Chapter 7
International Factor Movements

Prepared by **Iordanis Petsas**

To Accompany

International Economics: Theory and Policy, Sixth Edition
by **Paul R. Krugman and Maurice Obstfeld**

Chapter Organization

- Introduction
- International Labor Mobility
- International Borrowing and Lending
- Direct Foreign Investment and Multinational Firms
- Summary
- Appendix: More on Intertemporal Trade

Introduction

- Movement of goods and services is one form of international integration.
- Another form of integration is international movements of factors of production (**factor movements**).
- Factor movements include:
  - Labor migration
  - Transfer of capital via international borrowing and lending
  - International linkages involved in the formation of multinational corporations
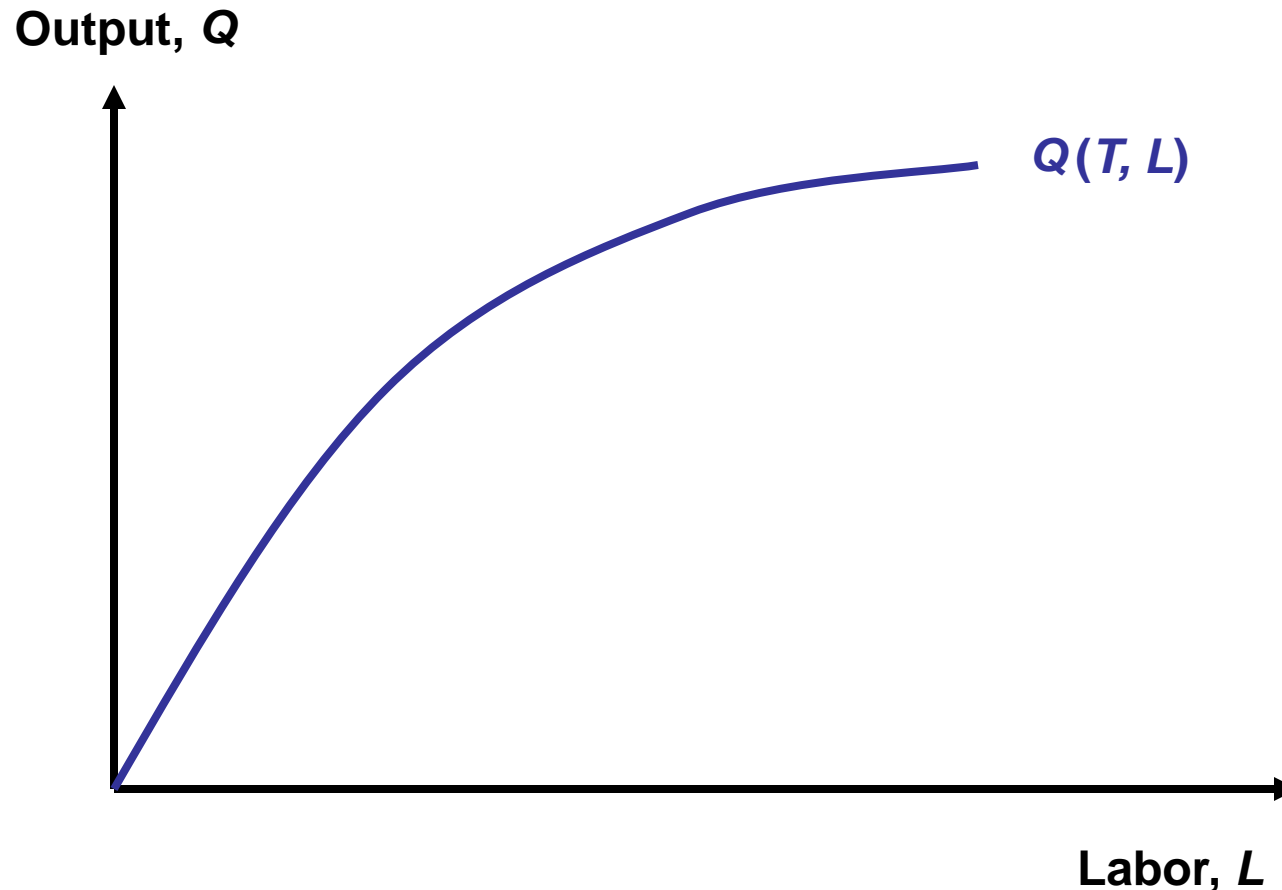
International Labor Mobility

- **A One-Good Model Without Factor Mobility**
  - Assumptions of the model:
    - There are two countries (Home and Foreign).
    - There are two factors of production: Land (T) and Labor (L).
    - Both countries produce only one good (refer to it as "output").
    - Both countries have the same technology but different overall land-labor ratios.
    - Home is the labor-abundant country and Foreign is the land-abundant country.
    - Perfect competition prevails in all markets.
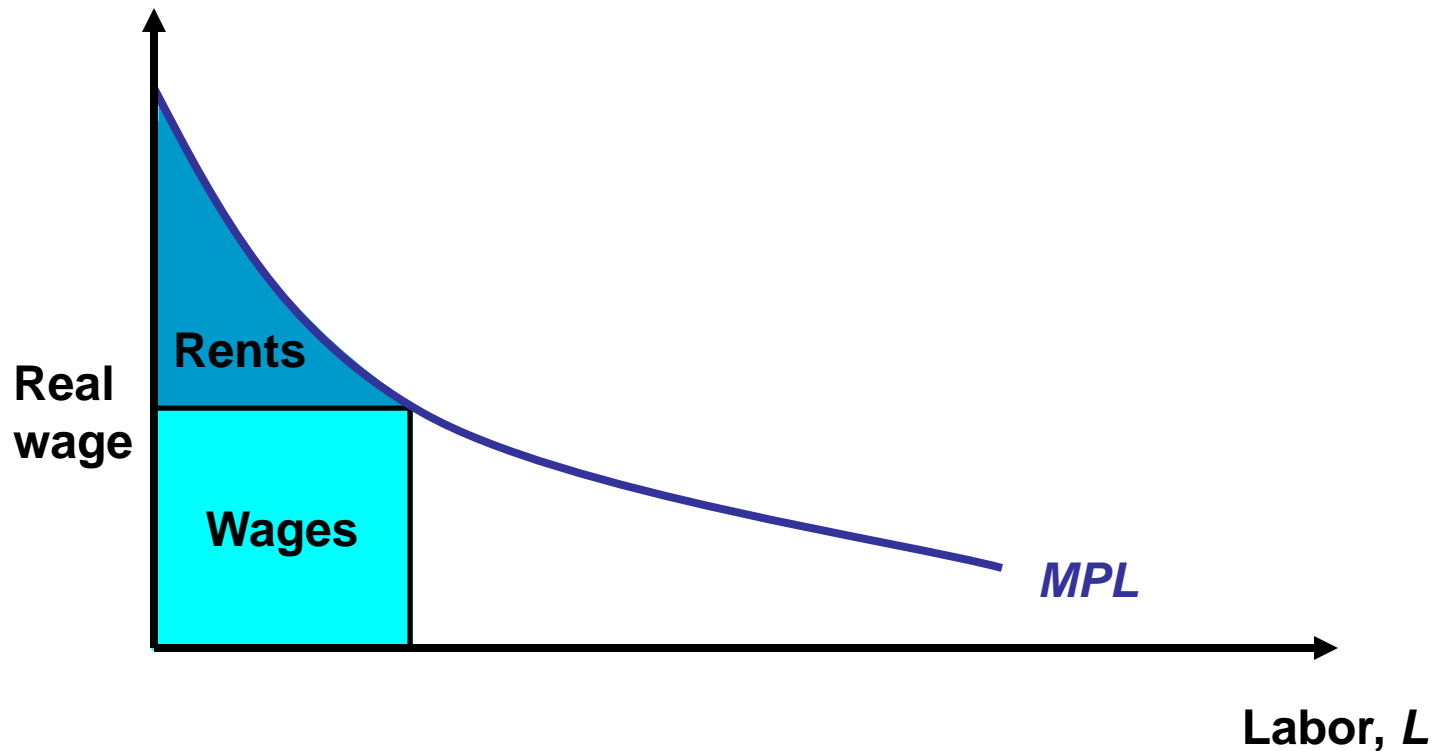
Figure 7-1: An Economy's Production Function

Output, *Q*

$Q(T, L)$

Labor, *L*

International Labor Mobility

Figure 7-2: The Marginal Product of Labor
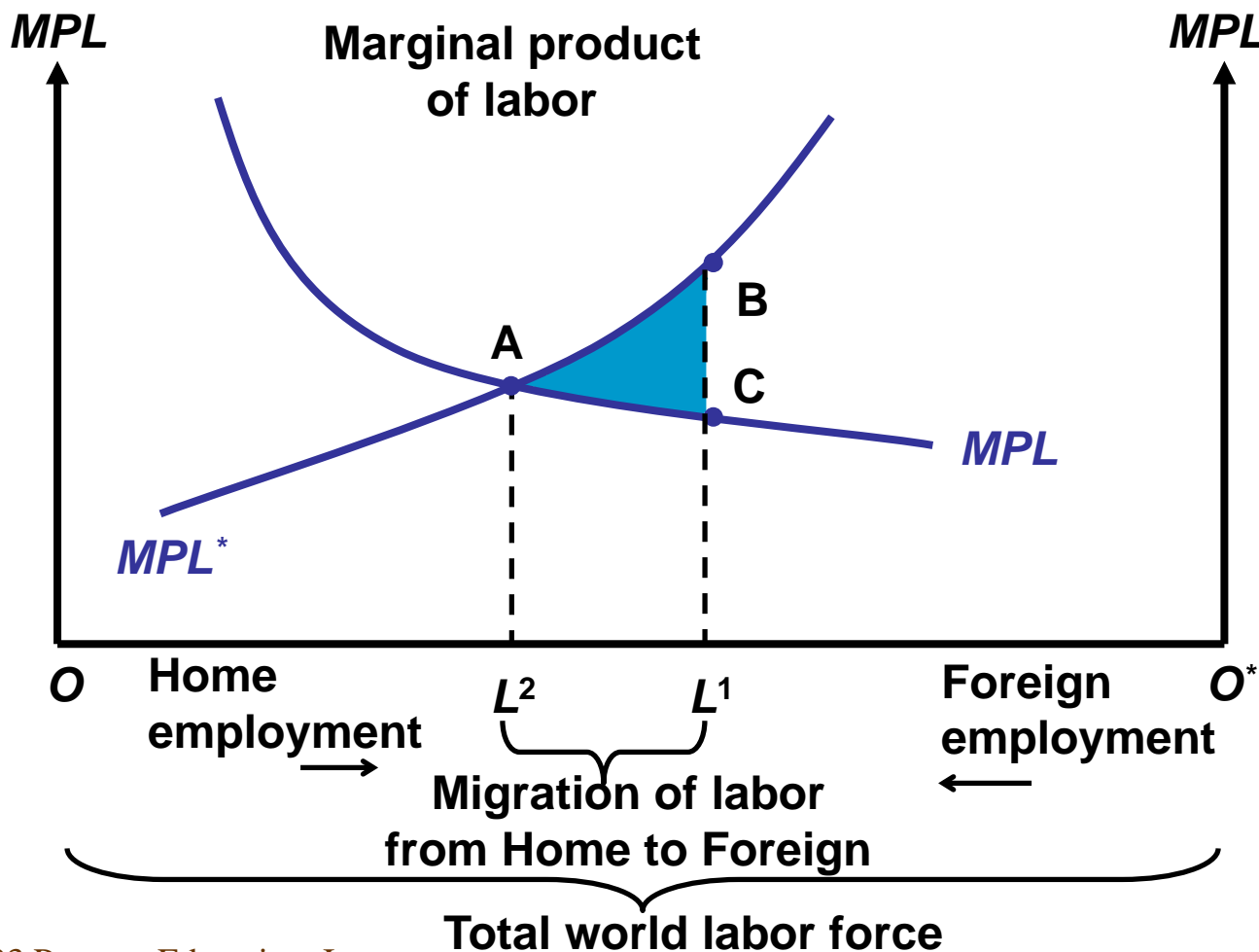
International Labor Mobility

- **International Labor Movement**
  - Suppose that workers are able to move between the two countries.
    - Home workers would like to move to Foreign until the marginal product of labor is the same in the two countries.
      - This movement will reduce the Home labor force and thus raise the real wage in Home.
      - This movement will increase the Foreign labor force and reduce the real wage in Foreign.

International Labor Mobility

Figure 7-3: Causes and Effects of International Labor Mobility

International Labor Mobility

- ■ The redistribution of the world's labor force:
  - Leads to a convergence of real wage rates
  - Increases the world's output as a whole
  - Leaves some groups worse off
- ■ Extending the Analysis
  - Modifying the model by adding some complications:
    - – Suppose the countries produce two goods, one labor-intensive and one land-intensive.
      - – Trade offers an alternative to factor mobility: Home can export labor and import land by exporting the labor-intensive good and importing the land-intensive good.

International Borrowing and Lending

- **International movements of capital**
  - Refer to borrowing and lending between countries
    - <u>Example</u>: A U.S. bank lends to a Mexican firm.
  - Can be interpreted as **intertemporal trade**
   - Refers to trade of goods today for goods in the future

International Borrowing and Lending

- Intertemporal Production Possibilities and Trade
  - Imagine an economy that consumes only one good and will exist for only two periods, which we will call present and future.
  - **Intertemporal production possibility frontier**
    - It represents a trade-off between present and future production of the consumption good.
    - Its shape will differ among countries:
      - Some countries will be biased toward present output.
      - Some countries will be biased toward future output.

Figure 7-4: The Intertemporal Production Possibility Frontier
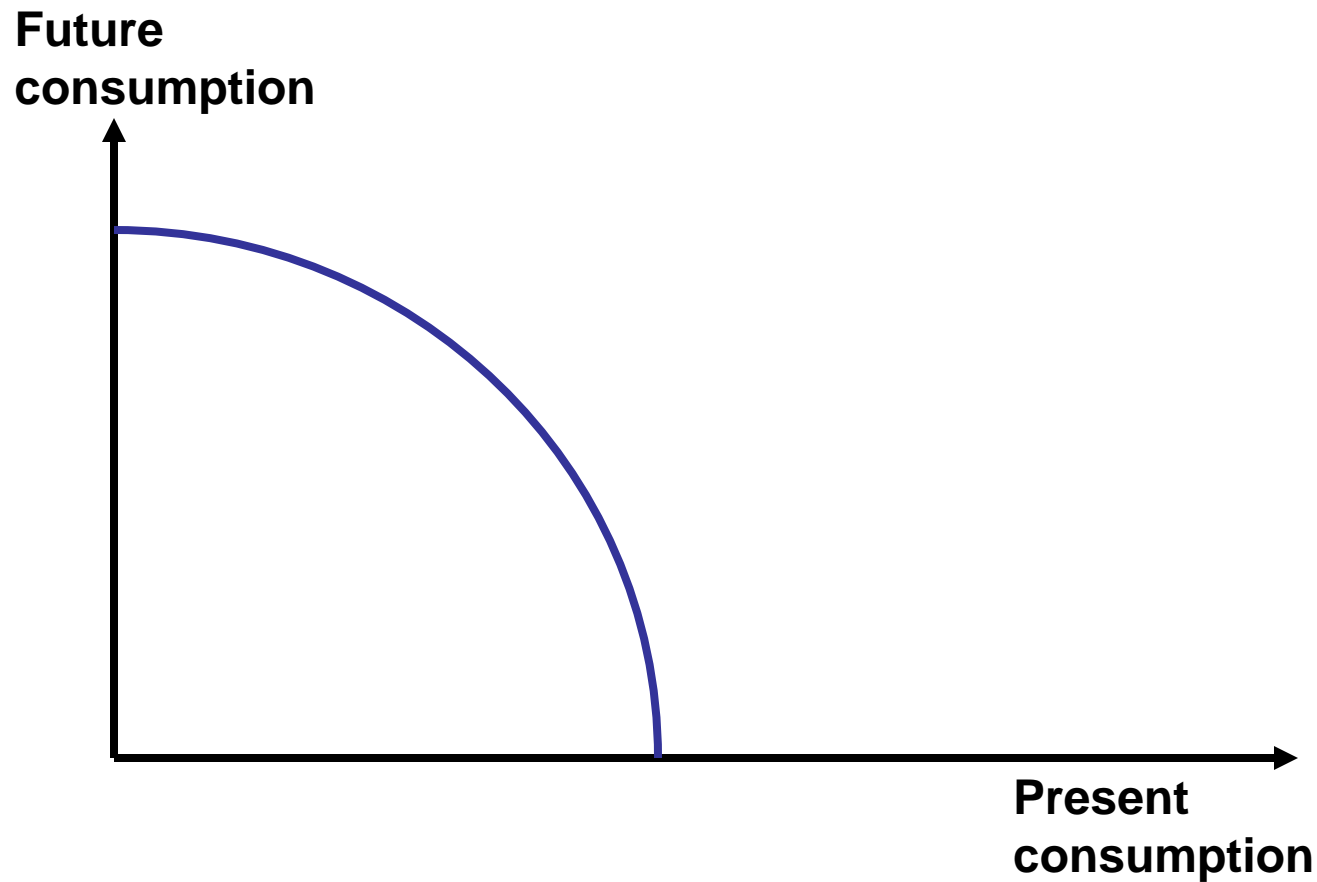
International Borrowing and Lending

- **The Real Interest Rate**
  - How does a country trade over time?
    – A country can trade over time by borrowing or lending.
    – When a country borrows, it gets the right to purchase some quantity of consumption at present in return for repayment of some larger quantity in the future.
      – The quantity of repayment in future will be $(1 + r)$ times the quantity borrowed in present, where r is the real interest rate on borrowing.
      – The relative price of future consumption is $1/(1 + r)$.

International Borrowing and Lending

- ■ Intertemporal Comparative Advantage
  - Assume that Home's intertemporal production possibilities are biased toward present production.
    - A country that has a comparative advantage in future production of consumption goods is one that in the absence of international borrowing and lending would have a low relative price of future consumption (i.e., high real interest rate).
      - High interest rate corresponds to a high return on investment.

Direct Foreign Investment and Multinational Firms

- **Direct foreign investment**
  - Refers to international capital flows in which a firm in one country creates or expands a subsidiary in another
  - Involves not only a transfer of resources but also the acquisition of *control*
    - The subsidiary does not simply have a financial obligation to the parent company; it is part of the same organizational structure.

Direct Foreign Investment and Multinational Firms

- Multinational firms
  - A vehicle for international borrowing and lending
  - They provide financing to their foreign subsidiaries
- Why is direct foreign investment rather than some other way of transferring funds chosen?
  - To allow the formation of multinational organization (extension of control)
- Why do firms seek to extend control?
  - The answer is summarized under the theory of multinational enterprise.

Direct Foreign Investment and Multinational Firms

- **The Theory of Multinational Enterprise**
  - Two elements explain the existence of a multinational:
    - **Location motive**
      - A good is produced in two (or more) different countries rather than one because of:
        - » Resources
        - » Transport costs
        - » Barriers of trade
    - **Internalization motive**
      - A good is produced in different locations by the same firm rather than by separate firms because it is more profitable to carry transactions on technology and management.
        - » **Technology transfer**
        - » **Vertical integration**

Direct Foreign Investment and Multinational Firms

- **Multinational Firms in Practice**
  - Multinational firms play an important part in world trade and investment.
    - <u>Example</u>: Half of U.S. imports can be regarded as transactions between branches of multinational firms, and 24% of U.S. assets abroad consist of the value of foreign subsidiaries of U.S. firms.
  - Multinational firms may be either domestic or foreign-owned.
    - Foreign-owned multinational firms play an important role in most economies, especially in the United States.

Direct Foreign Investment and Multinational Firms

Table 7-1: France, United Kingdom, and United States: Shares of Foreign-Owned Firms in Manufacturing Sales, Value Added, and Employment, 1985 and 1990 (percentages)

| Country	Sales		Value added		Employment	
	1985	**1990**	**1985**	**1990**	**1985**	**1990**
France	26.7	28.4	25.3	27.1	21.1	23.7
United Kingdom	20.3	24.1	18.7	21.1	14.0	14.9
United States	8.0	16.4	8.3	13.4	8.0	10.8

Source: U.S. Department of Commerce, *Foreign Direct Investment in the United States: An Update* (1994).

Direct Foreign Investment and Multinational Firms

Figure 7-5: Foreign Direct Investment in the United States

Direct foreign investment, percent of GNP (annual average)
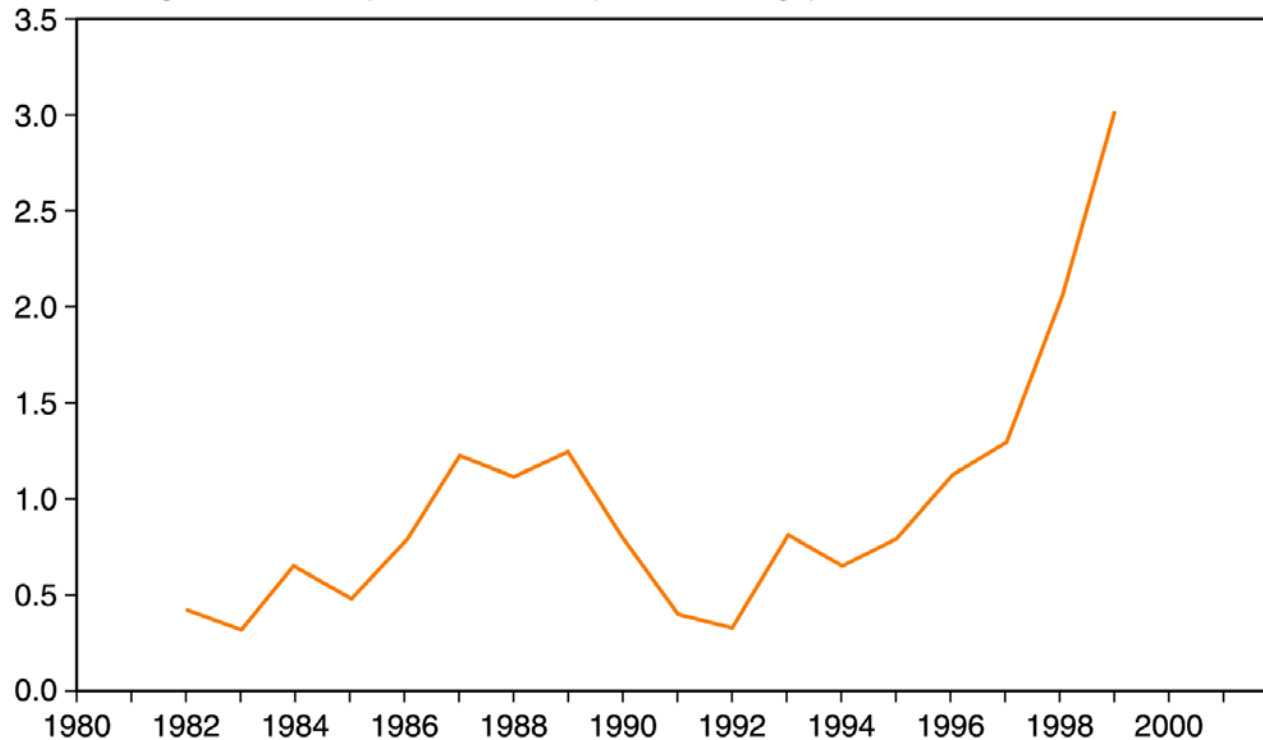
Foreign direct investment flows into the United States surged in 1986–1989 and again after 1992, rapidly raising the share of U.S. production controlled by foreign firms.

Source: U.S. Commerce Dept.

Summary

- International factor movements can sometimes substitute for trade.

- International borrowing and lending can be viewed as a kind of international trade of present consumption for future consumption rather than trade of one good for another.

