopt inflationary monetary policy or a devaluation of the yen?

- The Bank of Japan appointed new governors in March 2003, and it has increased the growth of the money supply and tried to depreciate the yen by purchasing international reserves, but it is too early to say if deflation has ended.
- An alternative policy is to let prices and wages fall over time (deflation), allowing a real depreciation of Japanese products.
- This alternative policy would allow low output and employment to gradually rise as prices, wages and the value of Japanese products slowly fall.

Figure 17-4

Effect of a Currency Devaluation

When a currency is devalued from E^0 to E^1, the economy's equilibrium moves from point 1 to point 2 as both output and the money supply expand.



Source: IMF International Financial Statistics

TABLE 17-1 Effects of a $100 Foreign Exchange Intervention: Summary

Domestic Central Bank's Action	Effect on Domestic Money Supply	Effect on Central Bank Domestic Assets	Effect on Central Bank Foreign Assets
Nonsterilized foreign exchange purchase	+$100	0	+$100
Sterilized foreign exchange purchase	0	−$100	+$100
Nonsterilized foreign exchange sale	−$100	0	−$100
Sterilized foreign exchange sale	0	+$100	−$100

Figure 17-1

Asset Market Equilibrium with a Fixed Exchange Rate, E^0

To hold the exchange rate fixed at E^0 when output rises from Y^1 to Y^2, the central bank must purchase foreign assets and thereby raise the money supply from M^1 to M^2.

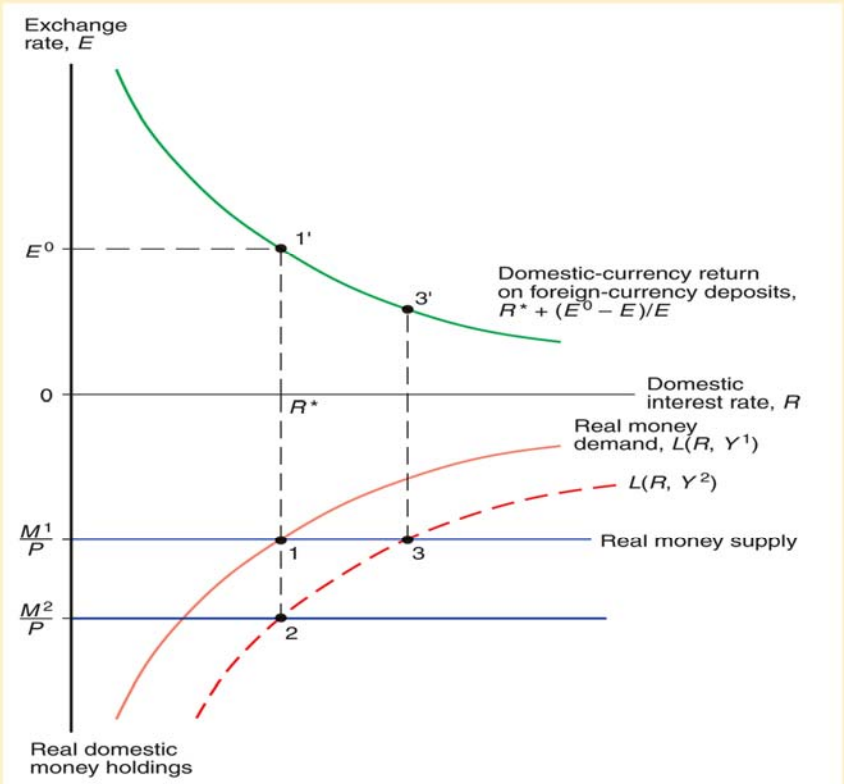


Figure 17-2

Monetary Expansion Is Ineffective Under a Fixed Exchange Rate

Initial equilibrium is shown at point 1, where the output and asset markets simultaneously clear at a fixed exchange rate of E^0 and an output level of Y^1. Hoping to increase output to Y^2, the central bank decides to increase the money supply by buying domestic assets and shifting AA^1 to AA^2. Because the central bank must maintain E^0, however, it has to sell foreign assets for domestic currency, an action that decreases the money supply immediately and returns AA^2 back to AA^1. The economy's equilibrium therefore remains at point 1, with output unchanged at Y^1.

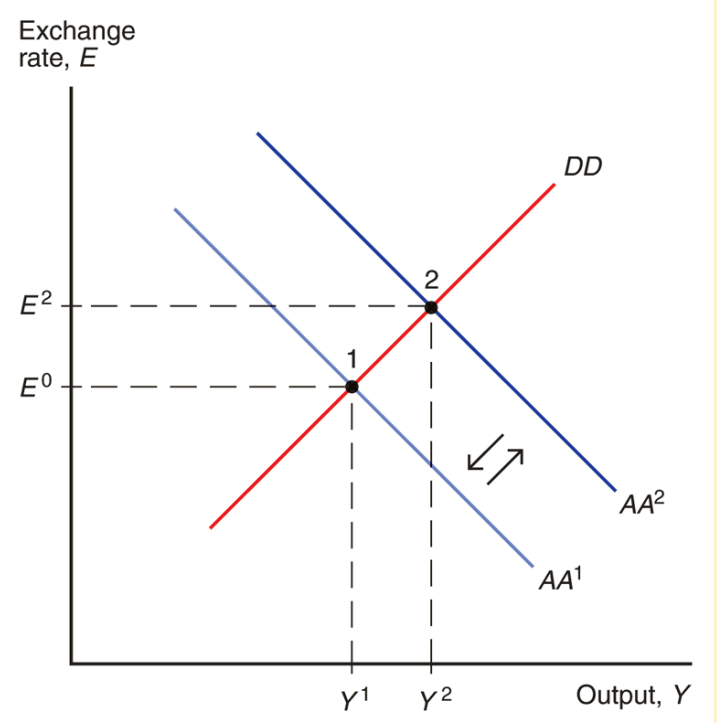


Figure 17A1-1

The Domestic Bond Supply and the Foreign Exchange Risk Premium Under Imperfect Asset Substitutability

An increase in the supply of domestic currency bonds that the private sector must hold raises the risk premium on domestic currency assets.

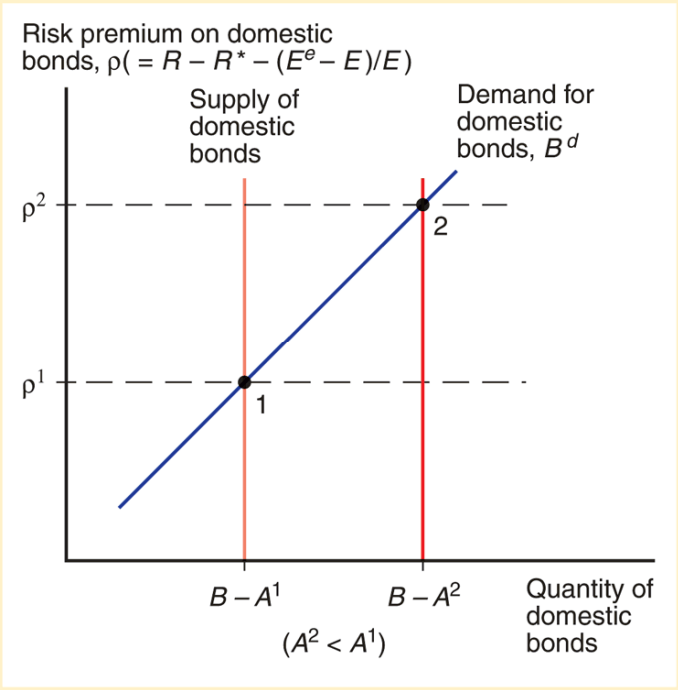
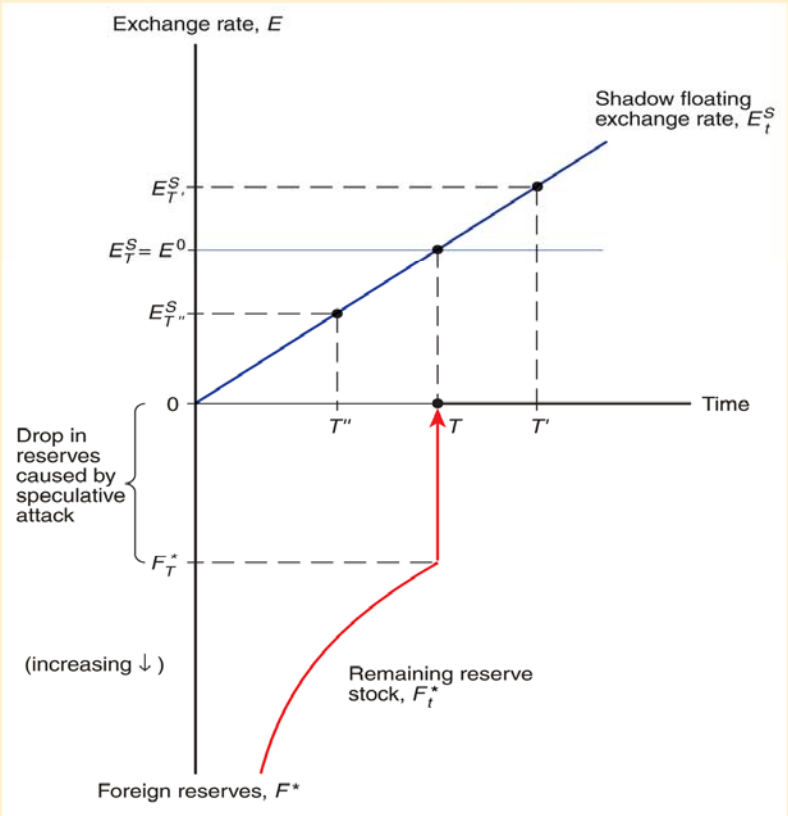


Figure 17A2-1

How the Timing of a Balance of Payments Crisis Is Determined

The market stages a speculative attack and buys the remaining foreign reserve stock F_T^* at time T, when the shadow floating exchange rate E_T^S just equals the precollapse fixed exchange rate E^0.



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Ершов Дмитрий Евгеньевич
Сучков Дмитрий Владимирович
Артюшина Екатерина Валерьевна

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«Нижегородский государственный архитектурно-строительный университет»
603950, Н.Новгород, Ильинская, 65
Полиграфцентр ННГАСУ, 603950, Н.Новгород, Ильинская, 65