- Multinational firms primarily exist as ways of extending control over activities taking place in two or more different countries.
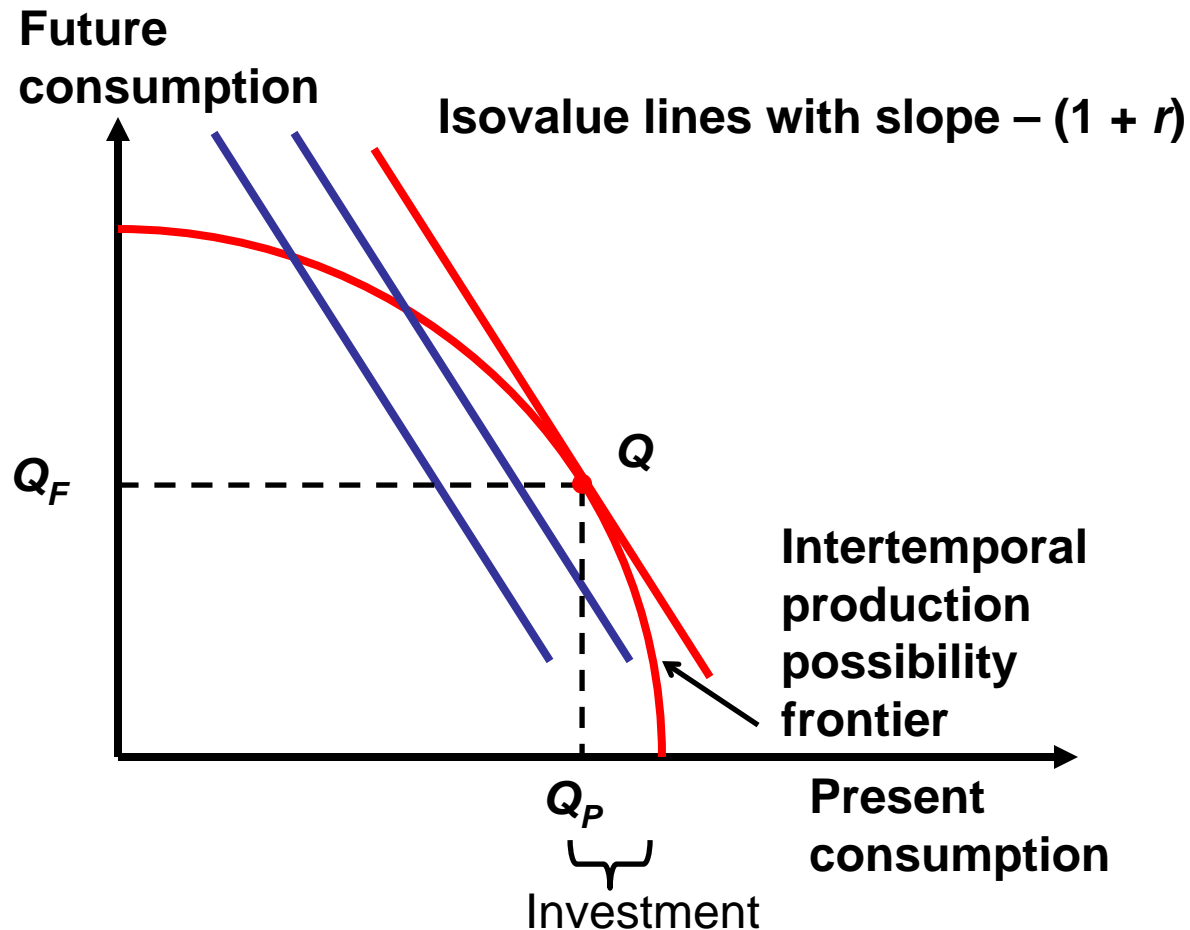
Summary

- Two elements explain the existence of a multinational:
  - A location motive.
  - An internalization motive.
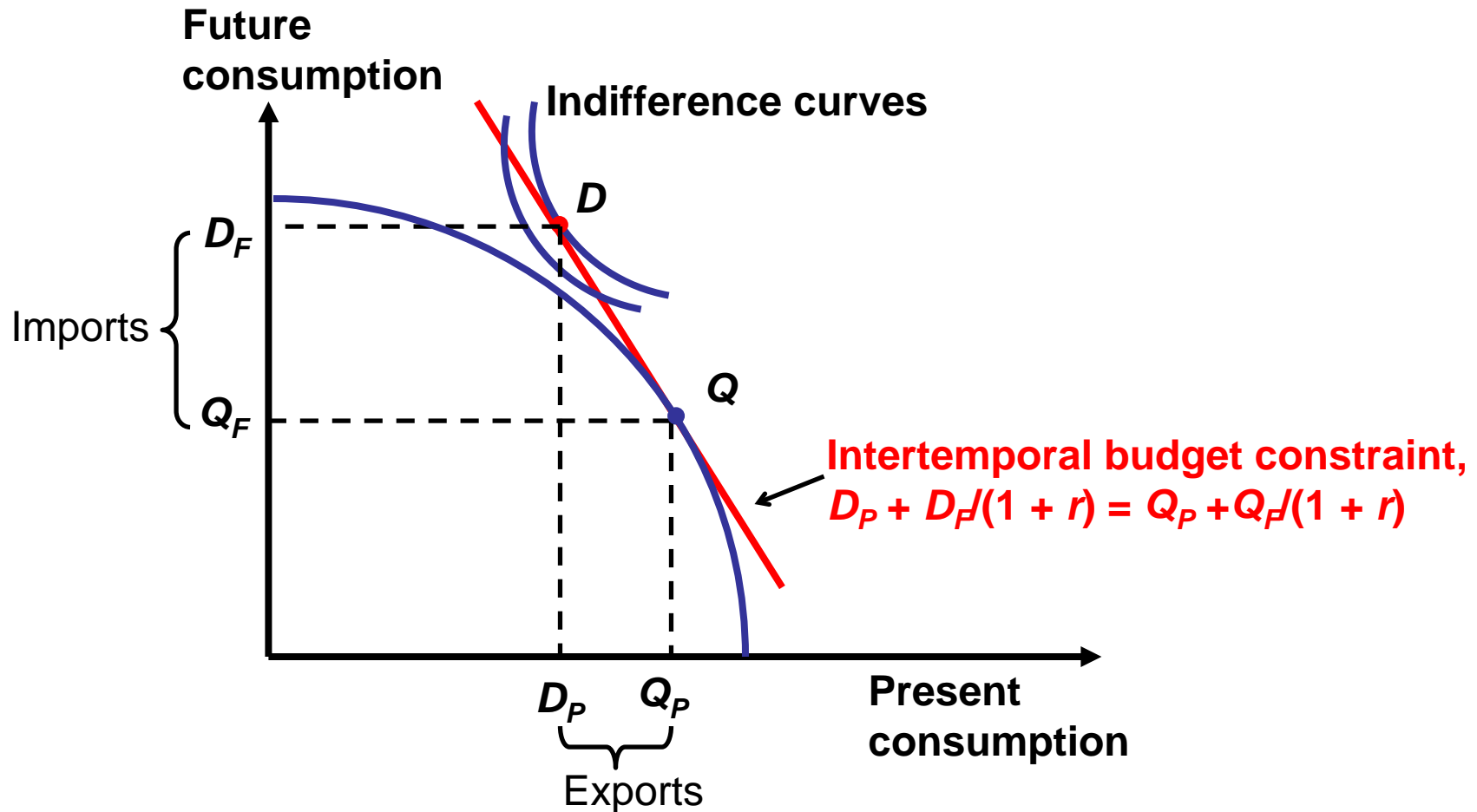
Appendix:
More on Intertemporal Trade

Figure 7A-1: Determining Home's Intertemporal Production Pattern

Future consumption

Isovalue lines with slope − (1 + r)

Q_F

Q

Intertemporal production possibility frontier

Q_P

Investment

Present consumption
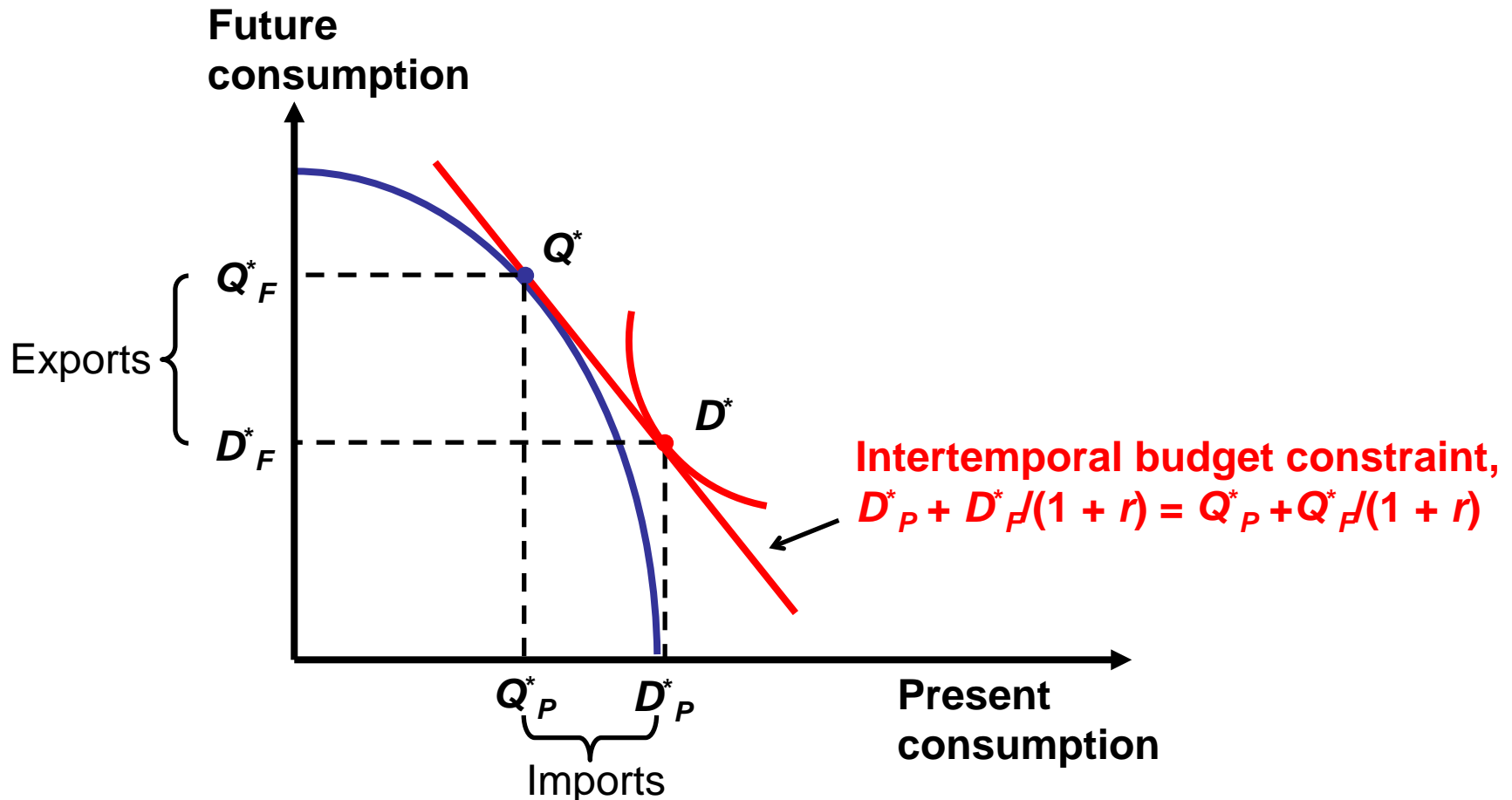
Appendix:
More on Intertemporal Trade

Figure 7A-2: Determining Home's Intertemporal Consumption Pattern

Appendix:
More on Intertemporal Trade

Figure 7A-3: Determining Foreign's Intertemporal Production and Consumption Patterns

Future consumption

Q^*_F

Exports

D^*_F

Q^*

D^*

Intertemporal budget constraint,
$D^*_P + D^*_F/(1 + r) = Q^*_P + Q^*_F/(1 + r)$

Q^*_P D^*_P
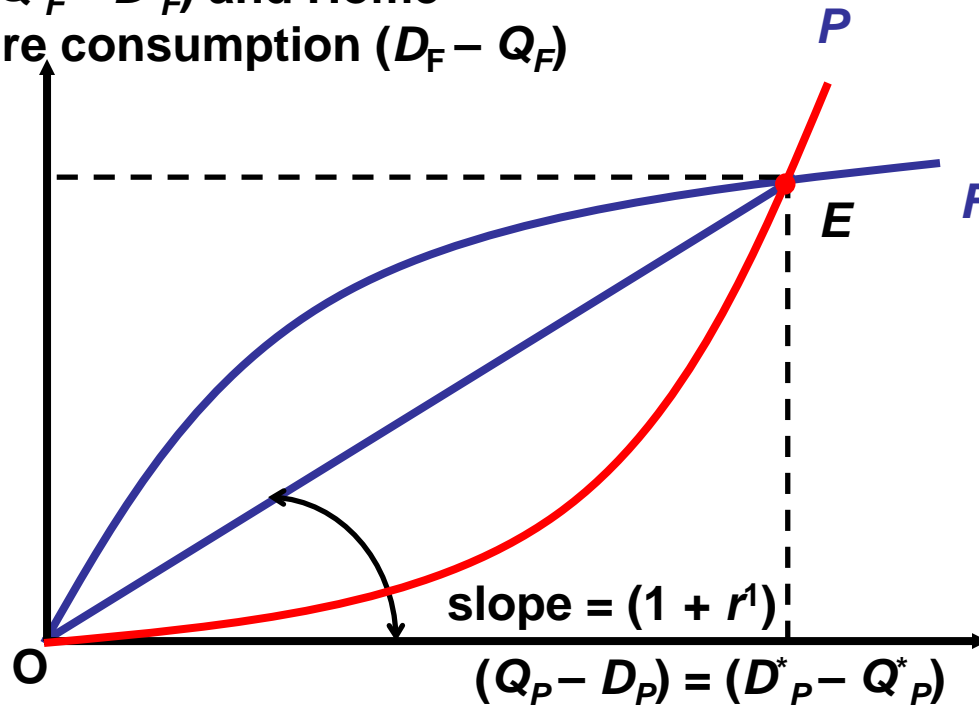
Imports

Present consumption

Appendix: More on Intertemporal Trade

Figure 7A-4: International Intertemporal Equilibrium in Terms of Offer Curves

Foreign exports of future consumption $(Q^*_F - D^*_F)$ and Home imports of future consumption $(D_F - Q_F)$

$(Q^*_F - D^*_F) = (D_F - Q_F)$

P

E

F

slope = $(1 + r^1)$

O

$(Q_P - D_P) = (D^*_P - Q^*_P)$

Home exports of present consumption $(Q_P - D_P)$ and Foreign imports of future consumption $(D^*_P - Q^*_P)$

Chapter 8
The Instruments of Trade Policy

Prepared by **Iordanis Petsas**

To Accompany

International Economics: Theory and Policy, Sixth Edition
by **Paul R. Krugman and Maurice Obstfeld**

Chapter Organization

- Introduction
- Basic Tariff Analysis
- Costs and Benefits of a Tariff
- Other Instruments of Trade Policy
- The Effects of Trade Policy: A Summary
- Summary
- Appendix I: Tariff Analysis in General Equilibrium
- Appendix II: Tariffs and Import Quotas in the Presence of Monopoly
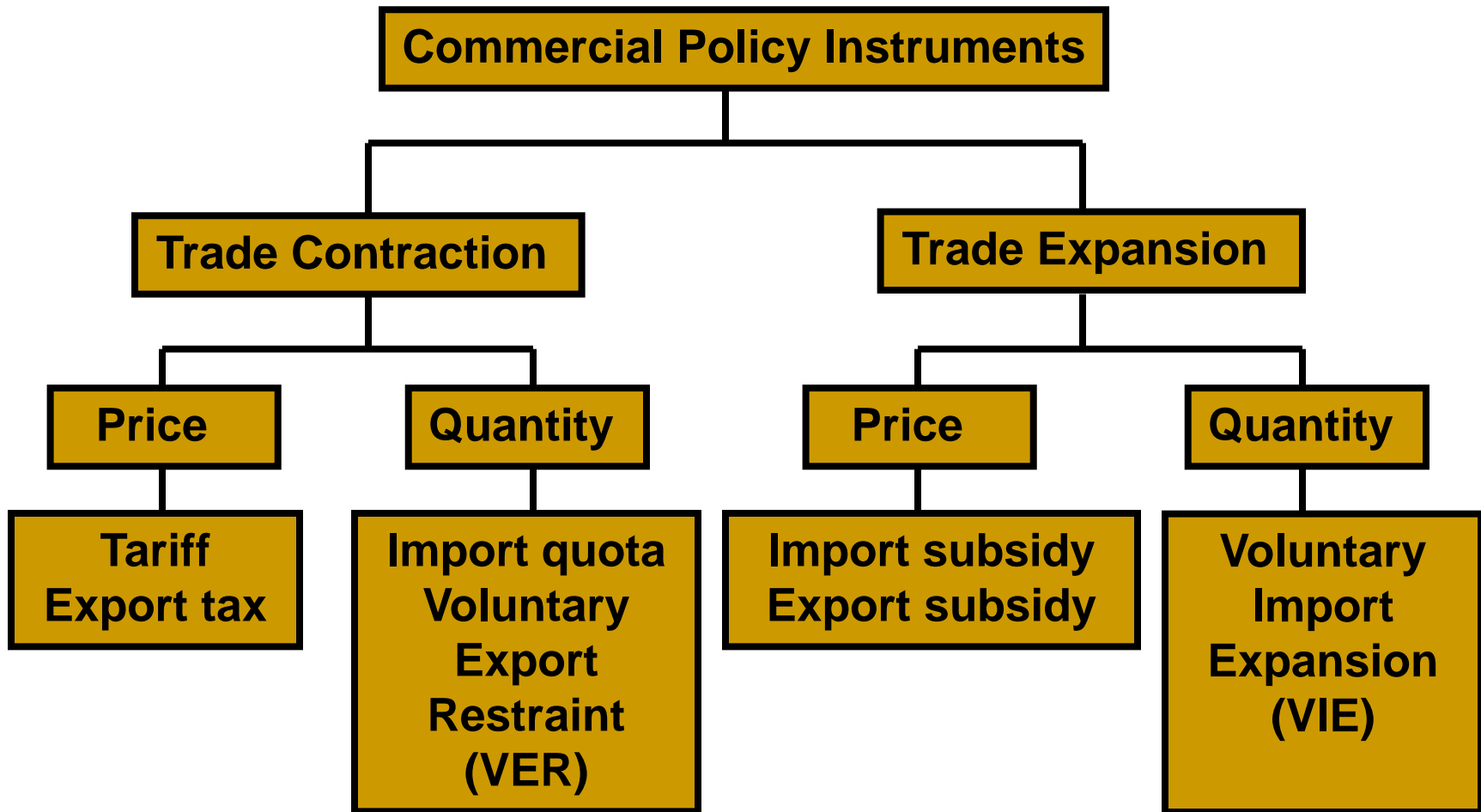
Introduction

- This chapter is focused on the following questions:
  - What are the effects of various trade policy instruments?
    - Who will benefit and who will lose from these trade policy instruments?
  - What are the costs and benefits of protection?
    - Will the benefits outweigh the costs?
  - What should a nation's trade policy be?
    - For example, should the United States use a tariff or an import quota to protect its automobile industry against competition from Japan and South Korea?

Introduction

Classification of Commercial Policy Instruments

```
              ┌─────────────────────────────────┐
              │  Commercial Policy Instruments  │
              └─────────────────────────────────┘
                 ┌───────────────┴───────────────┐
         ┌───────────────────┐         ┌───────────────────┐
         │ Trade Contraction │         │  Trade Expansion  │
         └───────────────────┘         └───────────────────┘
          ┌────────┴────────┐            ┌────────┴────────┐
      ┌─────────┐     ┌──────────┐   ┌─────────┐    ┌──────────┐
      │  Price  │     │ Quantity │   │  Price  │    │ Quantity │
      └─────────┘     └──────────┘   └─────────┘    └──────────┘
          │                │             │               │
   ┌────────────┐  ┌──────────────┐ ┌──────────────┐ ┌────────────┐
   │   Tariff   │  │ Import quota │ │Import subsidy│ │ Voluntary  │
   │ Export tax │  │  Voluntary   │ │Export subsidy│ │  Import    │
   └────────────┘  │   Export     │ └──────────────┘ │ Expansion  │
                   │  Restraint   │                  │   (VIE)    │
                   │    (VER)     │                  └────────────┘
                   └──────────────┘
```

Basic Tariff Analysis

- Tariffs can be classified as:
  - **Specific tariffs**
    - Taxes that are levied as a fixed charge for each unit of goods imported
      - Example: A specific tariff of $10 on each imported bicycle with an international price of $100 means that customs officials collect the fixed sum of $10.
  - **Ad valorem tariffs**
    - Taxes that are levied as a fraction of the value of the imported goods
      - Example: A 20% ad valorem tariff on bicycles generates a $20 payment on each $100 imported bicycle.

Basic Tariff Analysis

- A compound duty (tariff) is a combination of an ad valorem and a specific tariff.

- Modern governments usually prefer to protect domestic industries through a variety of nontariff barriers, such as:
  - **Import quotas**
    - Limit the quantity of imports
  - **Export restraints**
    - Limit the quantity of exports

Basic Tariff Analysis

- **Supply, Demand, and Trade in a Single Industry**
  - Suppose that there are two countries (Home and Foreign).
  - Both countries consume and produce wheat, which can be costless transported between the countries.
  - In each country, wheat is a competitive industry.
  - Suppose that in the absence of trade the price of wheat at Home exceeds the corresponding price at Foreign.
    - This implies that shippers begin to move wheat from Foreign to Home.
      - The export of wheat raises its price in Foreign and lowers its price in Home until the initial difference in prices has been eliminated.

Basic Tariff Analysis

- To determine the world price (P_w) and the quantity trade (Q_w), two curves are defined:
  - Home **import demand curve**
    - Shows the maximum quantity of imports the Home country would like to consume at each price of the imported good.
      - That is, the excess of what Home consumers demand over what Home producers supply: $MD = D(P) - S(P)$
  - Foreign **export supply curve**
    - Shows the maximum quantity of exports Foreign would like to provide the rest of the world at each price.
      - That is, the excess of what Foreign producers supply over what foreign consumers demand: $XS = S*(P*) - D*(P*)$

Basic Tariff Analysis

Figure 8-1: Deriving Home's Import Demand Curve
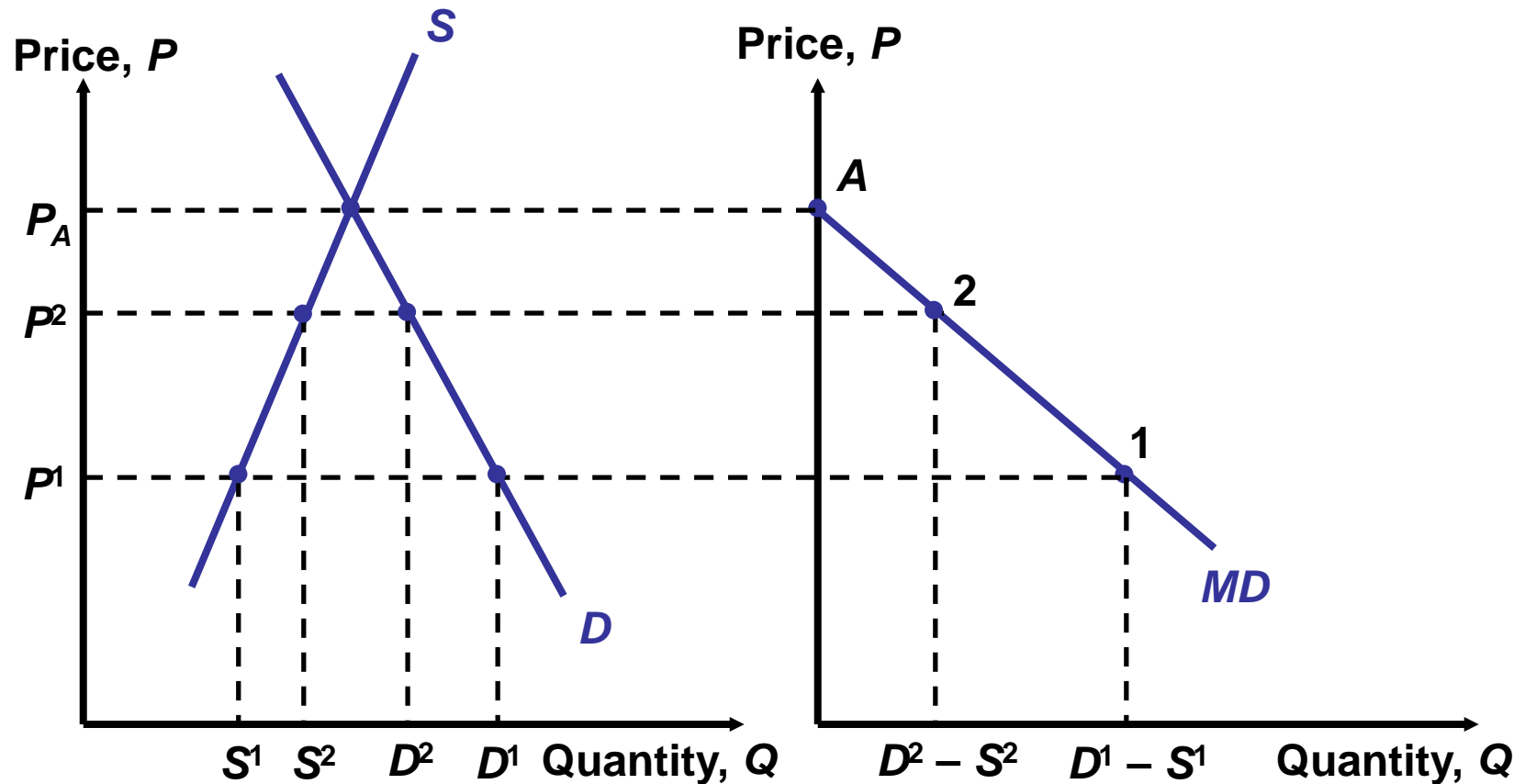
Basic Tariff Analysis

- Properties of the **import demand curve**:
  - It intersects the vertical axis at the closed economy price of the importing country.
  - It is downward sloping.
  - It is flatter than the domestic demand curve in the importing country.

Basic Tariff Analysis

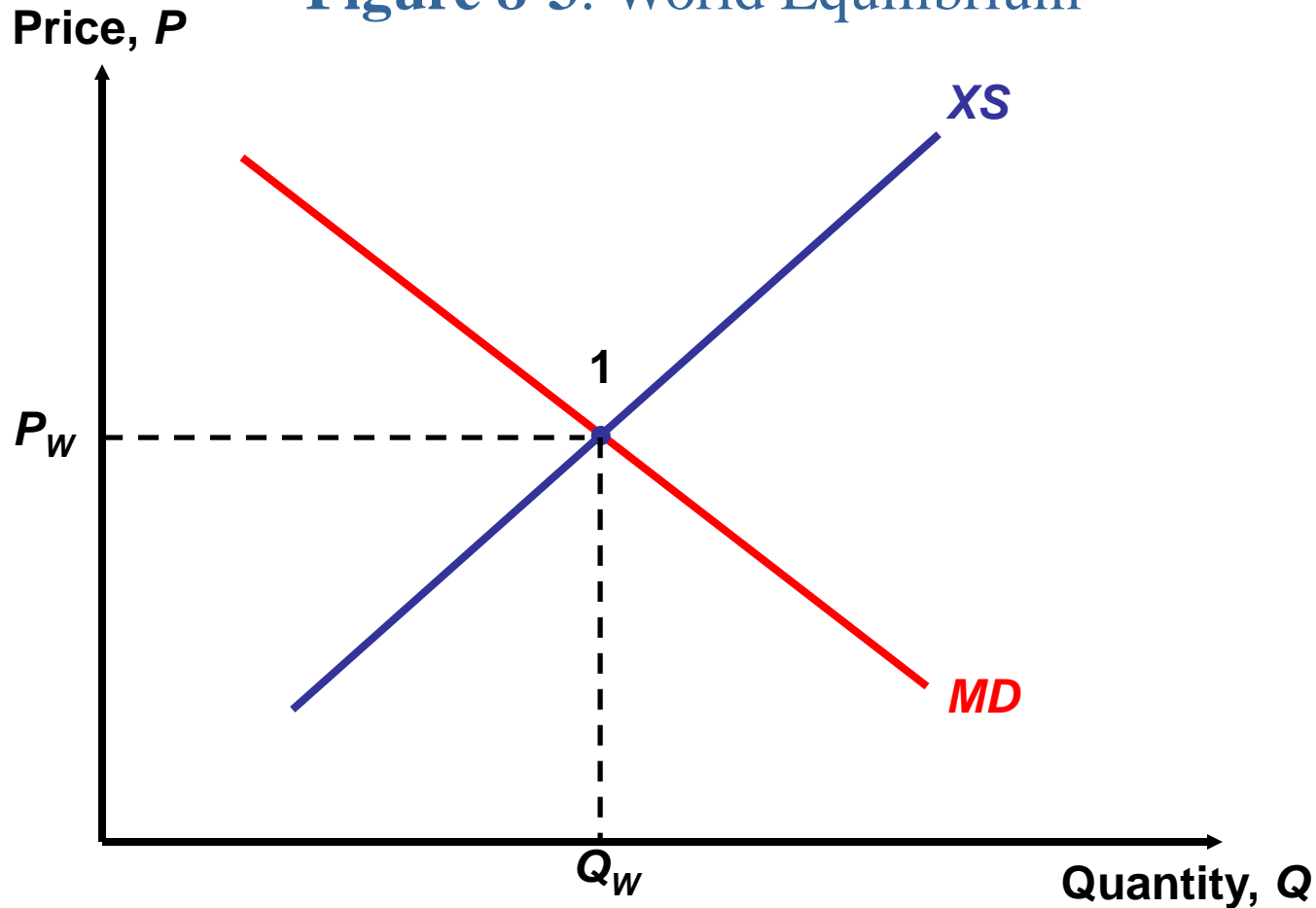**Figure 8-2**: Deriving Foreign's Export Supply Curve
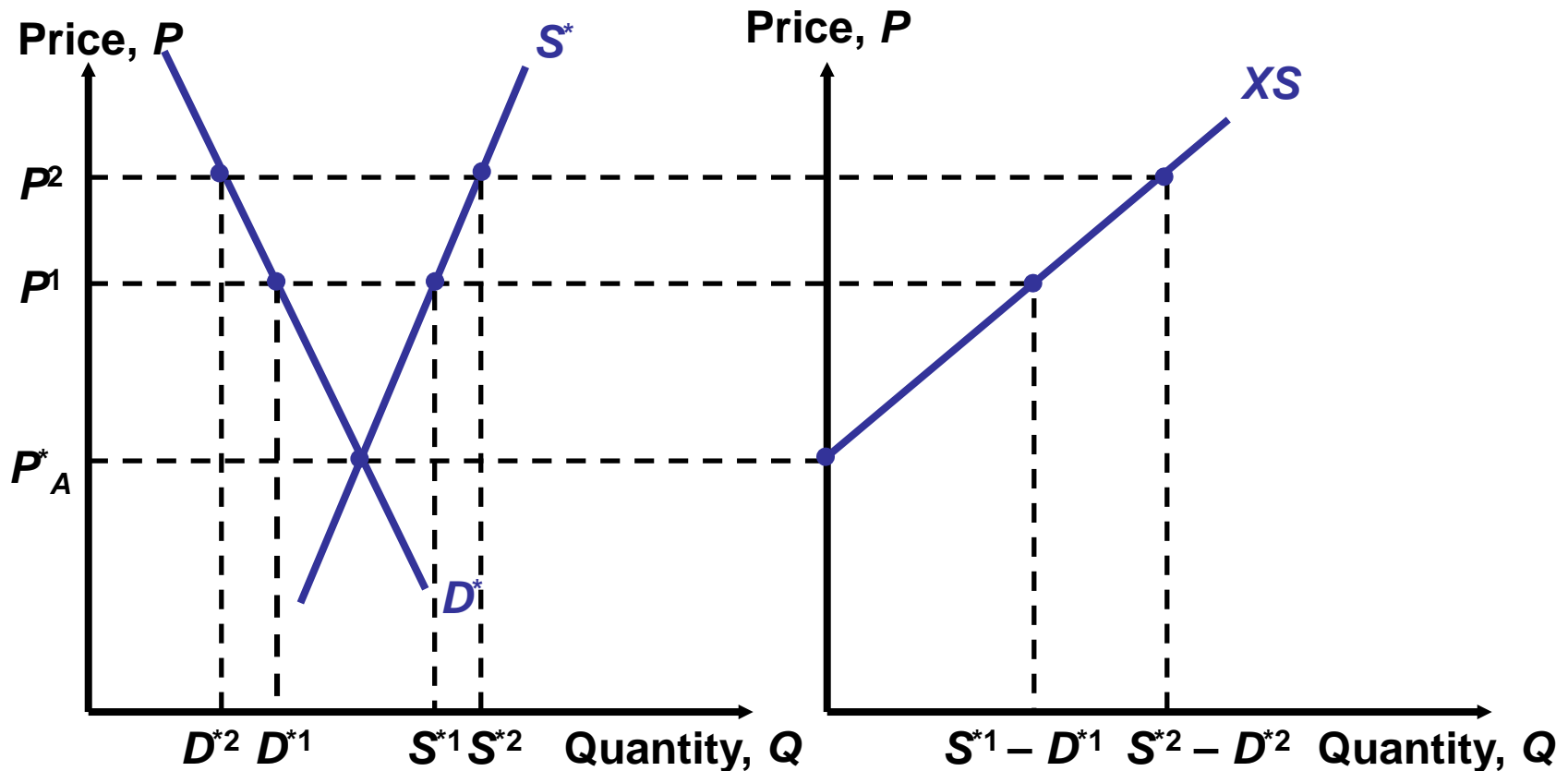
Basic Tariff Analysis

■ Properties of the **export supply curve**:

- It intersects the vertical axis at the closed economy price of the exporting country.

- It is upward sloping.

- It is flatter that the domestic supply curve in the exporting country.

Basic Tariff Analysis

Figure 8-3: World Equilibrium

Basic Tariff Analysis

- Useful definitions:
  - The **terms of trade** is the relative price of the exportable good expressed in units of the importable good.
  - A **small country** is a country that cannot affect its terms of trade no matter how much it trades with the rest of the world.
- The analytical framework will be based on either of the following:
  - Two large countries trading with each other
  - A small country trading with the rest of the world

Basic Tariff Analysis

- **Effects of a Tariff**
  - Assume that two large countries trade with each other.
  - Suppose Home imposes a tax of $2 on every bushel of wheat imported.
    - Then shippers will be unwilling to move the wheat unless the price difference between the two markets is at least $2.
  - Figure 8-4 illustrates the effects of a specific tariff of t per unit of wheat.

Figure 8-4: Effects of a Tariff

Home market

Price, P

S

P_T
P_W

t

D

Quantity, Q

World market

Price, P

XS

2

1

P^*_T

3

MD

Quantity, Q

Q_T Q_W

Foreign market

Price, P

S^*

D^*

Quantity, Q
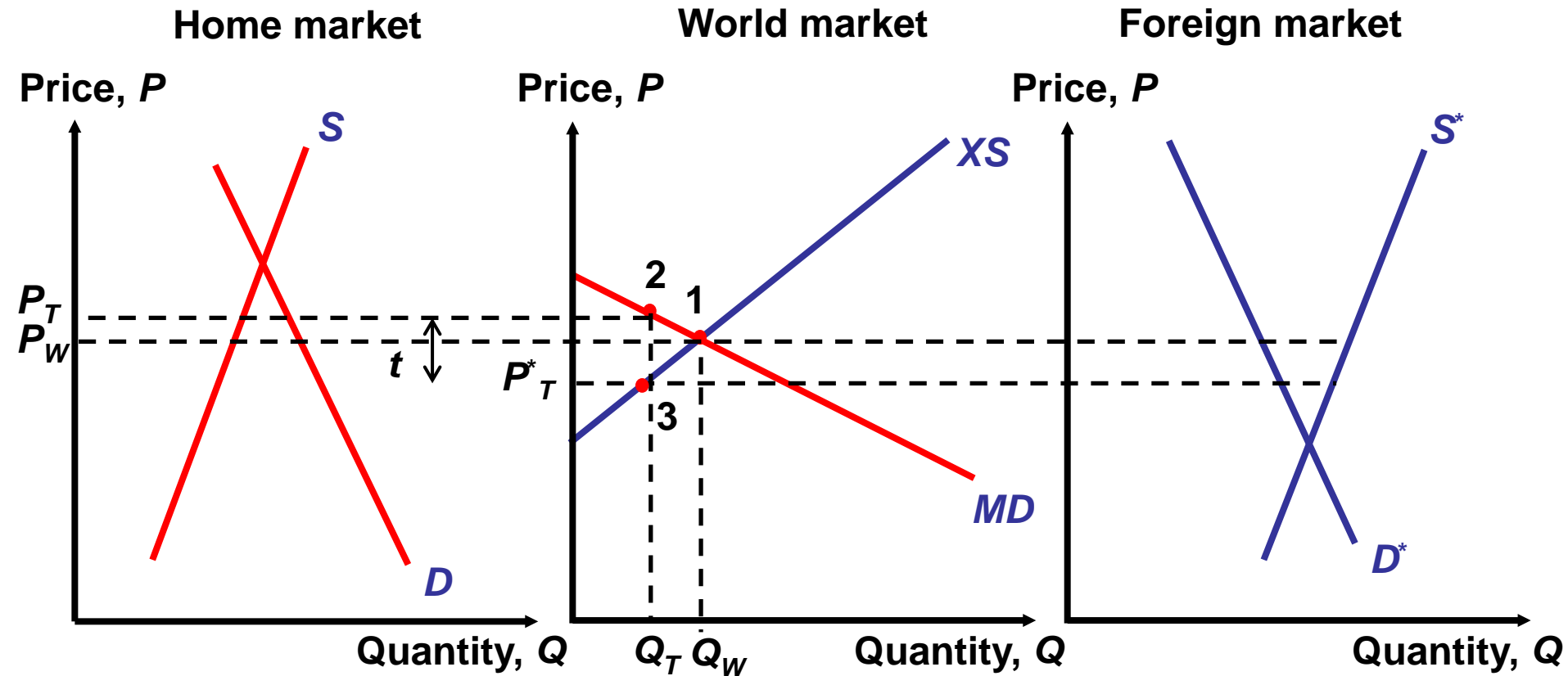
Basic Tariff Analysis

- In the absence of tariff, the world price of wheat (P_w) would be equalized in both countries.

- With the tariff in place, the price of wheat rises to P_T at Home and falls to P^*_T ($= P_T - t$) at Foreign until the price difference is $\$t$.

  - <u>In Home</u>: producers supply more and consumers demand less due to the higher price, so that fewer imports are demanded.

  - <u>In Foreign</u>: producers supply less and consumers demand more due to the lower price, so that fewer exports are supplied.

  - Thus, the volume of wheat traded declines due to the imposition of the tariff.

Basic Tariff Analysis

- The increase in the domestic Home price is less than the tariff, because part of the tariff is reflected in a decline in Foreign's export price.

  - If Home is a small country and imposes a tariff, the foreign export prices are unaffected and the domestic price at Home (the importing country) rises by the full amount of the tariff.

Basic Tariff Analysis

Figure 8-5: A Tariff in a Small Country

Price, P

$P_W + t$

P_W

S^1 S^2 D^2 D^1

Quantity, Q

Imports after tariff

Imports before tariff
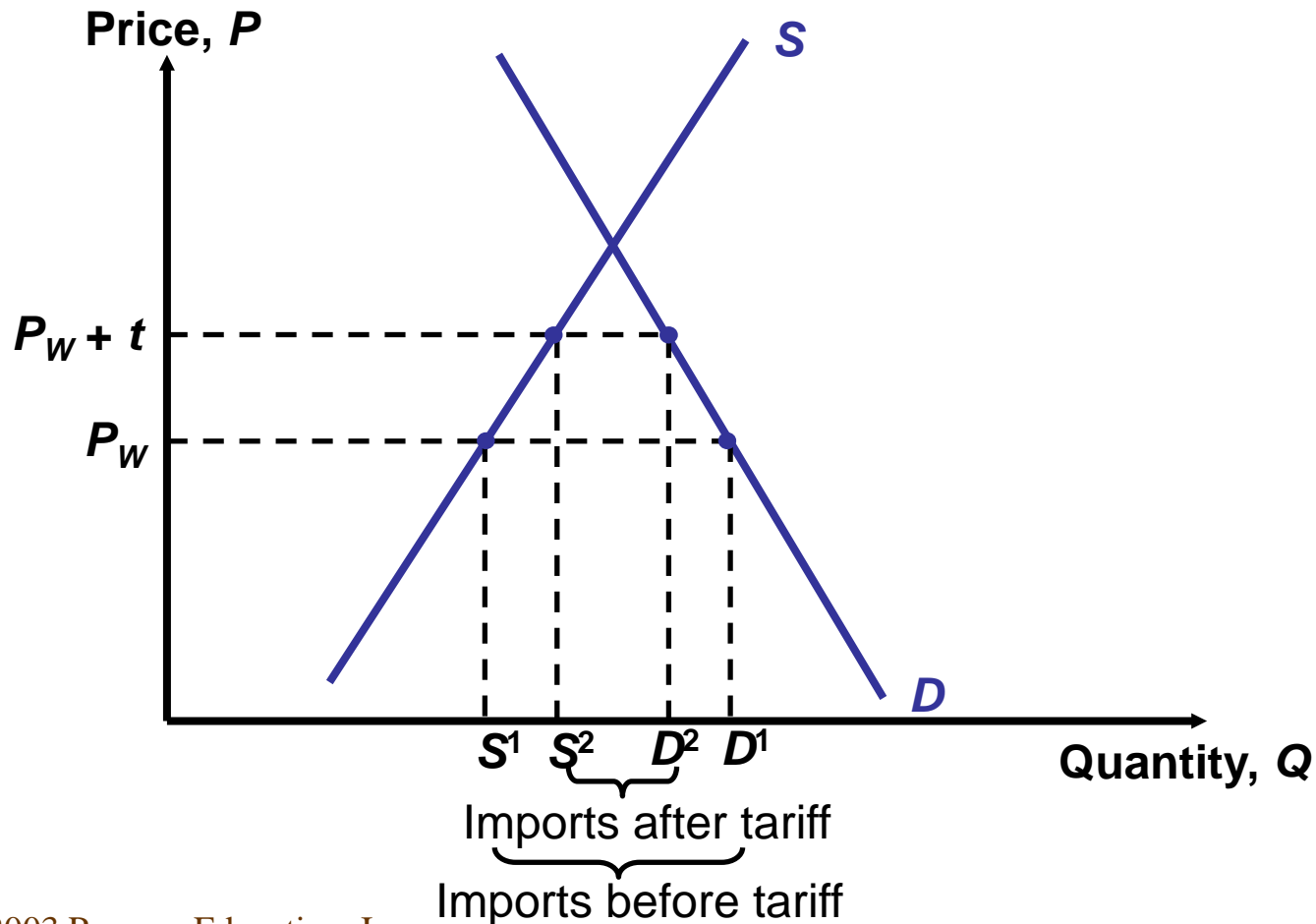
Basic Tariff Analysis

- **Measuring the Amount of Protection**
  - In analyzing trade policy in practice, it is important to know how much protection a trade policy actually provides.
    - One can express the amount of protection as a percentage of the price that would prevail under free trade.
      - Two problems arise from this method of measurement:
        » In the large country case, the tariff will lower the foreign export price.
        » Tariffs may have different effects on different stages of production of a good.

Basic Tariff Analysis

- **Effective rate of protection**
  - One must consider both the effects of tariffs on the final price of a good, and the effects of tariffs on the costs of inputs used in production.
    - The actual protection provided by a tariff will not equal the tariff rate if imported intermediate goods are used in the production of the protected good.
      - <u>Example</u>: A European airplane that sells for $50 million has cost $60 million to produce. Half of the purchase price of the aircraft represents the cost of components purchased from other countries. A subsidy of $10 million from the European government cuts the cost of the value added to purchasers of the airplane from $30 to $20 million. Thus, the effective rate of protection is (30-20)/20 = 50%.

Costs and Benefits of a Tariff

- A tariff raises the price of a good in the importing country and lowers it in the exporting country.
- As a result of these price changes:
  - Consumers lose in the importing country and gain in the exporting country
  - Producers gain in the importing country and lose in the exporting country
  - Government imposing the tariff gains revenue
- To measure and compare these costs and benefits, we need to define consumer and producer surplus.

Costs and Benefits of a Tariff

- **Consumer and Producer Surplus**
  - **Consumer surplus**
    - It measures the amount a consumer gains from a purchase by the difference between the price he actually pays and the price he would have been willing to pay.
    - It can be derived from the market demand curve.
    - Graphically, it is equal to the area under the demand curve and above the price.
    - Example: Suppose a person is willing to pay $20 per packet of pills, but the price is only $5. Then, the consumer surplus gained by the purchase of a packet of pills is $15.

Costs and Benefits of a Tariff

Figure 8-6: Deriving Consumer Surplus from the Demand Curve
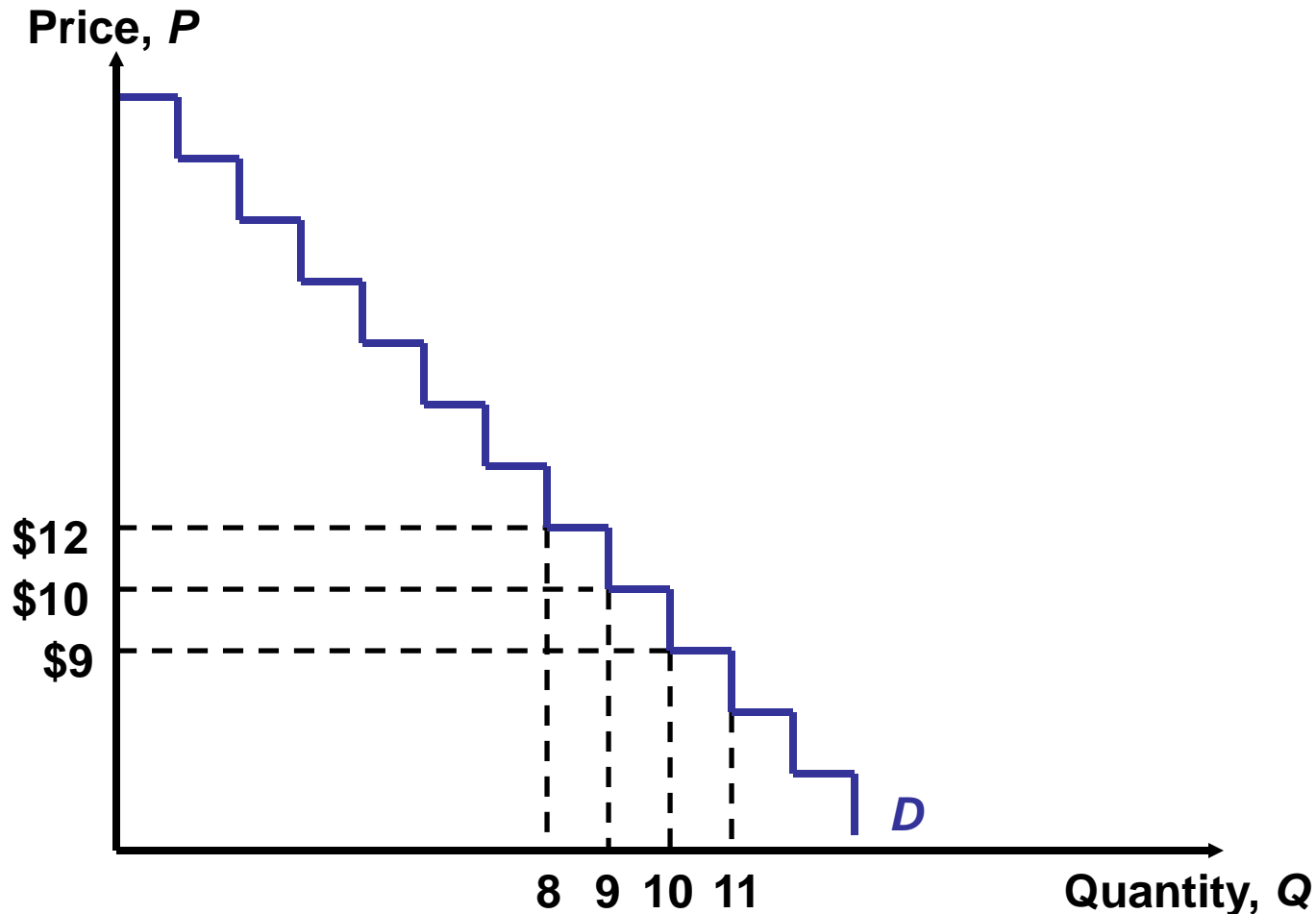
Costs and Benefits of a Tariff

Figure 8-7: Geometry of Consumer Surplus
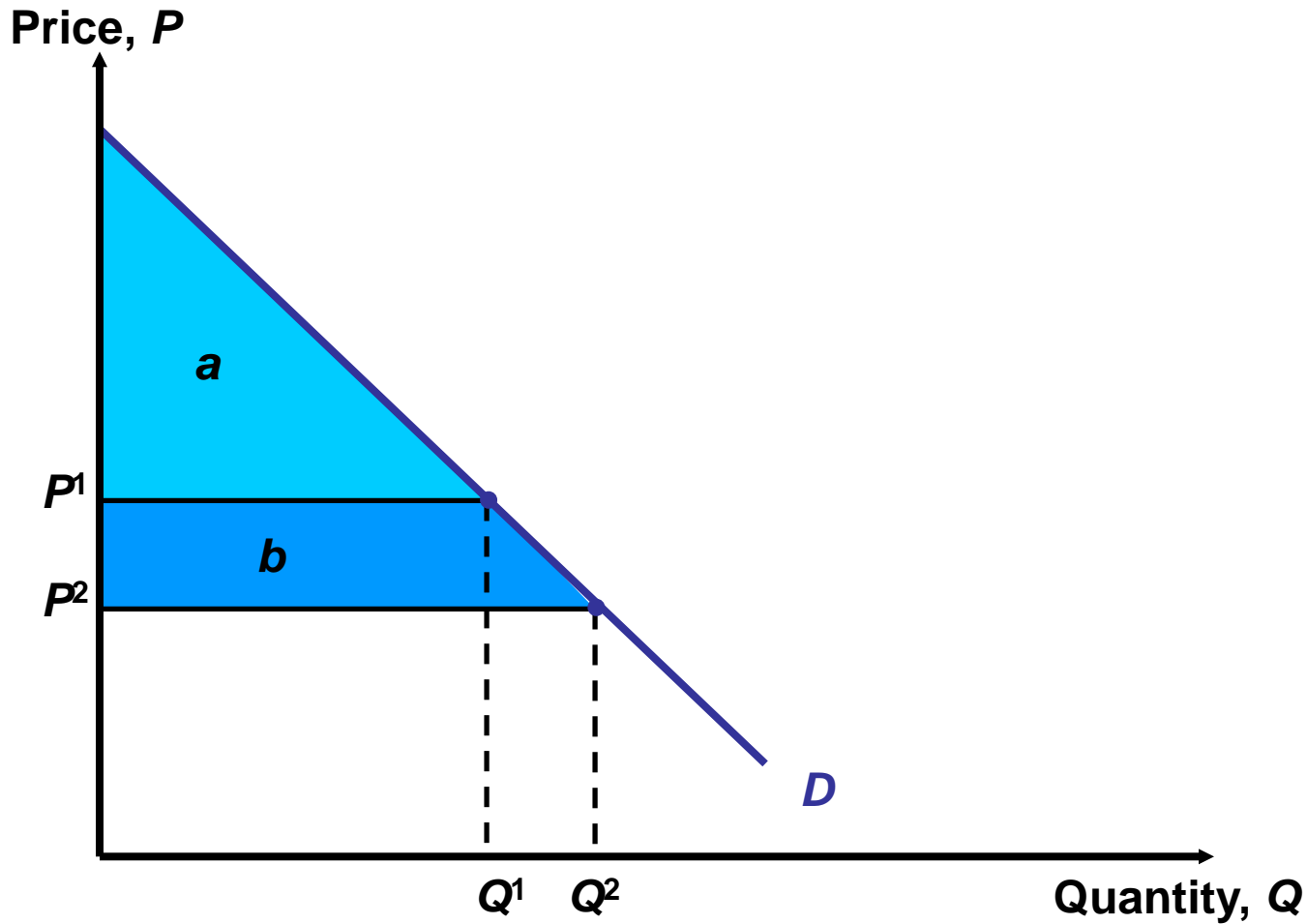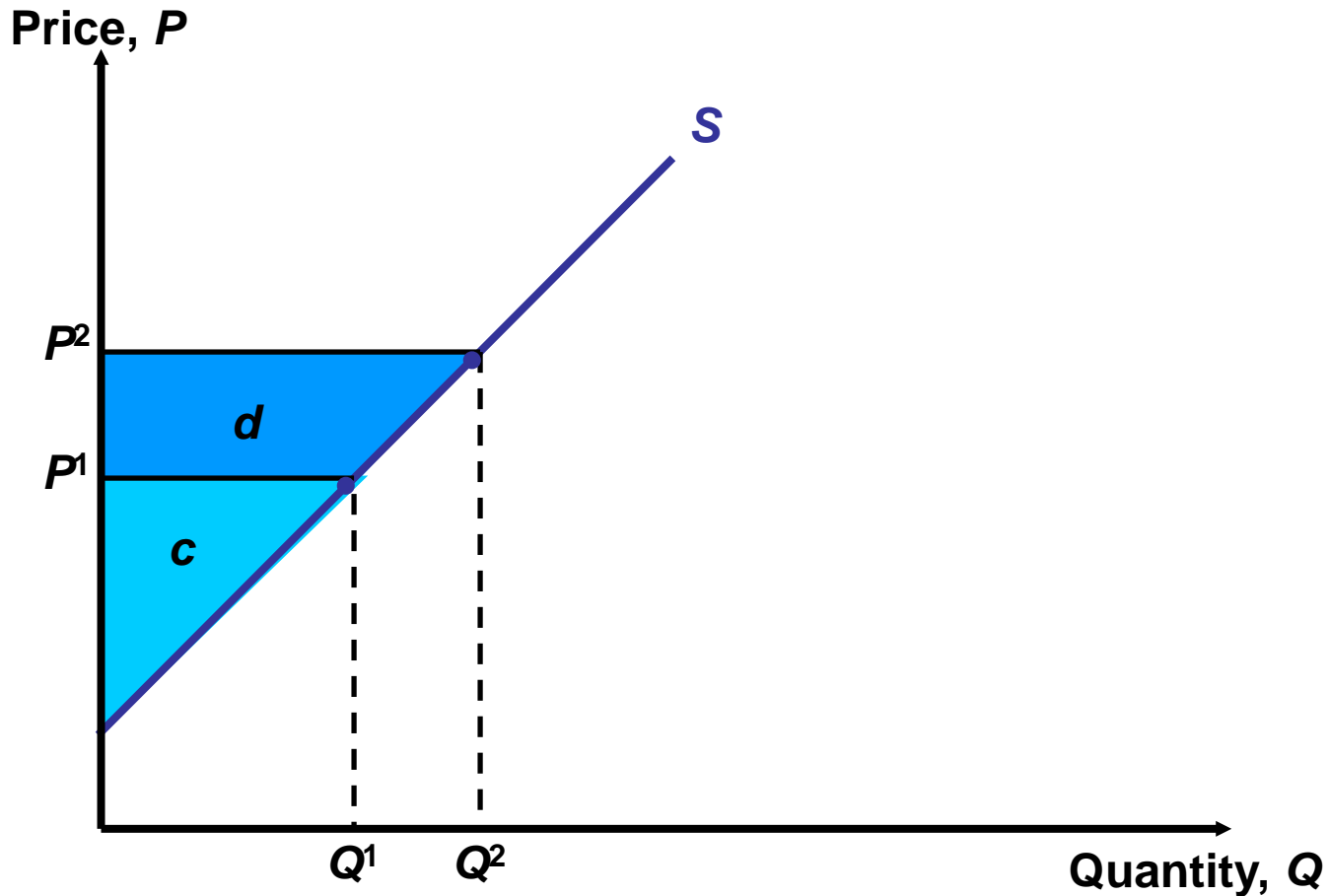
Costs and Benefits of a Tariff

- **Producer surplus**
  - It measures the amount a producer gains from a sale by the difference between the price he actually receives and the price at which he would have been willing to sell.
  - It can be derived from the market supply curve.
  - Graphically, it is equal to the area above the supply curve and below the price.
  - Example: A producer willing to sell a good for $2 but receiving a price of $5 gains a producer surplus of $3.

Costs and Benefits of a Tariff

Figure 8-8: Geometry of Producer Surplus

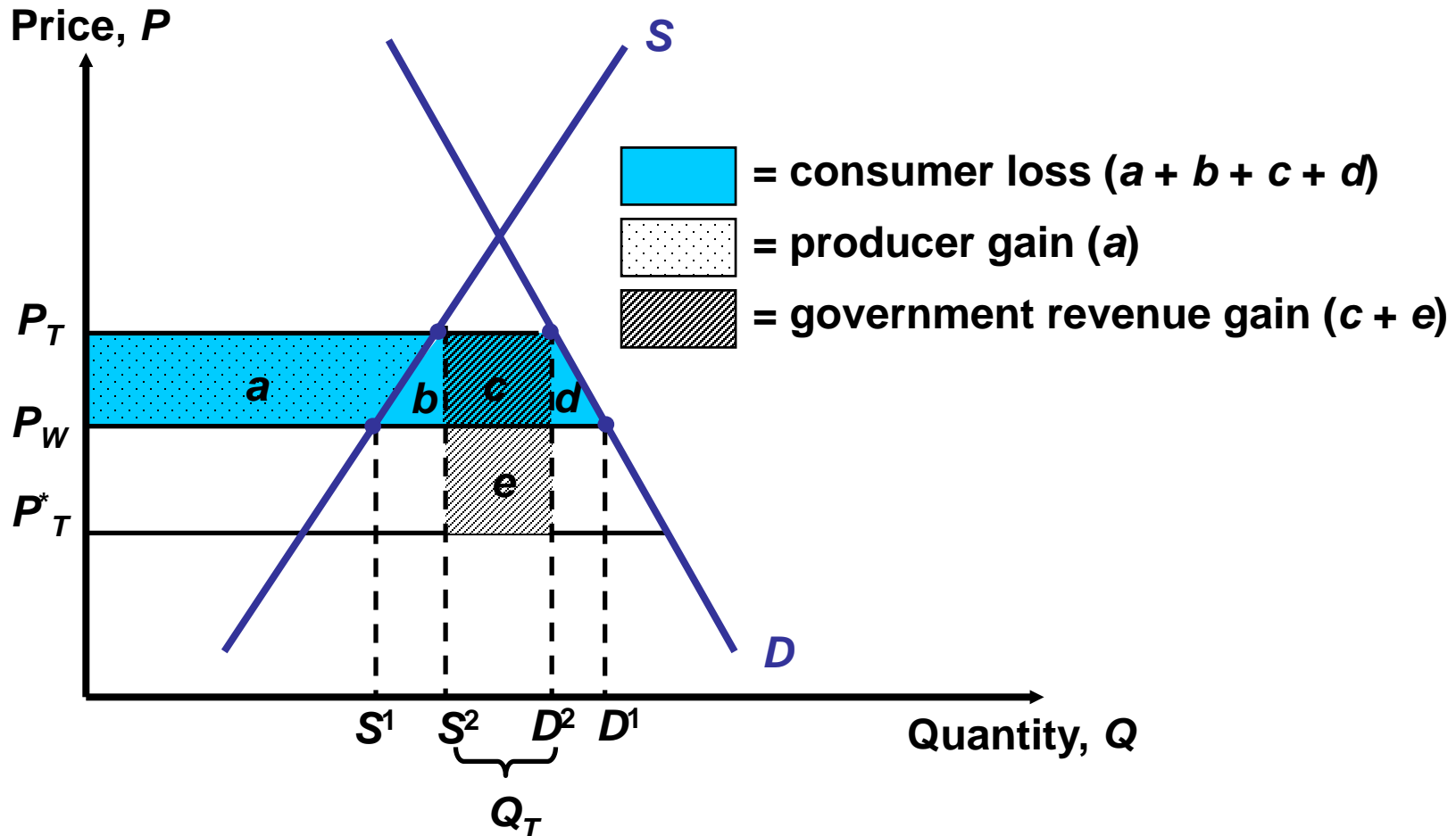# Costs and Benefits of a Tariff

- **Measuring the Cost and Benefits**
  - Is it possible to add consumer and producer surplus?
    - We can (algebraically) add consumer and producer surplus because any change in price affects each individual in two ways:
      - As a consumer
      - As a worker
    - We assume that at the margin a dollar's worth of gain or loss to each group is of the same social worth.

Costs and Benefits of a Tariff

Figure 8-9: Costs and Benefits of a Tariff for the Importing Country

Costs and Benefits of a Tariff

- The areas of the two triangles *b* and *d* measure the loss to the nation as a whole (efficiency loss) and the area of the rectangle *e* measures an offsetting gain (terms of trade gain).

  – The **efficiency loss** arises because a tariff distorts incentives to consume and produce.

    – Producers and consumers act as if imports were more expensive than they actually are.

    – Triangle *b* is the **production distortion loss** and triangle *d* is the **consumption distortion loss**.

  – The **terms of trade gain** arises because a tariff lowers foreign export prices.

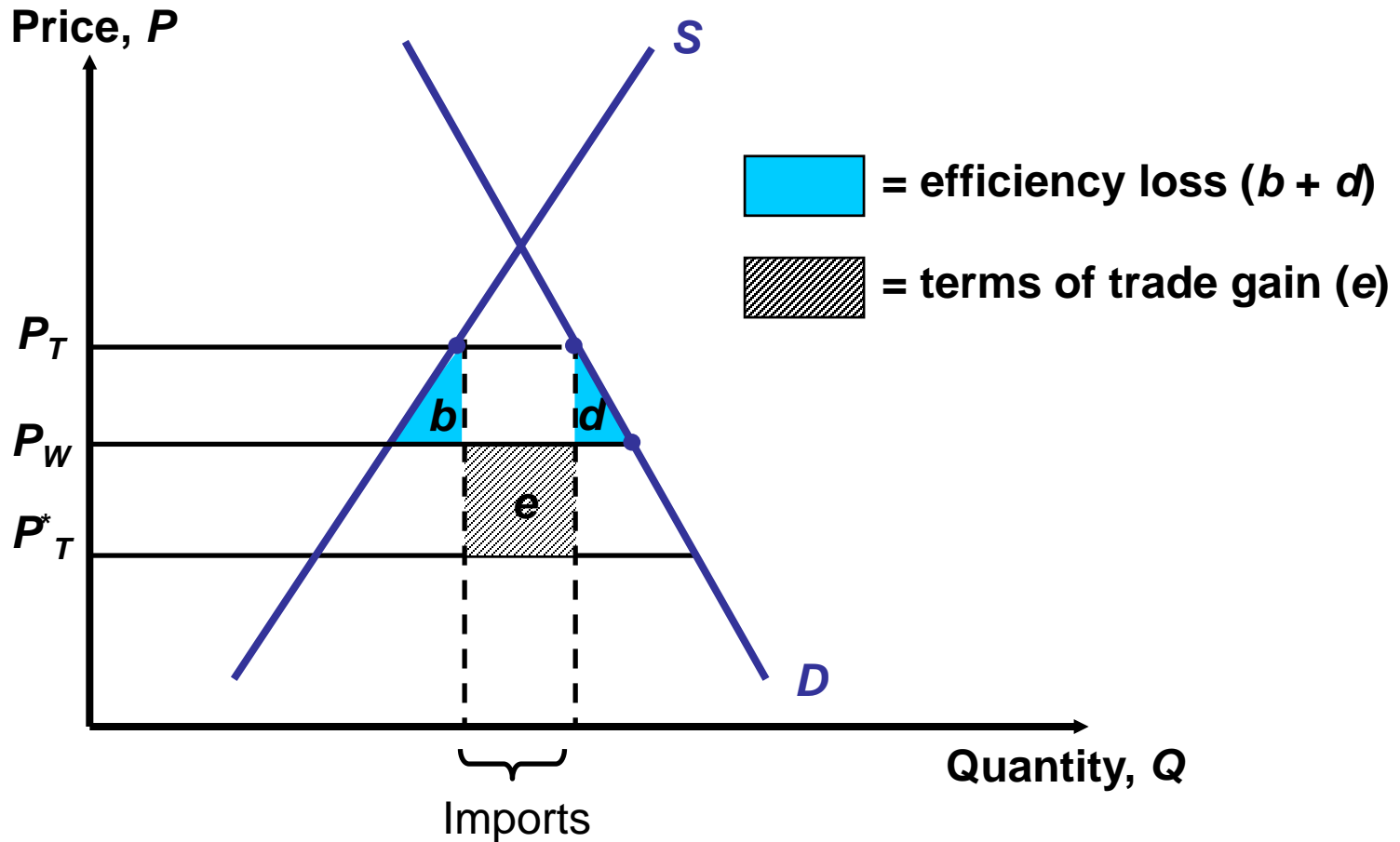# Costs and Benefits of a Tariff

- If the terms of trade gain is greater than the efficiency loss, the tariff increases welfare for the importing country.
  - In the case of a small country, the tariff reduces welfare for the importing country.

Costs and Benefits of a Tariff

Figure 8-10: Net Welfare Effects of a Tariff

Other Instruments of Trade Policy

- Export Subsidies: Theory
  - **Export subsidy**
    - A payment by the government to a firm or individual that ships a good abroad
      - When the government offers an export subsidy, shippers will export the good up to the point where the domestic price exceeds the foreign price by the amount of the subsidy.
    - It can be either specific or ad valorem.

Other Instruments of Trade Policy

Figure 8-11: Effects of an Export Subsidy
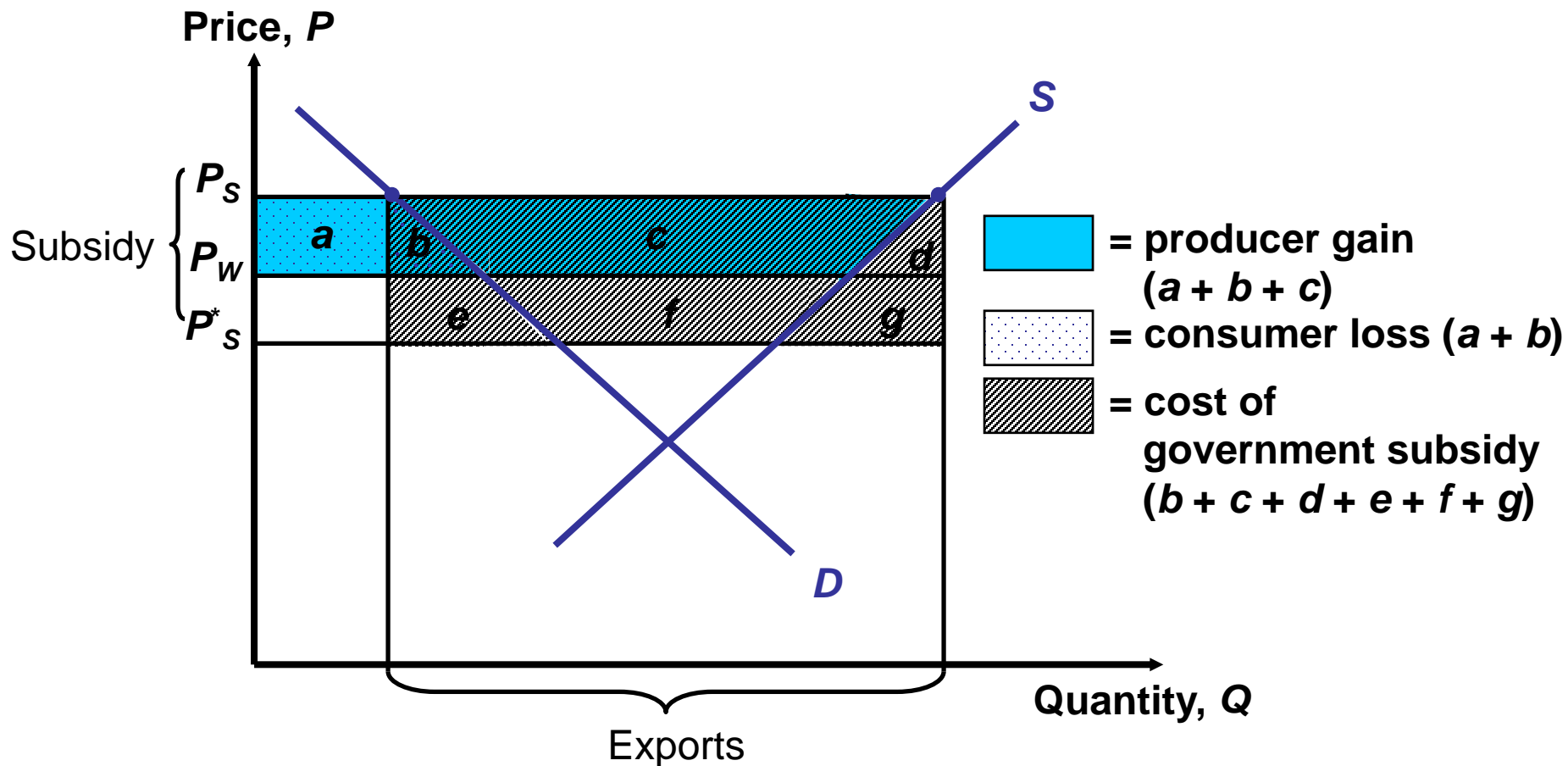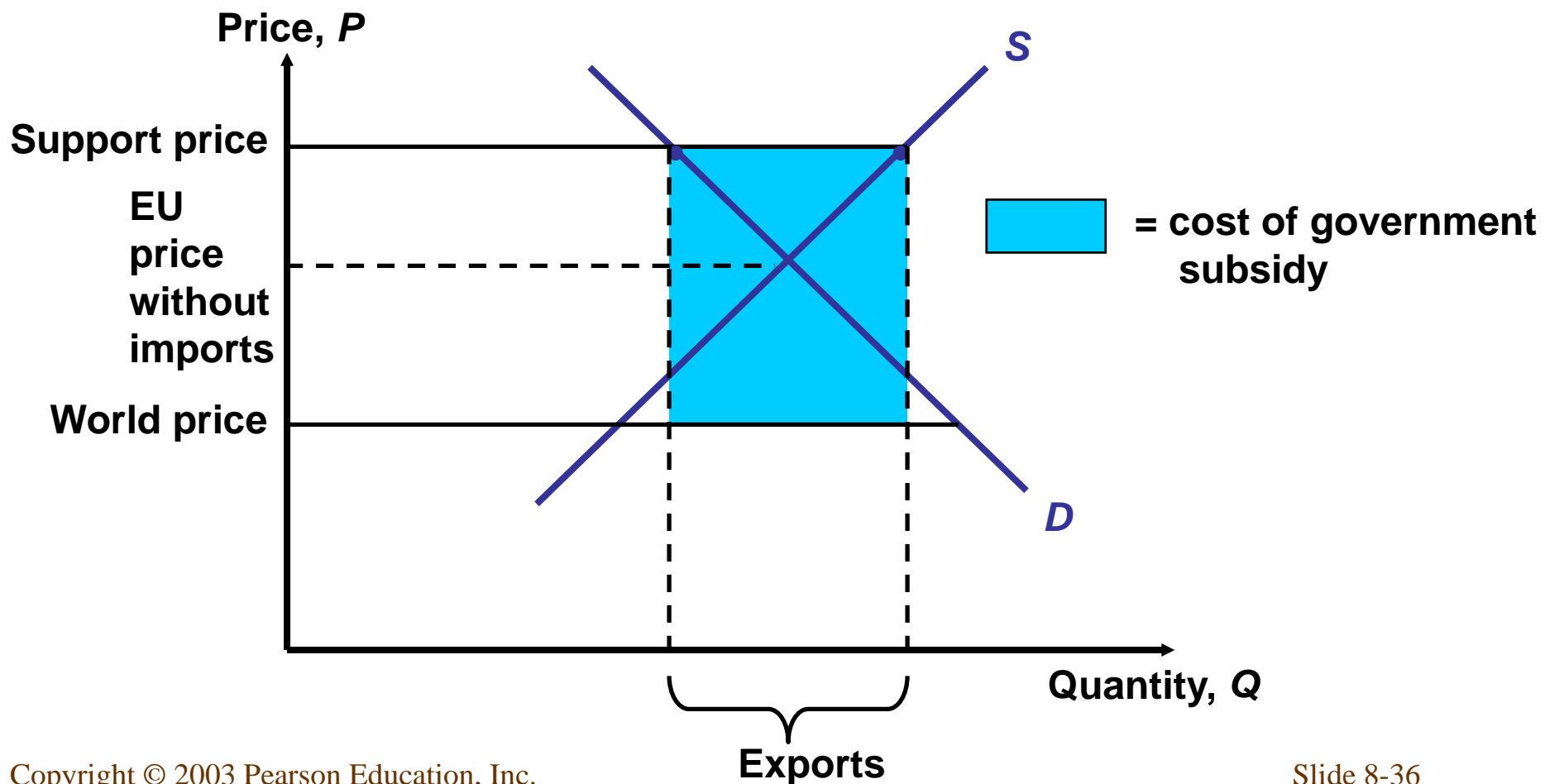
Other Instruments of Trade Policy

- An export subsidy raises prices in the exporting country while lowering them in the importing country.

- In addition, and in contrast to a tariff, the export subsidy worsens the terms of trade.

- An export subsidy unambiguously leads to costs that exceed its benefits.

Other Instruments of Trade Policy

Figure 8-12: Europe's Common Agricultural Program

Other Instruments of Trade Policy

- **Import Quotas: Theory**
  - An import quota is a direct restriction on the quantity of a good that is imported.
    - <u>Example</u>: The United States has a quota on imports of foreign cheese.
  - The restriction is usually enforced by issuing licenses to some group of individuals or firms.
    - <u>Example</u>: The only firms allowed to import cheese are certain trading companies.
  - In some cases (e.g. sugar and apparel), the right to sell in the United States is given directly to the governments of exporting countries.

Other Instruments of Trade Policy

- An import quota always raises the domestic price of the imported good.
- License holders are able to buy imports and resell them at a higher price in the domestic market.
  - The profits received by the holders of import licenses are known as **quota rents**.
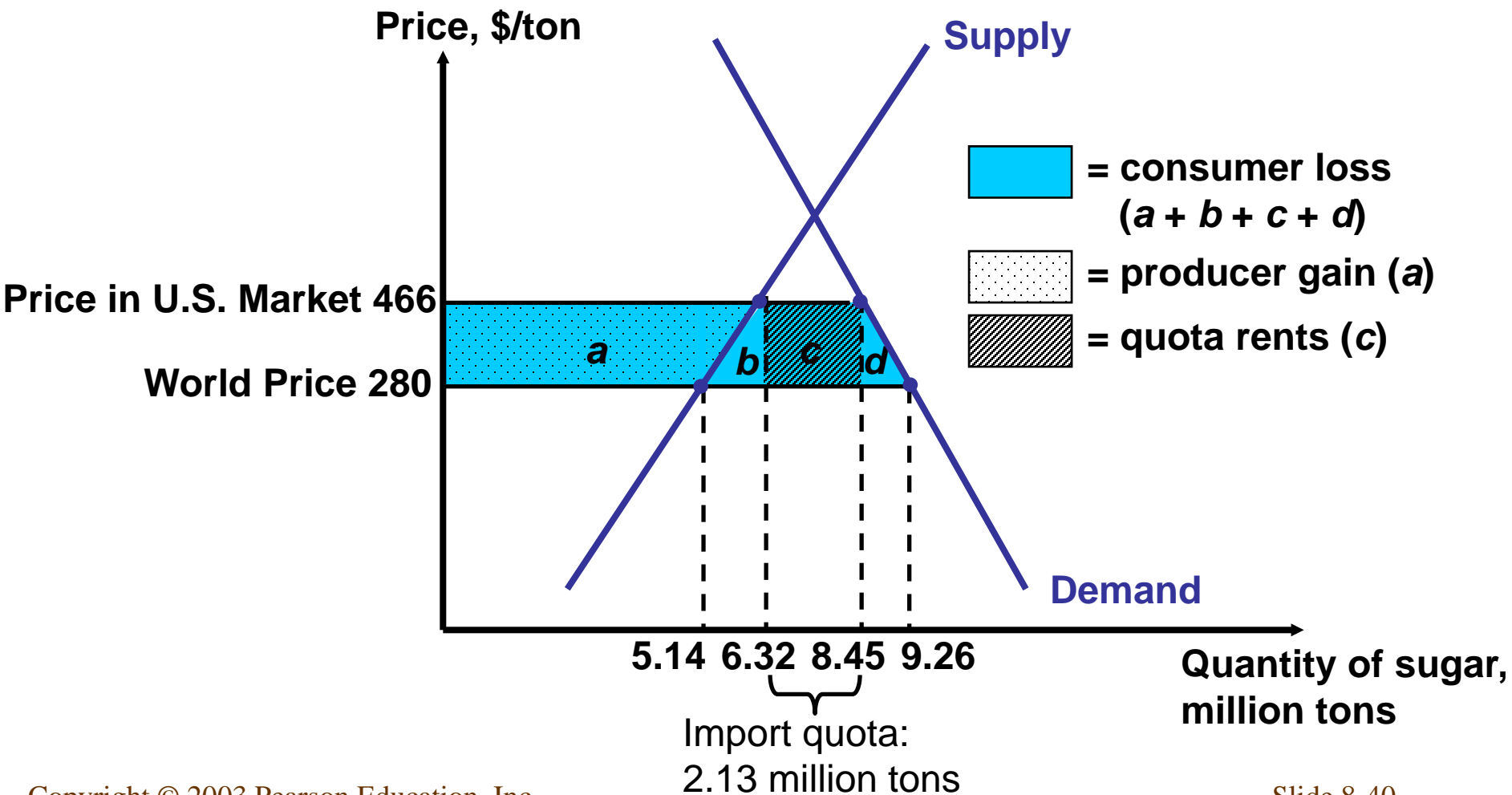
Other Instruments of Trade Policy

- Welfare analysis of import quotas versus of that of tariffs
  - The difference between a quota and a tariff is that with a quota the government receives *no* revenue.
  - In assessing the costs and benefits of an import quota, it is crucial to determine who gets the rents.
    - When the rights to sell in the domestic market are assigned to governments of exporting countries, the transfer of rents abroad makes the costs of a quota substantially higher than the equivalent tariff.

Other Instruments of Trade Policy

Figure 8-13: Effects of the U.S. Import Quota on Sugar

Price, $/ton

Supply

= consumer loss
(*a* + *b* + *c* + *d*)

= producer gain (*a*)

= quota rents (*c*)

Price in U.S. Market 466

World Price 280

a

b *c* *d*

Demand

5.14 6.32 8.45 9.26

Quantity of sugar, million tons

Import quota:
2.13 million tons

Other Instruments of Trade Policy

- **Voluntary Export Restraints**
  - A **voluntary export restraint (VER)** is an export quota administered by the exporting country.
    - It is also known as a voluntary restraint agreement (VRA).
  - VERs are imposed at the request of the importer and are agreed to by the exporter to forestall other trade restrictions.

Other Instruments of Trade Policy

- A VER is exactly like an import quota where the licenses are assigned to foreign governments and is therefore very costly to the importing country.

- A VER is always more costly to the importing country than a tariff that limits imports by the same amount.

  – The tariff equivalent revenue becomes rents earned by foreigners under the VER.

    – <u>Example</u>: About 2/3 of the cost to consumers of the three major U.S. voluntary restraints in textiles and apparel, steel, and automobiles is accounted for by the rents earned by foreigners.

- A VER produces a loss for the importing country.

Other Instruments of Trade Policy

- **Local Content Requirements**
  - A **local content requirement** is a regulation that requires that some specified fraction of a final good be produced domestically.
    - This fraction can be specified in physical units or in value terms.
  - Local content laws have been widely used by developing countries trying to shift their manufacturing base from assembly back into intermediate goods.

Other Instruments of Trade Policy

- Local content laws do not produce either government revenue or quota rents.
  - Instead, the difference between the prices of imports and domestic goods gets averaged in the final price and is passed on to consumers.
    - Example: Suppose that auto assembly firms are required to use 50% domestic parts. The cost of imported parts is $6000 and the cost of the same parts domestically is $10,000. Then the average cost of parts is $8000 (0.5 x $6000 + 0.5 x $10,000).
- Firms are allowed to satisfy their local content requirement by exporting instead of using parts domestically.

Other Instruments of Trade Policy

- **Other Trade Policy Instruments**
  - Export credit subsidies
    - A form of a subsidized loan to the buyer of exports.
    - They have the same effect as regular export subsidies.
  - National procurement
    - Purchases by the government (or public firms) can be directed towards domestic goods, even if they are more expensive than imports.
  - Red-tape barriers
    - Sometimes governments place substantial barriers based on health, safety and customs procedures.

The Effects of Trade Policy: A Summary

Table 8-1: Effects of Alternative Trade Policies

	Tariff	Export subsidy	Import quota	Voluntary export restraint
Producer surplus	Increases	Increases	Increases	Increases
Consumer surplus	Falls	Falls	Falls	Falls
Government revenue	Increases	Falls (government spending rises)	No change (rents to license holders)	No change (rents to foreigners)
Overall national welfare	Ambiguous (falls for small country)	Falls	Ambiguous (falls for small country)	Falls

Summary

- A tariff drives a wedge between foreign and domestic prices, raising the domestic price but by less than the tariff rate (except in the "small" country case).
  - In the small country case, a tariff is fully reflected in domestic prices.
- The costs and benefits of a tariff or other trade policy instruments may be measured using the concepts of consumer and producer surplus.
  - The domestic producers of a good gain
 - The domestic consumers lose
  - The government collects tariff revenue

Summary

- The net welfare effect of a tariff can be separated into two parts:
    - Efficiency (consumption and production) loss
    - Terms of trade gain (is zero in the case of a small country)
- An export subsidy causes efficiency losses similar to a tariff but compounds these losses by causing a deterioration of the terms of trade.
- Under import quotas and voluntary export restraints the government of the importing country receives no revenue.

Appendix I: Tariff Analysis in General Equilibrium

Table 8AI-1: Free Trade Equilibrium for a Small Country
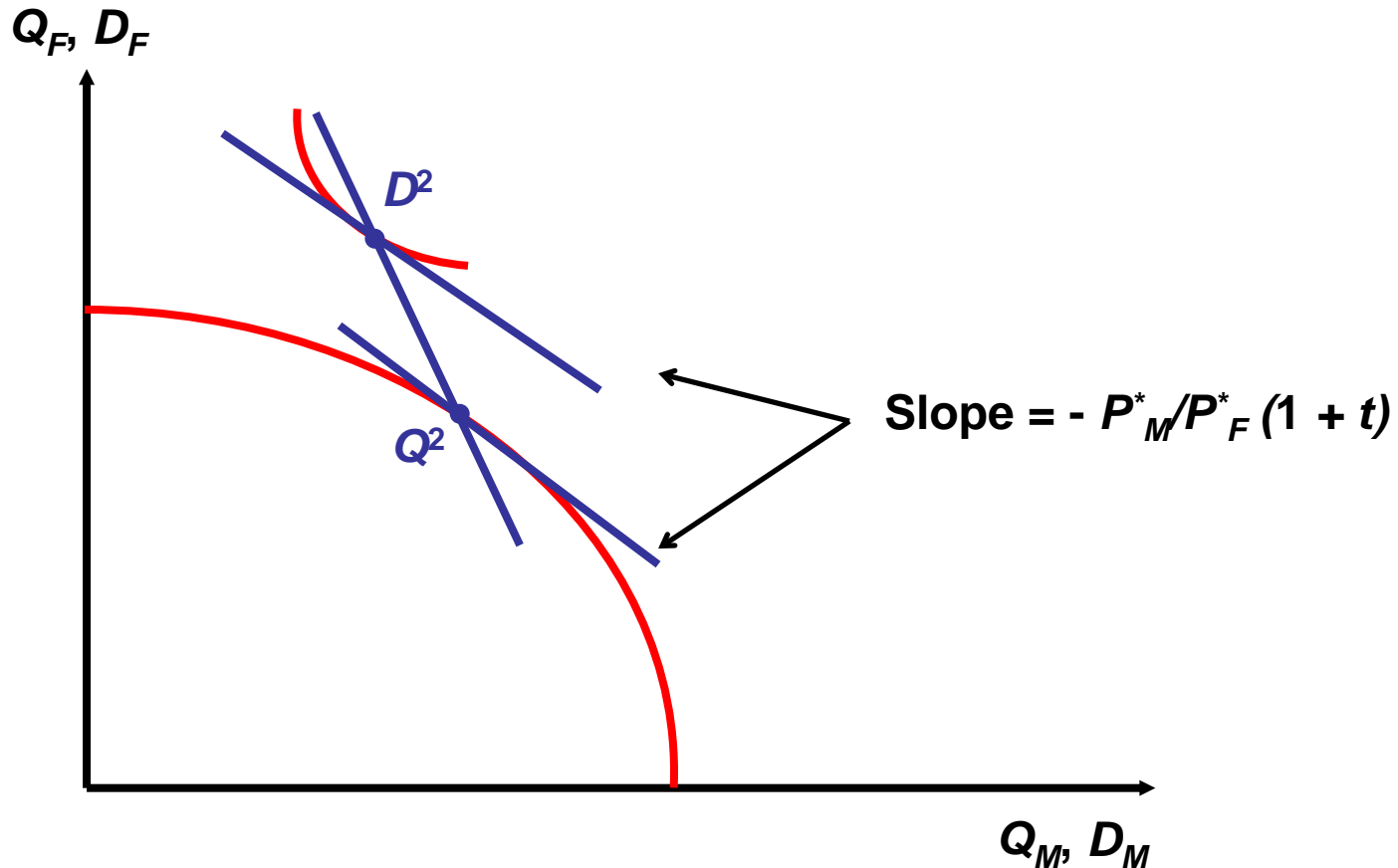
Food production and consumption, Q_F, D_F

D^1

Q^1

Slope = $-P^*_M/P^*_F$
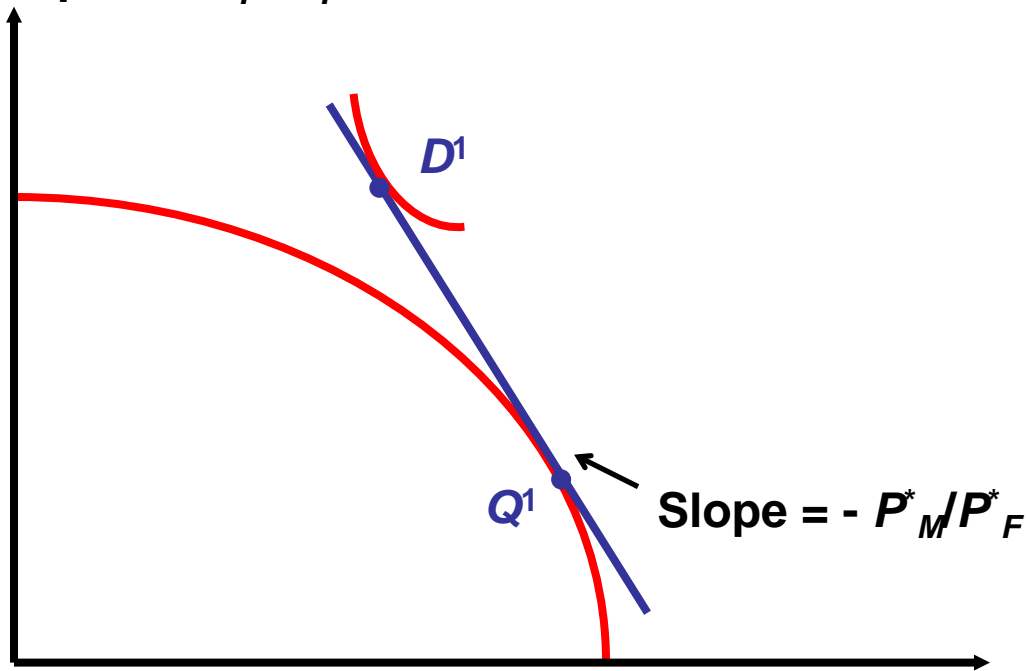
Manufactures production and consumption, Q_M, D_M

Table 8AI-2: A Tariff in a Small Country

Slope = $-P^*_M/P^*_F (1 + t)$

Appendix I: Tariff Analysis in General Equilibrium

Table 8AI-3: Effect of a Tariff on the Terms of Trade
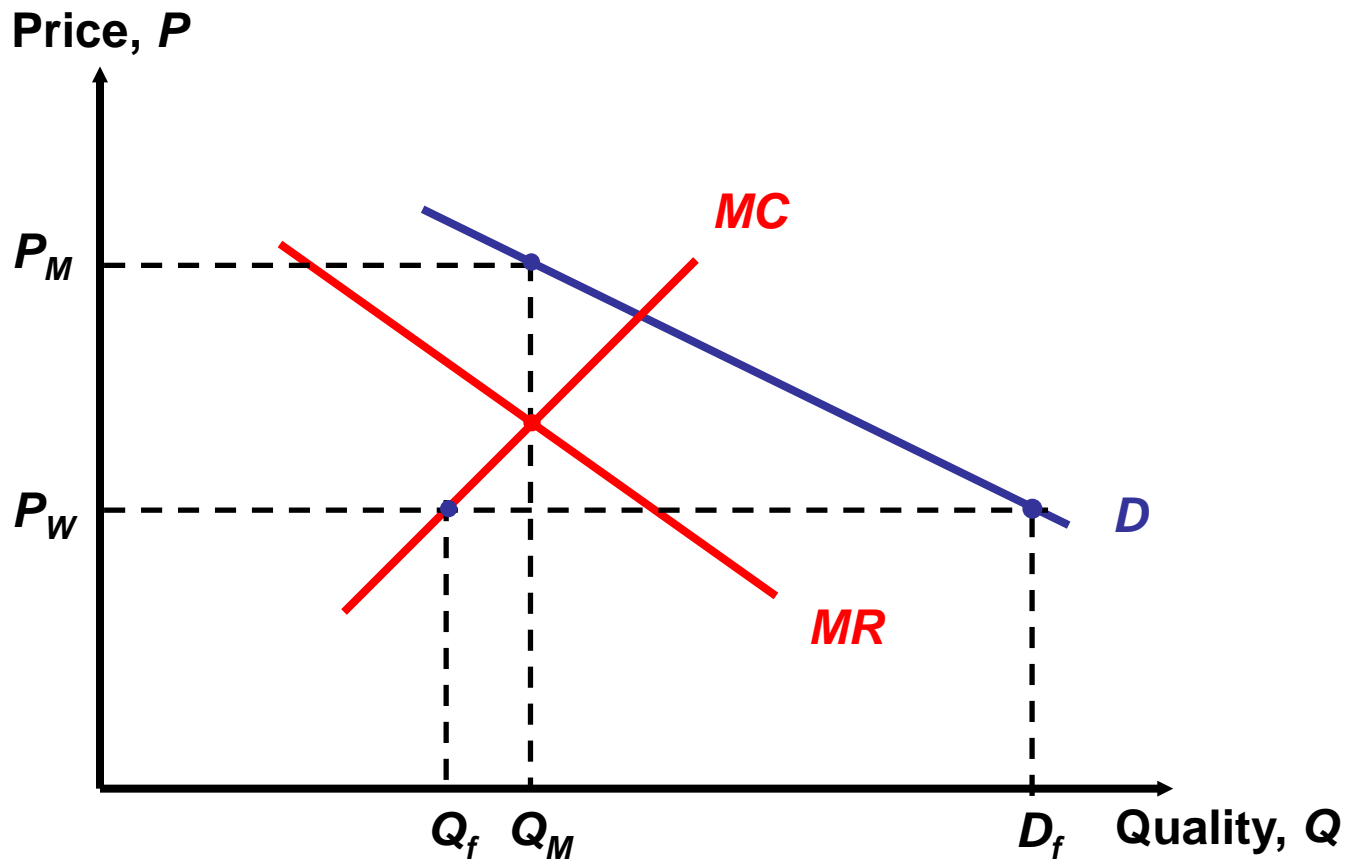
Home imports of food, $D_F - Q_F$
Foreign exports of food, $Q_F^* - D_F^*$

Slope $= (P_M^*/P_F^*)^2$

M^1

Slope $= (P_M^*/P_F^*)^1$

M^2

F

1

3

2

O   Home exports of manufactures, $Q_M - D_M$
Foreign imports of manufactures, $D_M^* - Q_M^*$
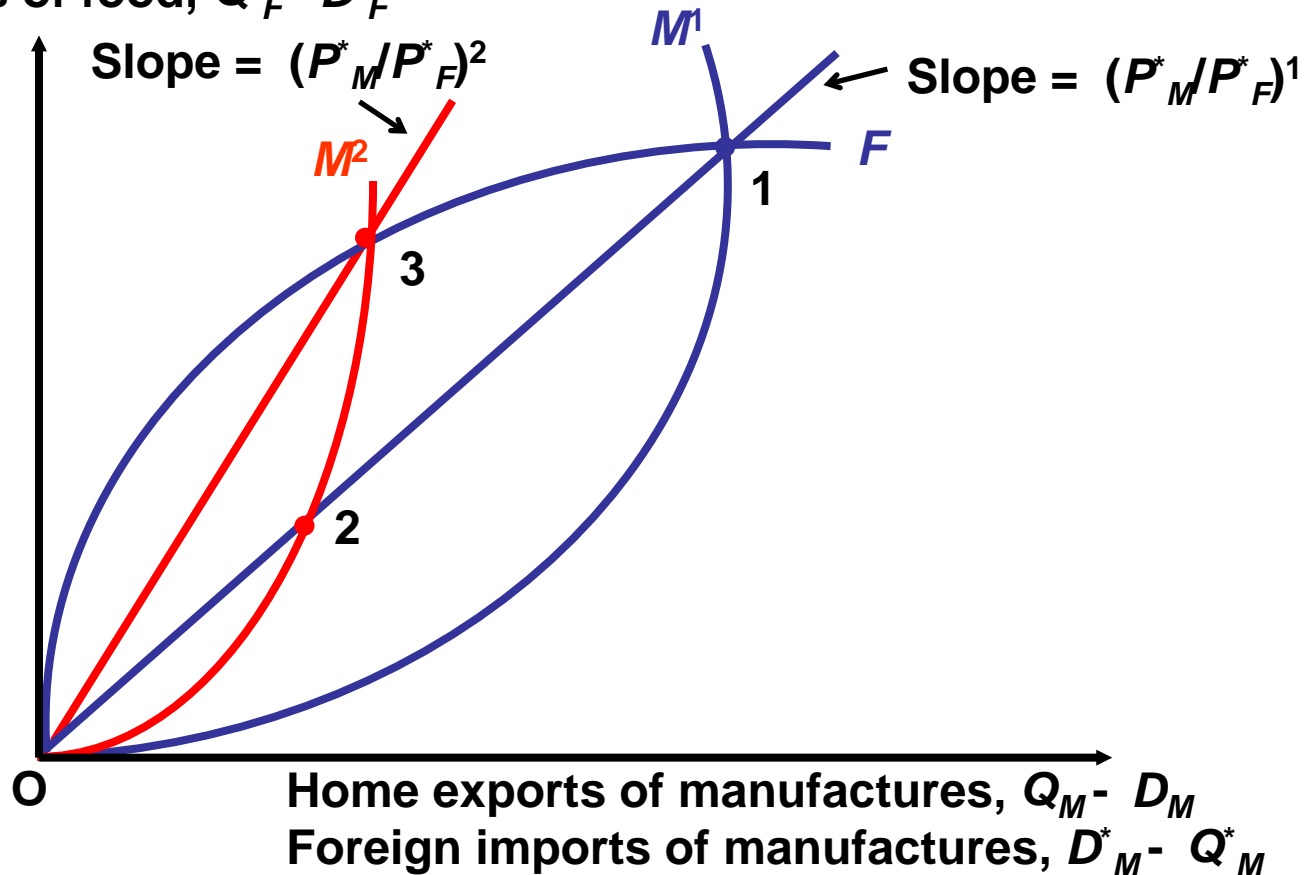
Appendix II: Tariffs and Import Quotas in the Presence of Monopoly

Table 8AII-1: A Monopolist Under Free Trade

Table 8AII-2: A Monopolist Protected by a Tariff

Table 8AII-3: A Monopolist Protected by an Import Quota

Table 8AII-4: Comparing a Tariff and a Quota
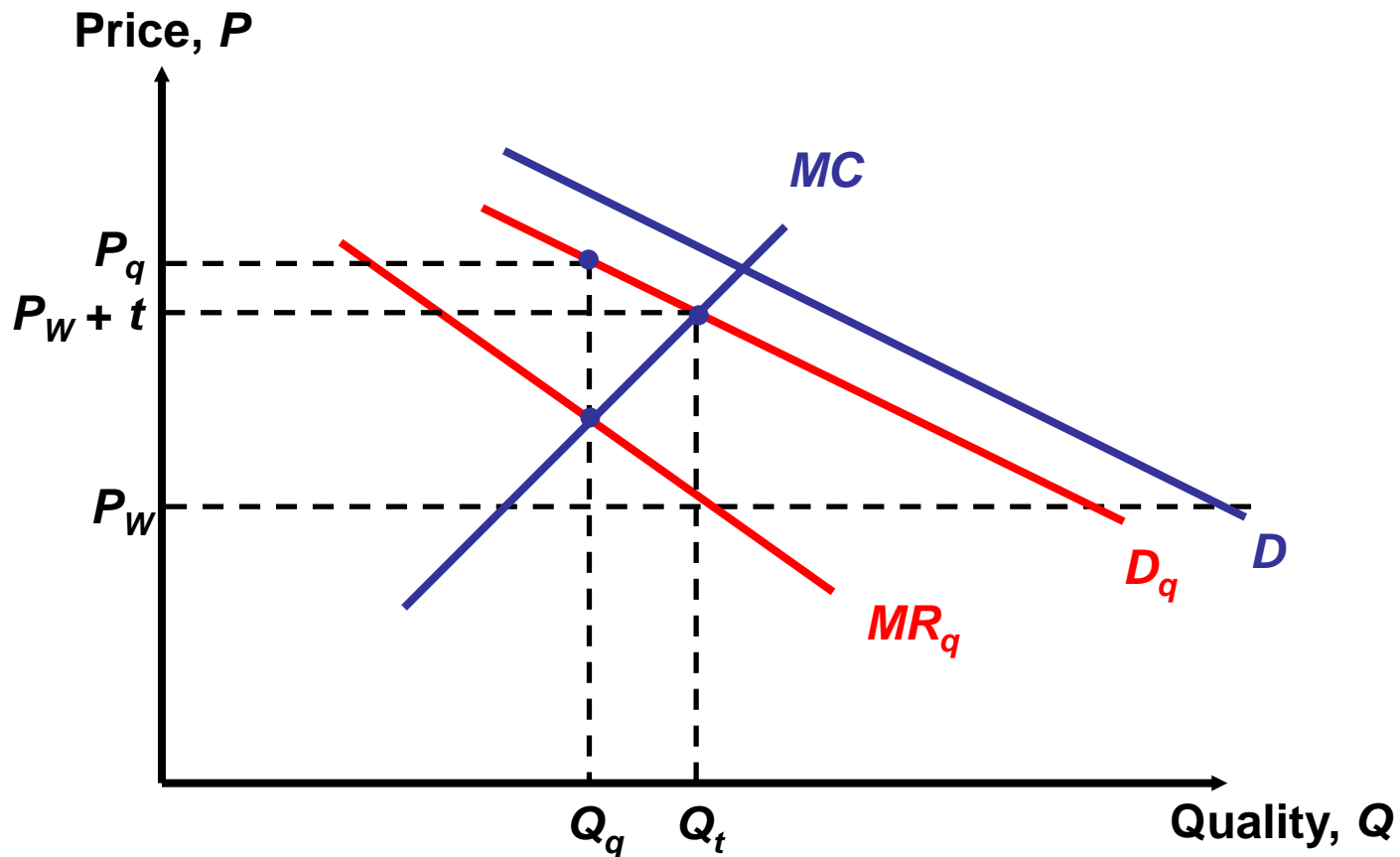
Chapter 13
Exchange Rates and the Foreign Exchange Market: An Asset Approach

Prepared by **Iordanis Petsas**

To Accompany

International Economics: Theory and Policy, **Sixth Edition**
by **Paul R. Krugman and Maurice Obstfeld**

Chapter Organization

- Introduction

- Exchange Rates and International Transactions

- The Foreign Exchange Market

- The Demand for Foreign Currency Assets

- Equilibrium in the Foreign Exchange Market

- Interest Rates, Expectations, and Equilibrium

- Summary

Introduction

- Exchange rates are important because they enable us to translate different counties' prices into comparable terms.

- Exchange rates are determined in the same way as other asset prices.

- The general goal of this chapter is to show:

  - How exchange rates are determined

  - The role of exchange rates in international trade

Exchange Rates and International Transactions

- An exchange rate can be quoted in two ways:
  - Direct
    - The price of the foreign currency in terms of dollars
  - Indirect
    - The price of dollars in terms of the foreign currency

Exchange Rates and International Transactions

Table 13-1: Exchange Rate Quotations

CURRENCY TRADING

Wednesday, October 24, 2001

EXCHANGE RATES

The New York foreign exchange mid-range rates below apply to trading among banks in amounts of $1 million and more, as quoted at 4 p.m. Eastern time by Reuters and other sources. Retail transactions provide fewer units of foreign currency per dollar. Rates for the 12 Euro currency countries are derived from the latest dollar-euro rate using the exchange ratios set 1/1/99.

Country	U.S. $ EQUIV. Wed	Tue	CURRENCY PER U.S. $ Wed	Tue
Argentina (Peso)	1.0001	1.0001	.9999	.9999
Australia (Dollar)	.5083	.5075	1.9675	1.9704
Austria (Schilling)	.06493	.06473	15.400	15.450
Bahrain (Dinar)	2.6525	2.6525	.3770	.3770
Belgium (Franc)	.0221	.0221	45.1482	45.2927
Brazil (Real)	.3626	.3663	2.7580	2.7300
Britain (Pound)	1.4290	1.4259	.6998	.7013
1-month forward	1.4266	1.4233	.7010	.7026
3-months forward	1.4219	1.4187	.7033	.7049
6-months forward	1.4155	1.4120	.7065	.7082
Canada (Dollar)	.6354	.6363	1.5739	1.5717
1-month forward	.6351	.6360	1.5745	1.5723
3-months forward	.6348	.6357	1.5754	1.5731
6-months forward	.6345	.6353	1.5760	1.5741
Chile (Peso)	.001408	.001408	710.15	710.35
China (Renminbi)	.1208	.1208	8.2767	8.2768
Colombia (Peso)	.0004309	.0004312	2320.50	2319.00
Czech. Rep. (Koruna)				
Commercial rate	.02682	.02679	37.291	37.326
Denmark (Krone)	.1202	.1198	8.3226	8.3495
Ecuador (US Dollar)-e	1.0000	1.0000	1.0000	1.0000
Finland (Markka)	.1503	.1498	6.6544	6.6757
France (Franc)	.1362	.1358	7.3414	7.3649
1-month forward	.1361	.1356	7.3495	7.3735
3-months forward	.1358	.1353	7.3654	7.3886
6-months forward	.1354	.1350	7.3838	7.4074
Germany (Mark)	.4568	.4554	2.1890	2.1960
1-month forward	.4563	.4549	2.1914	2.1985
3-months forward	.4554	.4539	2.1961	2.2030
6-months forward	.4542	.4528	2.2016	2.2086
Greece (Drachma)	.002622	.002614	381.37	382.59
Hong Kong (Dollar)	.1282	.1282	7.8000	7.7998
Hungary (Forint)	.003538	.003550	282.69	281.71
India (Rupee)	.02082	.02084	48.030	47.980
Indonesia (Rupiah)	.0000978	.0000983	10230	10170
Ireland (Punt)	1.1346	1.1308	.8814	.8843
Israel (Shekel)	.2319	.2327	4.3130	4.2980
Italy (Lira)	.0004615	.0004600	2167.06	2174.00
Japan (Yen)	.008139	.008151	122.87	122.68
1-month forward	.008155	.008168	122.62	122.42
3-months forward	.008186	.008198	122.16	121.98
6-months forward	.008229	.008242	121.53	121.33
Jordan (Dinar)	1.4104	1.4104	.7090	.7090
Kuwait (Dinar)	3.2658	3.2658	.3062	.3062
Lebanon (Pound)	.0006634	.0006614	1507.50	1512.00
Malaysia (Ringgit)-b	.2632	.2632	3.8000	3.8000
Malta (Lira)	2.2212	2.2163	.4502	.4512
Mexico (Peso)				
Floating rate	.1083	.1084	9.2300	9.2250
Netherlands (Guilder)	.4054	.4042	2.4664	2.4743
New Zealand (Dollar)	.4184	.4181	2.3901	2.3918
Norway (Krone)	.1123	.1120	8.9071	8.9311
Pakistan (Rupee)	.01623	.01626	61.600	61.500
Peru (new Sol)	.2897	.2897	3.4515	3.4520
Philippines (Peso)	.01927	.01925	51.900	51.950
Poland (Zloty)-d	.2429	.2432	4.1175	4.1125
Portugal (Escudo)	.004457	.004443	224.38	225.10
Russia (Ruble)-a	.03381	.03382	29.576	29.564
Saudi Arabia (Riyal)	.2666	.2666	3.7512	3.7510
Singapore (Dollar)	.5472	.5477	1.8275	1.8258
Slovak Rep. (Koruna)	.02048	.02046	48.824	48.869
South Africa (Rand)	.1067	.1059	9.3716	9.4400
South Korea (Won)	.0007731	.0007683	1293.50	1301.50
Spain (Peseta)	.005370	.005353	186.22	186.81
Sweden (Krona)	.0943	.0940	10.6050	10.6382
Switzerland (Franc)	.6033	.6024	1.6575	1.6600
1-month forward	.6034	.6025	1.6573	1.6598
3-months forward	.6035	.6026	1.6571	1.6596
6-months forward	.6038	.6030	1.6561	1.6585
Taiwan (Dollar)	.02896	.02896	34.530	34.530
Thailand (Baht)	.02233	.02233	44.790	44.775
Turkey (Lira)-f	.00000062	.00000062	1615000	1610000
United Arab (Dirham)	.2723	.2723	3.6730	3.6730
Uruguay (New Peso)				
Financial	.07177	.07194	13.933	13.900
Venezuela (Bolivar)	.001346	.001346	742.76	742.75
SDR	1.2687	1.2663	.7882	.7897
Euro	.8935	.8907	1.1192	1.1227

Special Drawing Rights (SDR) are based on exchange rates for the U.S., German, British, French , and Japanese currencies. Source: International Monetary Fund.
a-Russian Central Bank rate. b-Government rate. d-Floating rate; trading band suspended on 4/11/00. e-Adopted U.S. dollar as of 9/11/00. f-Floating rate, eff. Feb. 22.

Exchange Rates and International Transactions

- **Domestic and Foreign Prices**
  - If we know the exchange rate between two countries' currencies, we can compute the price of one country's exports in terms of the other country's money.
    - <u>Example</u>: The dollar price of a £50 sweater with a dollar exchange rate of $1.50 per pound is (1.50 $/£) x (£50) = $75.

Exchange Rates and International Transactions

- Two types of changes in exchange rates:
  - **Depreciation of home country's currency**
    - A rise in the home currency prices of a foreign currency
    - It makes home goods cheaper for foreigners and foreign goods more expensive for domestic residents.
  - **Appreciation of home country's currency**
    - A fall in the home price of a foreign currency
    - It makes home goods more expensive for foreigners and foreign goods cheaper for domestic residents.

Exchange Rates and International Transactions

- **Exchange Rates and Relative Prices**
  - Import and export demands are influenced by relative prices.
  - Appreciation of a country's currency:
    - Raises the relative price of its exports
    - Lowers the relative price of its imports
  - Depreciation of a country's currency:
    - Lowers the relative price of its exports
    - Raises the relative price of its imports

Exchange Rates and International Transactions

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.

The Foreign Exchange Market

- Exchange rates are determined in the **foreign exchange market**.
  - The market in which international currency trades take place
- The Actors
  - The major participants in the foreign exchange market are:
    - Commercial banks
    - International corporations
    - Nonbank financial institutions
    - Central banks

Exchange Rates and International Transactions

- **Interbank trading**
  - Foreign currency trading among banks
  - It accounts for most of the activity in the foreign exchange market.

Exchange Rates and International Transactions

- **Characteristics of the Market**
  - The worldwide volume of foreign exchange trading is enormous, and it has ballooned in recent years.
  - New technologies, such as Internet links, are used among the major foreign exchange trading centers (London, New York, Tokyo, Frankfurt, and Singapore).
  - The integration of financial centers implies that there can be no significant **arbitrage**.
    - The process of buying a currency cheap and selling it dear.

Exchange Rates and International Transactions

- **Vehicle currency**
  - A currency that is widely used to denominate international contracts made by parties who do not reside in the country that issues the vehicle currency.
    - Example: In 2001, around 90% of transactions between banks involved exchanges of foreign currencies for U.S. dollars.
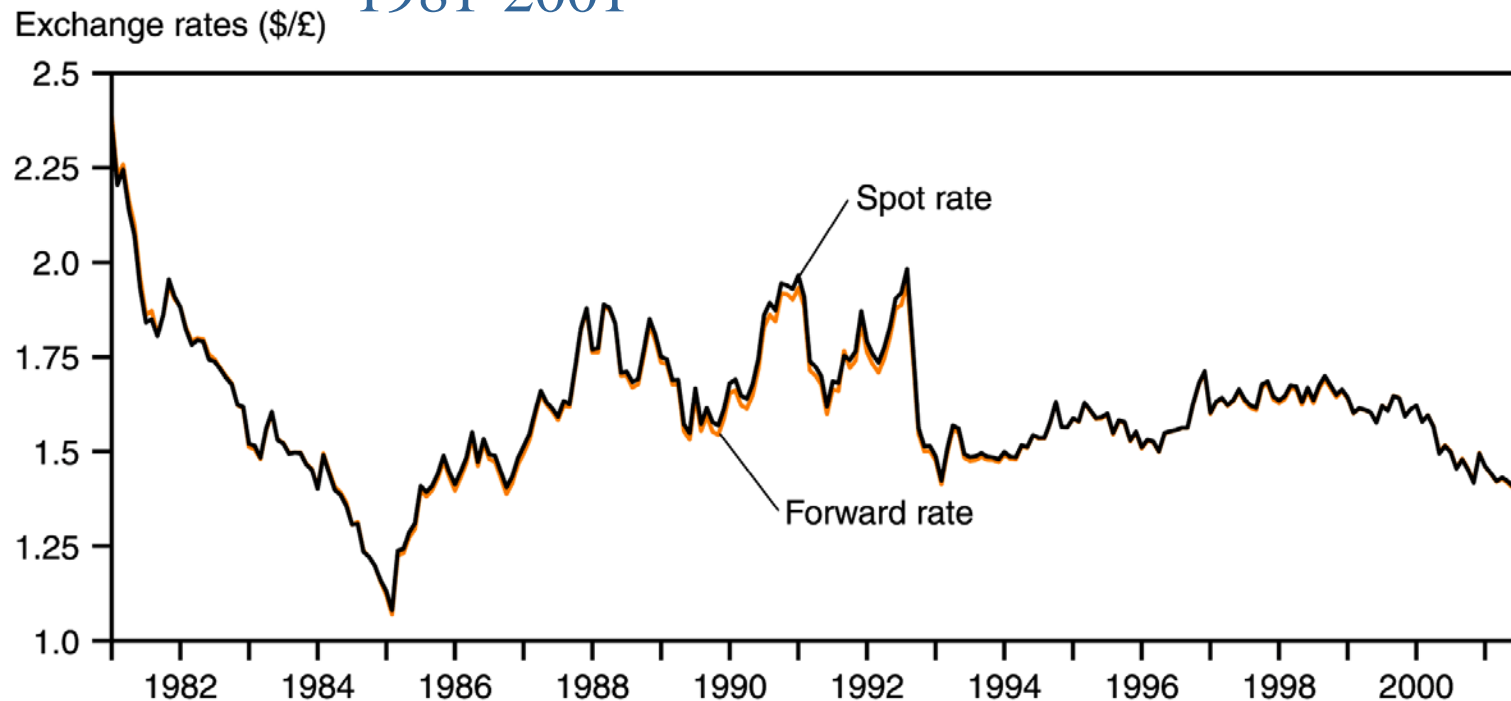
Exchange Rates and International Transactions

- **Spot Rates and Forward Rates**
  - **Spot exchange rates**
    - Apply to exchange currencies "on the spot"
  - **Forward exchange rates**
    - Apply to exchange currencies on some future date at a prenegotiated exchange rate
  - Forward and spot exchange rates, while not necessarily equal, do move closely together.

Exchange Rates and International Transactions

Figure 13-1: Dollar/Pound Spot and Forward Exchange Rates, 1981-2001

Exchange rates ($/£)

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.

Exchange Rates and International Transactions

■ Foreign Exchange Swaps

- Spot sales of a currency combined with a forward repurchase of the currency.

- They make up a significant proportion of all foreign exchange trading.

Exchange Rates and International Transactions

- **Futures and Options**
  - Futures contract
    - The buyer buys a promise that a specified amount of foreign currency will be delivered on a specified date in the future.
  - Foreign exchange option
    - The owner has the right to buy or sell a specified amount of foreign currency at a specified price at any time up to a specified expiration date.

The Demand for Foreign Currency Assets

- The demand for a foreign currency bank deposit is influenced by the same considerations that influence the demand for any other asset.

- Assets and Asset Returns
  - **Defining Asset Returns**
    - The percentage increase in value an asset offers over some time period.
  - **The Real Rate of Return**
    - The rate of return computed by measuring asset values in terms of some broad representative basket of products that savers regularly purchase.

The Demand for Foreign Currency Assets

- Risk and Liquidity
  - Savers care about two main characteristics of an asset other than its return:
    - **Risk**
      - The variability it contributes to savers' wealth
    - **Liquidity**
      - The ease with which it can be sold or exchanged for goods

The Demand for Foreign Currency Assets

- ■ Interest Rates

  - Market participants need two pieces of information in order to compare returns on different deposits:

    – How the money values of the deposits will change

    – How exchange rates will change

  - A currency's **interest rate** is the amount of that currency an individual can earn by lending a unit of the currency for a year.

    – <u>Example</u>: At a dollar interest rate of 10% per year, the lender of $1 receives $1.10 at the end of the year.

The Demand for Foreign Currency Assets

Interest rates (percent per year)
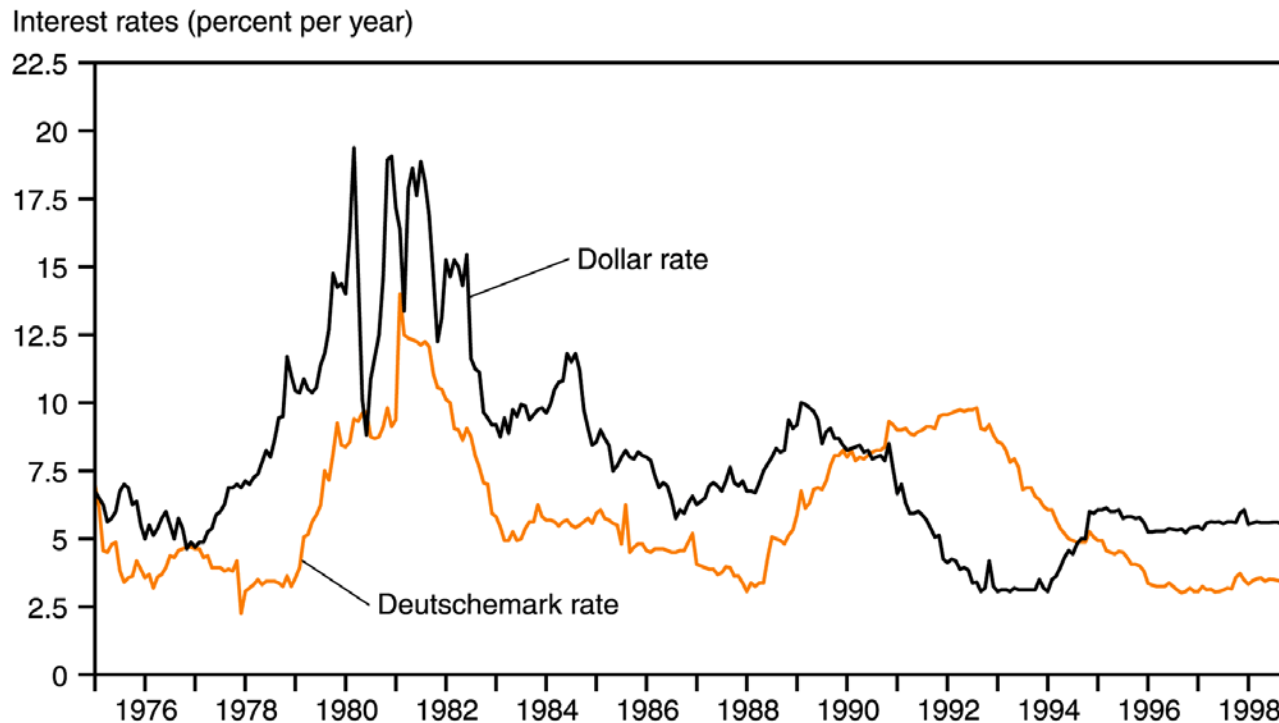
Since dollar and DM interest rates are not measured in comparable terms, they can move quite differently over time.

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

The Demand for Foreign Currency Assets

- ■ **Exchange Rates and Asset Returns**
  - The returns on deposits traded in the foreign exchange market depend on interest rates and expected exchange rate changes.
  - In order to decide whether to buy a euro or a dollar deposit, one must calculate the dollar return on a euro deposit.

The Demand for Foreign Currency Assets

- **A Simple Rule**
  - The dollar rate of return on euro deposits is approximately the euro interest rate plus the **rate of depreciation** of the dollar against the euro.
    - The rate of depreciation of the dollar against the euro is the percentage increase in the dollar/euro exchange rate over a year.

The Demand for Foreign Currency Assets

- The expected rate of return difference between dollar and euro deposits is:

$$R_\$ - [R_€ + (E^e_{\$/€} - E_{\$/€})/E_{\$/€}] = R_\$ - R_€ - (E^e_{\$/€} - E_{\$/€})/E_{\$/€} \quad (13\text{-}1)$$

where:

$R_\$$ = interest rate on one-year dollar deposits

$R_€$ = today's interest rate on one-year euro deposits

$E_{\$/€}$ = today's dollar/euro exchange rate (number of dollars per euro)

$E^e_{\$/€}$ = dollar/euro exchange rate (number of dollars per euro) expected to prevail a year from today

The Demand for Foreign Currency Assets

- When the difference in Equation (13-1) is positive, dollar deposits yield the higher expected rate of return. When it is negative, euro deposits yield the higher expected rate of return.

The Demand for Foreign 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 $\dfrac{E^e_{\$/€} - E_{\$/€}}{E_{\$/€}}$	Rate of Return Difference between Dollar and Euro Deposits $R_\$ - R_{€} - \dfrac{(E^e_{\$/€} - E_{\$/€})}{E_{\$/€}}$
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 Demand for Foreign Currency Assets

- ■ Return, Risk, and Liquidity in the Foreign Exchange Market
  - The demand for foreign currency assets depends not only on returns but on risk and liquidity.
    - There is no consensus among economists about the importance of risk in the foreign exchange market.
    - Most of the market participants that are influenced by liquidity factors are involved in international trade.
      - Payments connected with international trade make up a very small fraction of total foreign exchange transactions.
  - Therefore, we ignore the risk and liquidity motives for holding foreign currencies.

Equilibrium in the Foreign Exchange Market

■ Interest Parity: The Basic Equilibrium Condition

- The foreign exchange market is in equilibrium when deposits of all currencies offer the same expected rate of return.

- **Interest parity condition**

  – The expected returns on deposits of any two currencies are equal when measured in the same currency.

  – It implies that potential holders of foreign currency deposits view them all as equally desirable assets.

  – The expected rates of return are equal when:

$$R_\$ = R_€ + (E^e_{\$/€} - E_{\$/€})/E_{\$/€} \qquad (13\text{-}2)$$

Equilibrium in the Foreign Exchange Market

- ■ **How Changes in the Current Exchange Rate Affect Expected Returns**
  - Depreciation of a country's currency today lowers the expected domestic currency return on foreign currency deposits.
  - Appreciation of the domestic currency today raises the domestic currency return expected of foreign currency deposits.
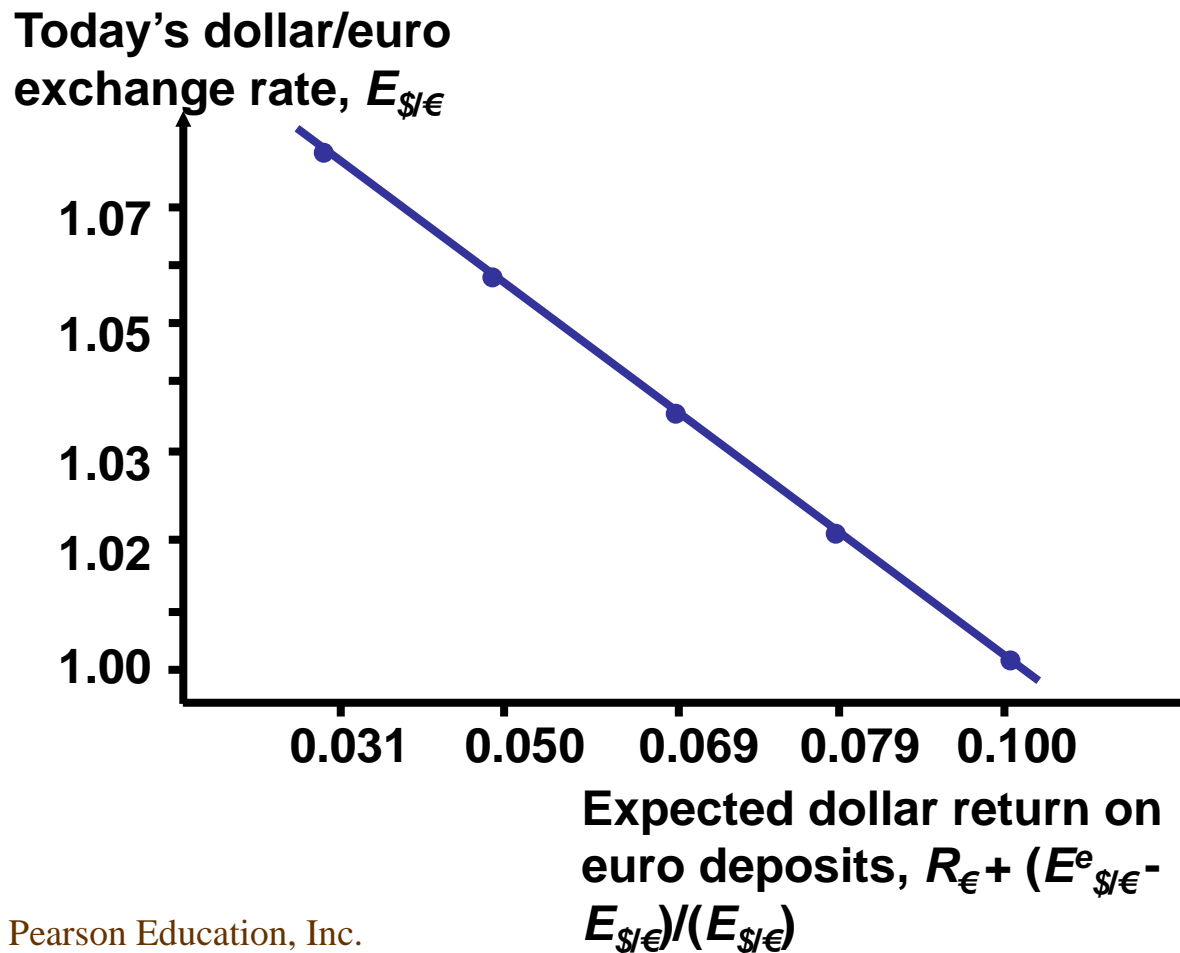
Equilibrium in the Foreign Exchange Market

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 $\dfrac{1.05 - E_{\$/€}}{E_{\$/€}}$	Expected Dollar Return on Euro Deposits $R_€ + \dfrac{1.05 - E_{\$/€}}{E_{\$/€}}$
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

Equilibrium in the Foreign Exchange Market

Figure 13-3: The Relation Between the Current Dollar/Euro Exchange Rate and the Expected Dollar Return on Euro Deposits

Today's dollar/euro exchange rate, $E_{\$/\euro}$

1.07

1.05

1.03

1.02

1.00

0.031   0.050   0.069   0.079   0.100

Expected dollar return on euro deposits, $R_\euro + (E^e_{\$/\euro} - E_{\$/\euro})/(E_{\$/\euro})$

Equilibrium in the Foreign Exchange Market

- **The Equilibrium Exchange Rate**
  - Exchange rates always adjust to maintain interest parity.
  - Assume that the dollar interest rate $R_\$$, the euro interest rate $R_\text{€}$ and the expected future dollar/euro exchange rate $E^e_{\$/\text{€}}$ are all given.

Equilibrium in the Foreign Exchange Market

Figure 13-4: Determination of the Equilibrium Dollar/Euro Exchange Rate

Interest Rates, Expectations, and Equilibrium

- **The Effect of Changing Interest Rates on the Current Exchange Rate**
  - An increase in the interest rate paid on deposits of a currency causes that currency to appreciate against foreign currencies.
    - A rise in dollar interest rates causes the dollar to appreciate against the euro.
    - A rise in euro interest rates causes the dollar to depreciate against the euro.

Interest Rates, Expectations, and Equilibrium

Figure 13-5: Effect of a Rise in the Dollar Interest Rate

Interest Rates, Expectations, and Equilibrium

Figure 13-6: Effect of a Rise in the Euro Interest Rate

Interest Rates, Expectations, and Equilibrium

- **The Effect of Changing Expectations on the Current Exchange Rate**
  - A rise in the expected future exchange rate causes a rise in the current exchange rate.
  - A fall in the expected future exchange rate causes a fall in the current exchange rate.

Summary

- Exchange rates play a role in spending decisions because they enable us to translate different countries' prices into comparable terms.

- A depreciation (appreciation) of a country's currency against foreign currencies makes its exports cheaper (more expensive) and its imports more expensive (cheaper).

- Exchange rates are determined in the foreign exchange market.

Summary

- An important category of foreign exchange trading is forward trading.

- The exchange rate is most appropriately thought of as being an asset price itself.

- The returns on deposits traded in the foreign exchange market depend on interest rates and expected exchange rate changes.

Summary

- Equilibrium in the foreign exchange market requires interest parity.

  - For given interest rates and a given expectation of the future exchange rate, the interest parity condition tells us the current equilibrium exchange rate.

- A rise in dollar (euro) interest rates causes the dollar to appreciate (depreciate) against the euro.

- Today's exchange rate is altered by changes in its expected future level.

Chapter 14
Money, Interest Rates, and Exchange Rates

Prepared by **Iordanis Petsas**

To Accompany

International Economics: Theory and Policy, Sixth Edition
by **Paul R. Krugman and Maurice Obstfeld**

Chapter Organization

- Introduction

- Money Defined: A Brief Review

- The Demand for Money by Individuals

- Aggregate Money Demand

- The Equilibrium Interest Rate: The Interaction of Money Supply and Demand

Chapter Organization

- The Money Supply and the Exchange Rate in the Short Run

- Money, the Price Level, and the Exchange Rate in the Long Run

- Inflation and Exchange Rate Dynamics

- Summary

Introduction

- Factors that affect a country's money supply or demand are among the most powerful determinants of its currency's exchange rate against foreign currencies.

- This chapter combines the foreign-exchange market with the money market to determine the exchange rate in the short run.

  - It analyzes the long-term effects of monetary changes on output prices and expected future exchange rates.

Money Defined: A Brief Review

- **Money as a Medium of Exchange**
  - A generally accepted means of payment
- **Money as a Unit of Account**
  - A widely recognized measure of value
- **Money as a Store of Value**
  - A transfer of purchasing power from the present into the future

Money Defined: A Brief Review

■ What Is Money?

- Assets widely used and accepted as a means of payment.

- Money is very liquid, but pays little or no return.
  - All other assets are less liquid but pay higher return.

- **Money Supply (M^s)**

$$M^s = \text{Currency} + \text{Checkable Deposits}$$

Money Defined: A Brief Review

- **How the Money Supply Is Determined**
  - An economy's money supply is controlled by its central bank.
    - The central bank:
      - Directly regulates the amount of currency in existence
      - Indirectly controls the amount of checking deposits issued by private banks

The Demand for Money by Individuals

- Three factors influence money demand:
  - Expected return
  - Risk
  - Liquidity
- Expected Return
  - The interest rate measures the opportunity cost of holding money rather than interest-bearing bonds.
    - A rise in the interest rate raises the cost of holding money and causes money demand to fall.

The Demand for Money by Individuals

- **Risk**
  - Holding money is risky.
    - An unexpected increase in the prices of goods and services could reduce the value of money in terms of the commodities consumed.
  - Changes in the risk of holding money need not cause individuals to reduce their demand for money.
    - Any change in the riskiness of money causes an equal change in the riskiness of bonds.

The Demand for Money by Individuals

- Liquidity
  - The main benefit of holding money comes from its liquidity.
    - Households and firms hold money because it is the easiest way of financing their everyday purchases.
  - A rise in the average value of transactions carried out by a household or firm causes its demand for money to rise.

Aggregate Money Demand

- **Aggregate money demand**
  - The total demand for money by all households and firms in the economy.
  - It is determined by three main factors:
    - Interest rate
      - It reduces the demand for money.
    - Price level
      - It raises the demand for money.
    - Real national income
      - It raises the demand for money.

Aggregate Money Demand

- The aggregate demand for money can be expressed by:

$$M^d = P \times L(R,Y) \qquad\qquad (14\text{-}1)$$

  where:

  P is the price level

  Y is real national income

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

- Equation (14-1) can also be written as:

$$M^d/P = L(R,Y) \qquad\qquad (14\text{-}2)$$

Aggregate Money Demand

Figure 14-1: Aggregate Real Money Demand and the Interest Rate

Interest rate, *R*

L(*R*,*Y*)

Aggregate real money demand

Aggregate Money Demand

Figure 14-2: Effect on the Aggregate Real Money Demand Schedule of a Rise in Real Income

The Equilibrium Interest Rate: The Interaction of Money Supply and Demand

- ■ Equilibrium in the Money Market
  - • The condition for equilibrium in the money market is:
    $$M^s = M^d \qquad (14\text{-}3)$$
  - • The money market equilibrium condition can be expressed in terms of aggregate real money demand as:
    $$M^s/P = L(R,Y) \qquad (14\text{-}4)$$

Figure 14-3: Determination of the Equilibrium Interest Rate

The Equilibrium Interest Rate: The Interaction of Money Supply and Demand

■ Interest Rates and the Money Supply

• An increase (fall) in the money supply lowers (raises) the interest rate, given the price level and output.

– The effect of increasing the money supply at a given price level is illustrated in Figure 14-4.

The Equilibrium Interest Rate: The Interaction of Money Supply and Demand

Figure 14-4: Effect of an Increase in the Money Supply on the Interest Rate

The Equilibrium Interest Rate: The Interaction of Money Supply and Demand

- ■ Output and the Interest Rate
  - An increase (fall) in real output raises (lowers) the interest rate, given the price level and the money supply.
    - Figure 14-5 shows the effect on the interest rate of a rise in the level of output, given the money supply and the price level.

The Equilibrium Interest Rate: The Interaction of Money Supply and Demand

Figure 14-5: Effect on the Interest Rate of a Rise in Real Income

The Money Supply and the Exchange Rate in the Short Run

- **Short run** analysis
  - The price level and the real output are given.
- **Long run** analysis
  - The price level is perfectly flexible and always adjusted immediately to preserve full employment.
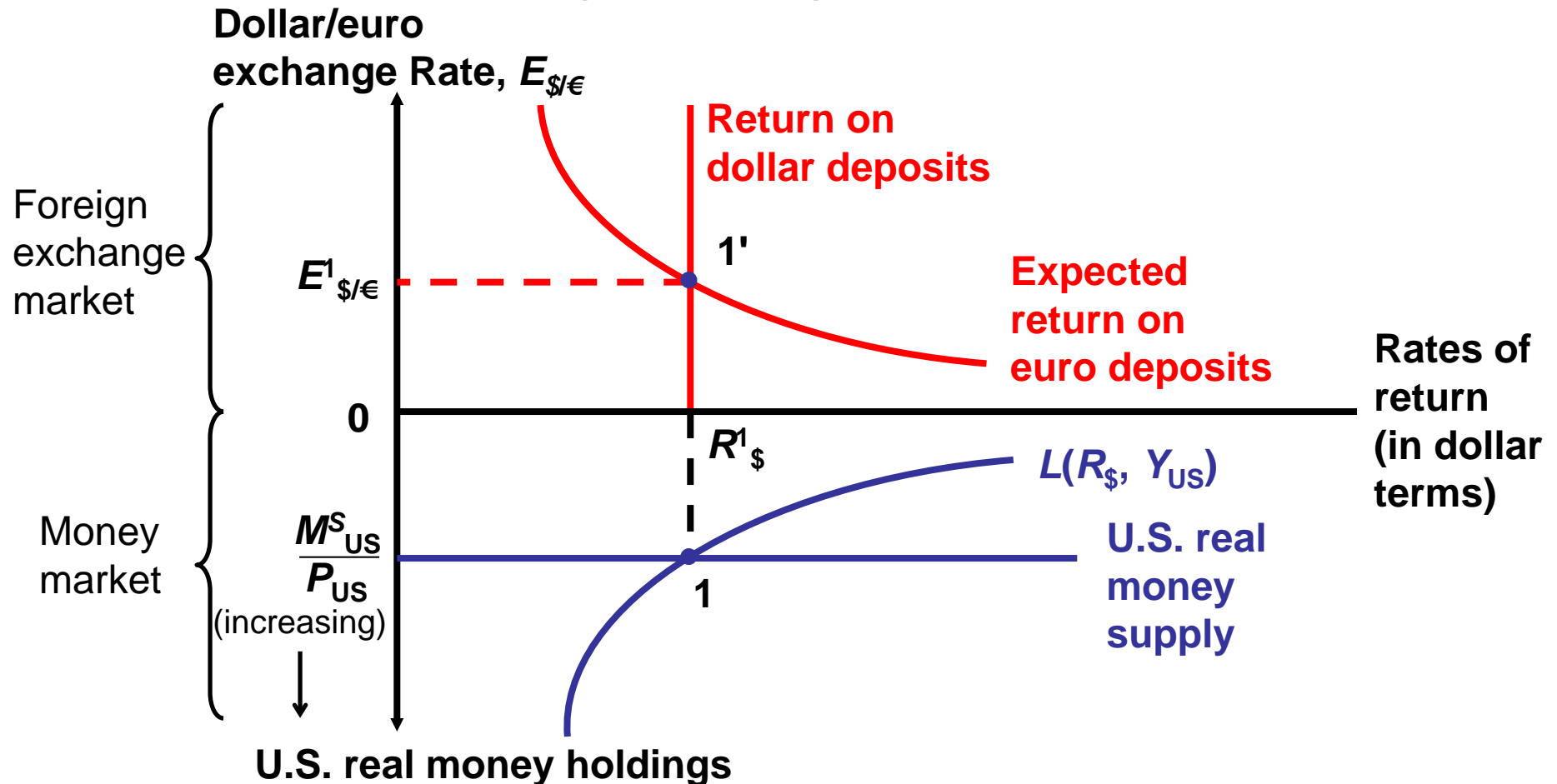
The Money Supply and the Exchange Rate in the Short Run

- **Linking Money, the Interest Rate, and the Exchange Rate**

  - The U.S. money market determines the dollar interest rate, which in turn affects the exchange rate that maintains the interest parity.

    – Figure 14-6 links the U.S. money market (bottom) and the foreign exchange market (top).

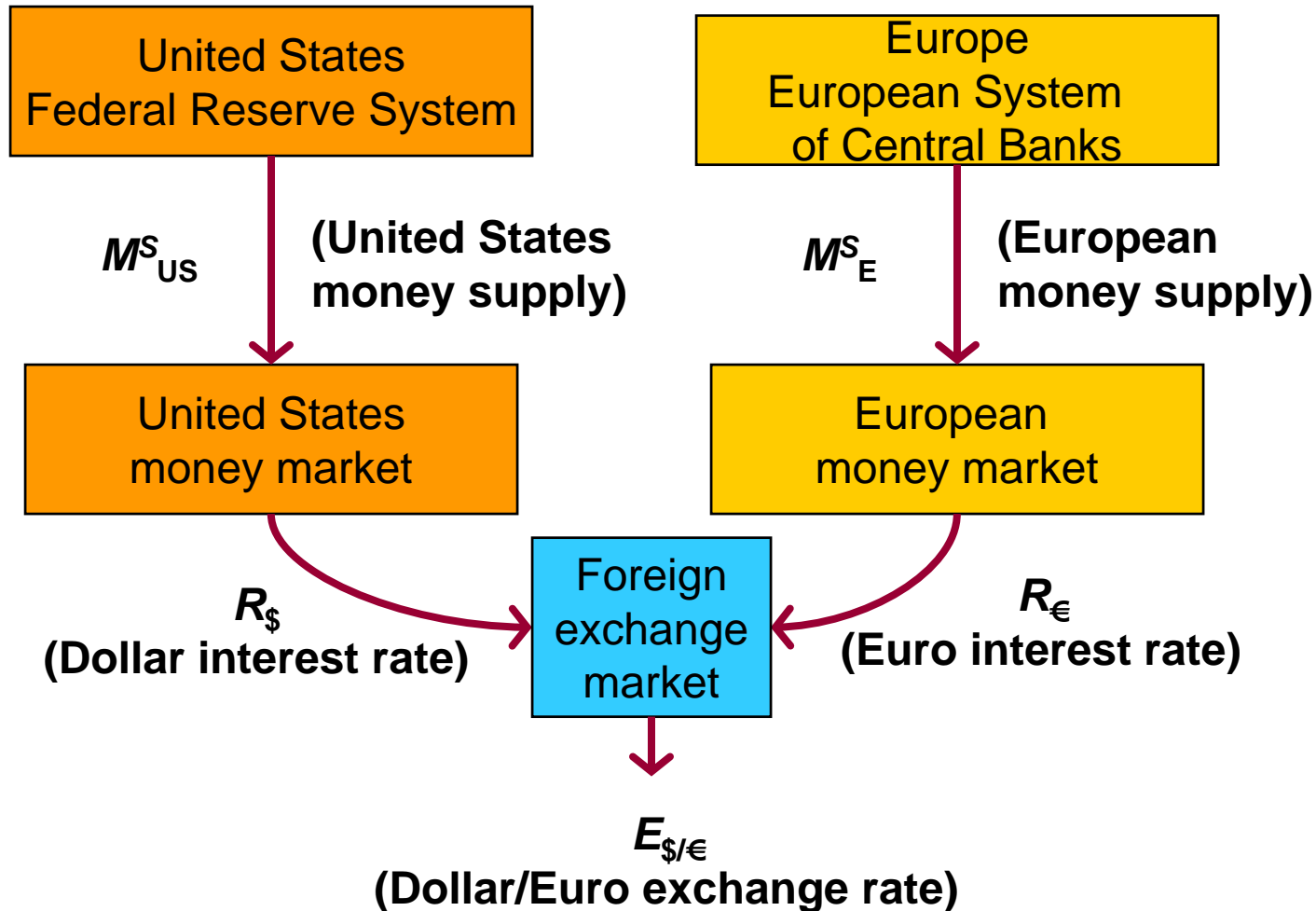# The Equilibrium Interest Rate: The Interaction of Money Supply and Demand

Figure 14-6: Simultaneous Equilibrium in the U.S. Money Market and the Foreign-Exchange Market

The Equilibrium Interest Rate: The Interaction of Money Supply and Demand

Figure 14-7: Money-Market/Exchange Rate Linkages

The Equilibrium Interest Rate: The Interaction of Money Supply and Demand
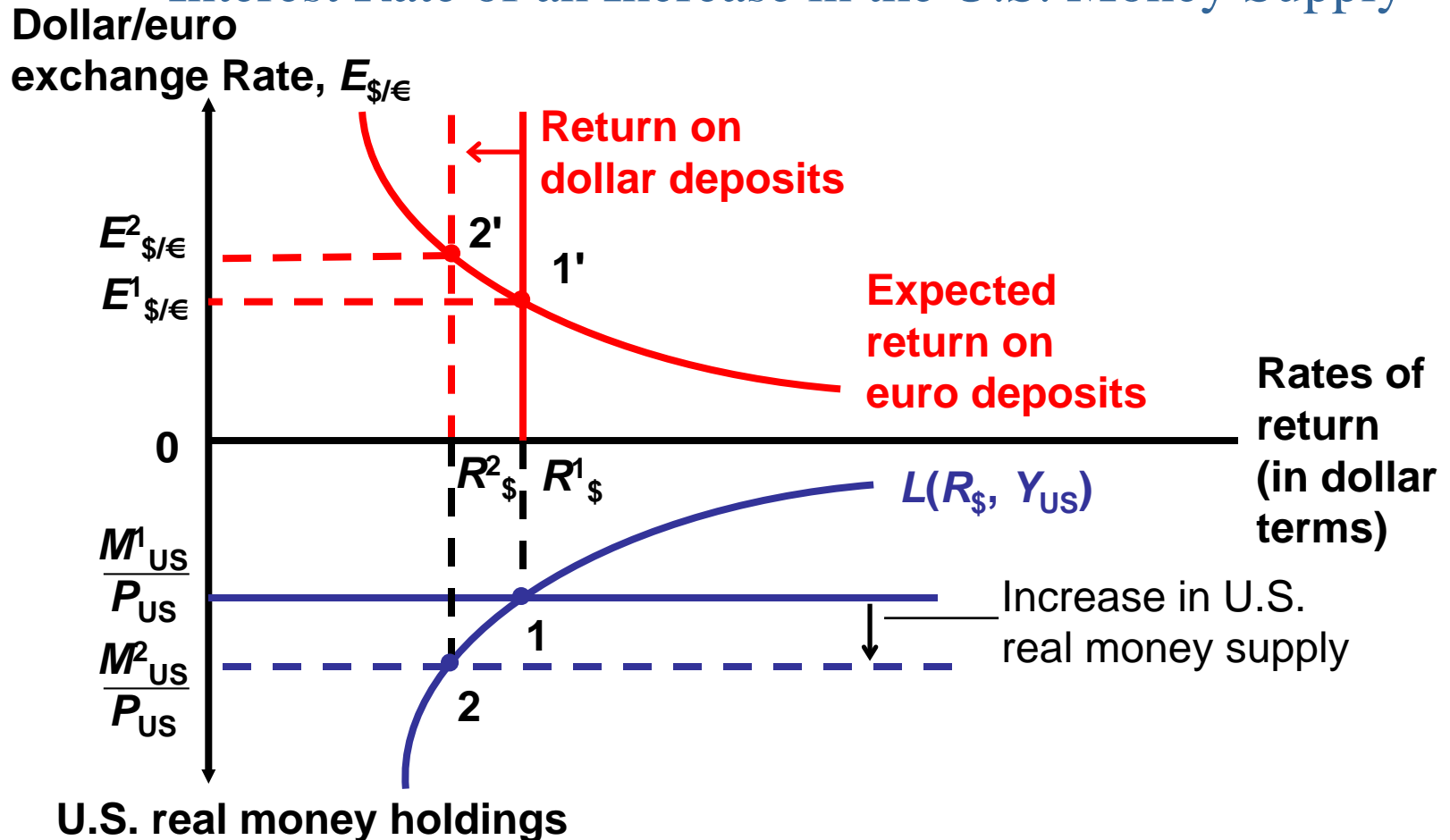
- **U.S. Money Supply and the Dollar/Euro Exchange Rate**
  - What happens when the Federal Reserve changes the U.S. money supply?
    - An increase (decrease) in a country's money supply causes its currency to depreciate (appreciate) in the foreign exchange market.

The Equilibrium Interest Rate: The Interaction of Money Supply and Demand

Figure 14-8: Effect on the Dollar/Euro Exchange Rate and Dollar Interest Rate of an Increase in the U.S. Money Supply

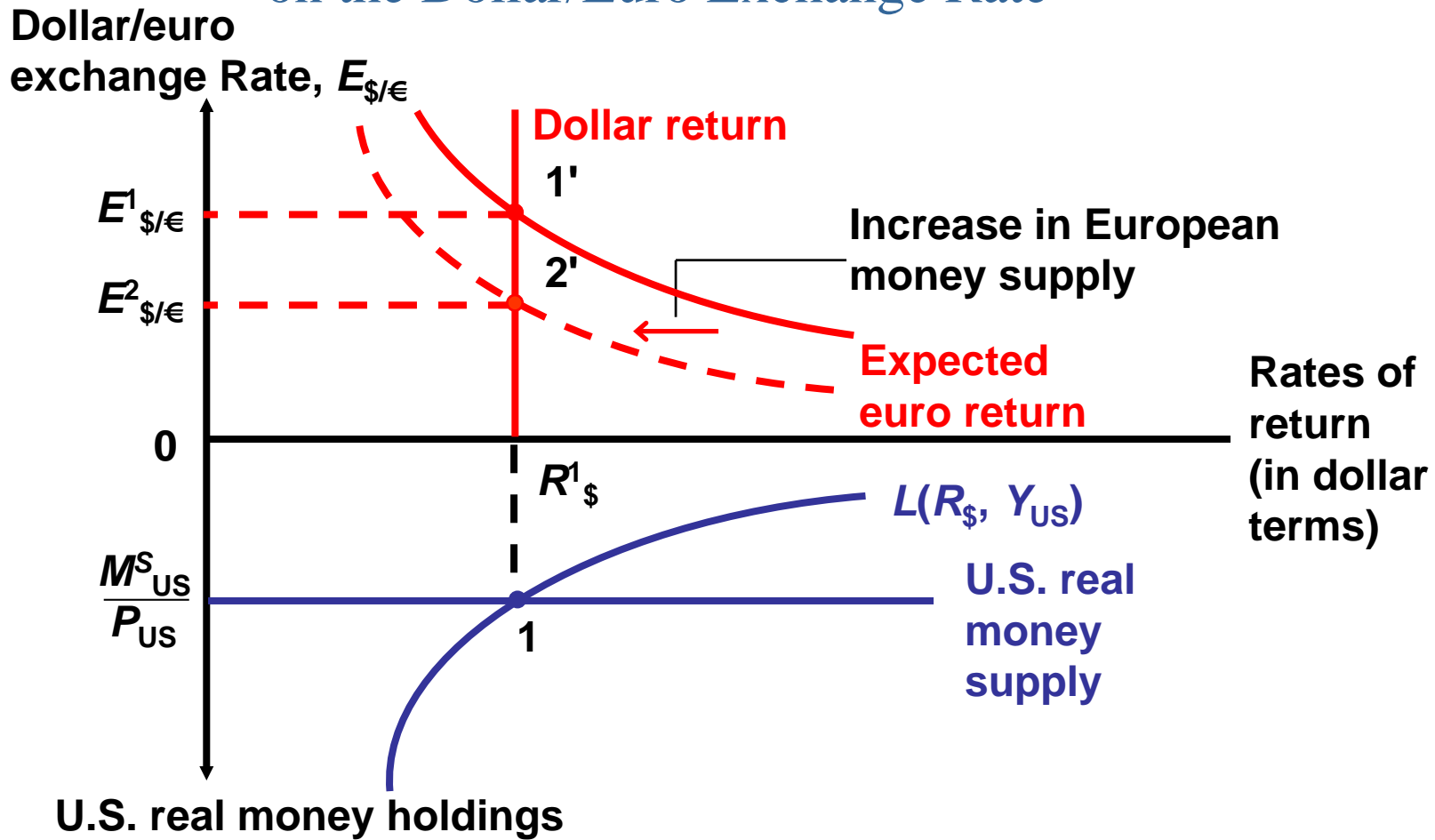# The Equilibrium Interest Rate: The Interaction of Money Supply and Demand

- Europe's Money Supply and the Dollar/Euro Exchange Rate
  - An increase in Europe's money supply causes a depreciation of the euro (i.e., appreciation of the dollar).
  - A reduction in Europe's money supply causes an appreciation of the euro (i.e., a depreciation of the dollar).
  - The change in the European money supply does not disturb the U.S. money market equilibrium.

Figure 14-9: Effect of an Increase in the European Money Supply on the Dollar/Euro Exchange Rate

Money, the Price Level, and the Exchange Rate in the Long Run

- **Long-run equilibrium**

  - Prices are perfectly flexible and always adjusted immediately to preserve full employment.

- Money and Money Prices

  - The money market equilibrium (Equation 14-4) can be rearranged to give the long-run equilibrium price level:

$$P = M^s/L(R,Y) \qquad\qquad (14\text{-}5)$$

  - An increase in a country's money supply causes a proportional increase in its price level.

Money, the Price Level, and the Exchange Rate in the Long Run

- ■ **The Long-Run Effects of Money Supply Changes**
  - A change in the supply of money has no effect on the long-run values of the interest rate or real output.
  - A permanent increase in the money supply causes a proportional increase in the price level's long-run value.
    - – This prediction is based on the money market equilibrium condition: $M^s/P = L$ or $P = M^s/L$.
    - – This condition implies that $\Delta P/P = \Delta M^s/M^s - \Delta L/L$.
      - – The inflation rate equals the monetary growth rate less the growth rate for money demand.

Money, the Price Level, and the Exchange Rate in the Long Run

- **Empirical Evidence on Money Supplies and Price Levels**
  - In a cross-section of countries, long-term changes in money supplies and price levels show a clear positive correlation.
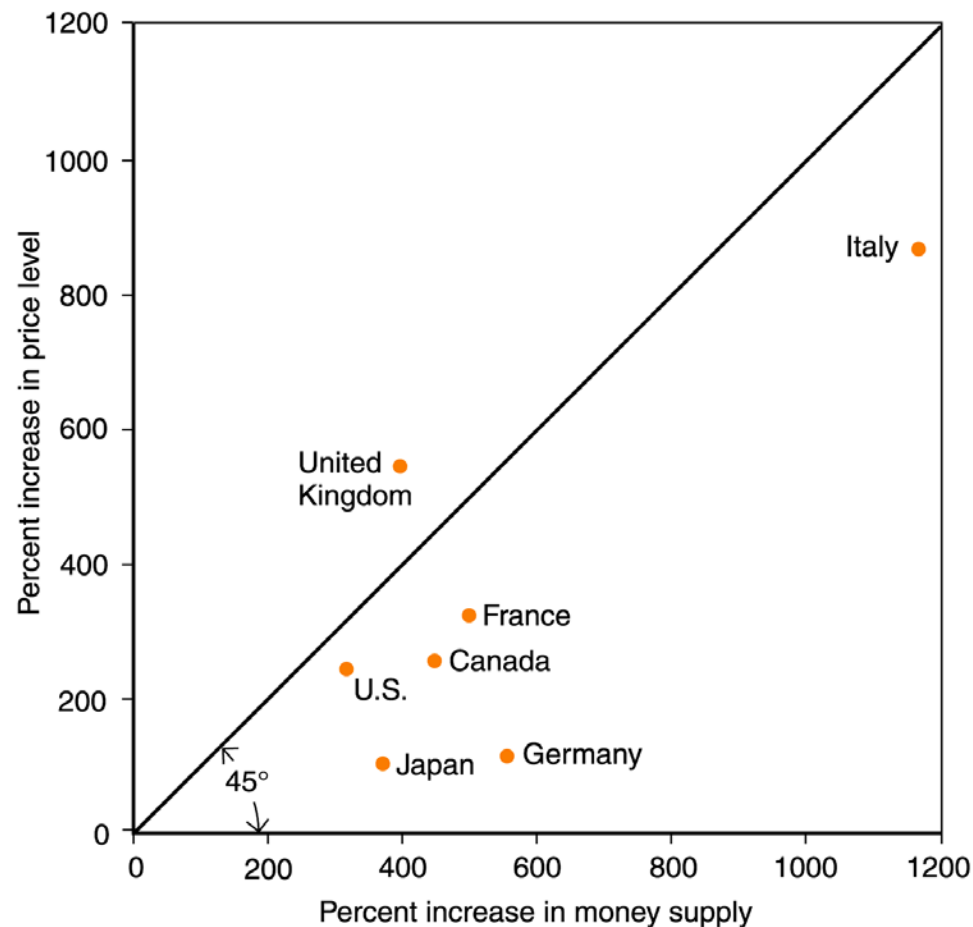
Money, the Price Level, and the Exchange Rate in the Long Run

Figure 14-10: Monetary Growth and Price-Level Change in the Seven Main Industrial Countries, 1973-1997

In a cross-section of countries, long-term changes in money supplies and price levels show a clear positive correlation. (The diagonal line indicates exactly proportional changes in money supplies and price levels.)

Source: OECD, *Main Economic Indicators,* and IMF, *International Financial Statistics.*

Money, the Price Level, and the Exchange Rate in the Long Run

- Money and the Exchange Rate in the Long Run
  - A permanent increase (decrease) in a country's money supply causes a proportional long-run depreciation (appreciation) of its currency against foreign currencies.

Inflation and Exchange Rate Dynamics

- **Inflation**
  - A situation where an economy's price level rises.
- **Deflation**
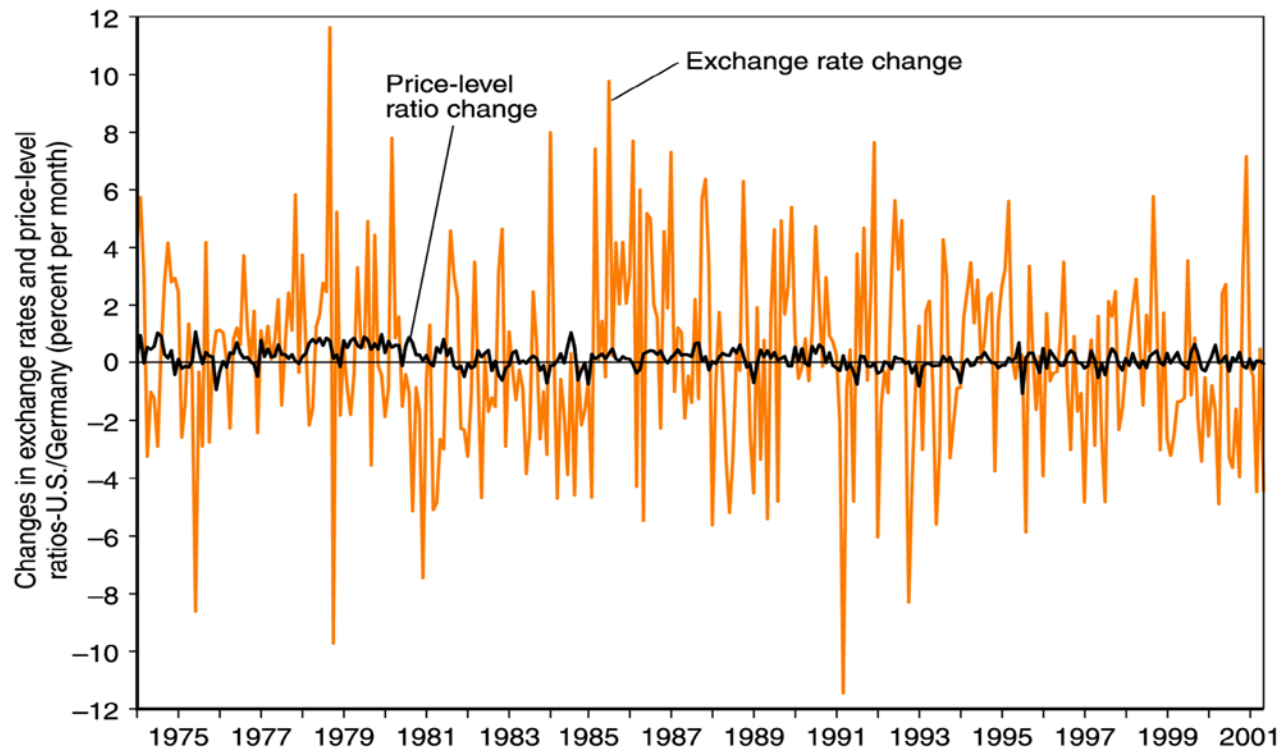 - A situation where an economy's price level falls.
- Short-Run Price Rigidity versus Long-Run Price Flexibility
  - The short-run "stickiness" of price levels is illustrated in Figure 14-11.

Inflation and Exchange Rate Dynamics

Figure 14-11: Month-to-Month Variability of the Dollar/DM Exchange Rate and of the U.S./German Price-Level Ratio, 1974-2001

The much greater month-to-month variability of the exchange rate suggests that price levels are relatively sticky in the short run.

Source: OECD, *Main Economic Indicators*.

Inflation and Exchange Rate Dynamics

- A change in the money supply creates demand and cost pressures that lead to future increases in the price level from three main sources:
    - Excess demand for output and labor
    - Inflationary expectations
    - Raw materials prices
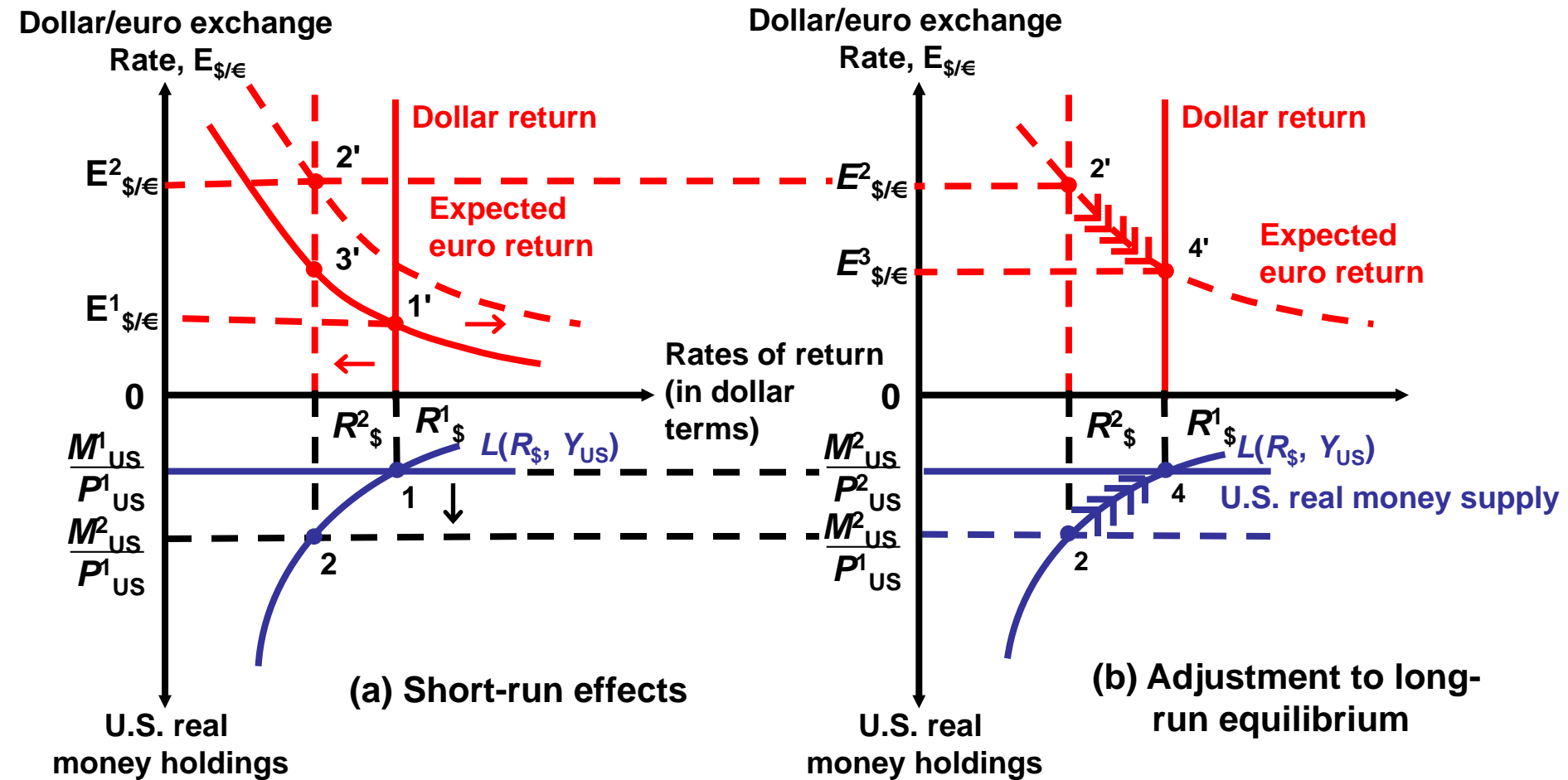
Inflation and Exchange Rate Dynamics

- **Permanent Money Supply Changes and the Exchange Rate**
  - How does the dollar/euro exchange rate adjust to a permanent increase in the U.S. money supply?
    - Figure 14-12 shows both the short-run and long-run effects of the increase in the U.S. money supply.
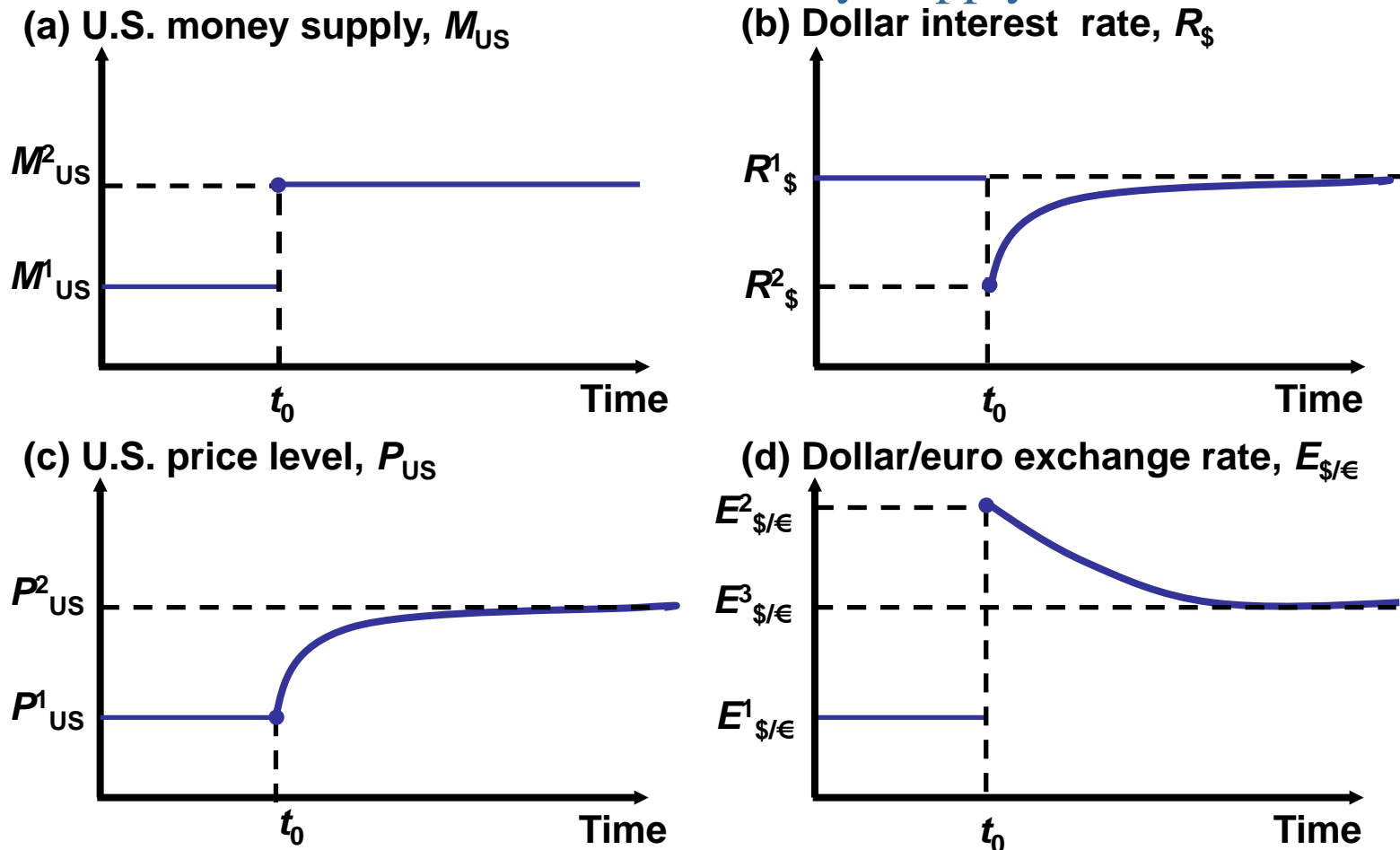
Inflation and Exchange Rate Dynamics

Figure 14-12: Effects of an Increase in the U.S.Money Supply

(a) Short-run effects

(b) Adjustment to long-run equilibrium

Inflation and Exchange Rate Dynamics

Figure 14-13: Time Paths of U.S. Economic Variables After a Permanent Increase in the U.S. Money Supply

(a) U.S. money supply, M_{US}

(b) Dollar interest rate, $R_\$$

(c) U.S. price level, P_{US}

(d) Dollar/euro exchange rate, $E_{\$/€}$

Inflation and Exchange Rate Dynamics

- **Exchange Rate Overshooting**
  - The exchange rate is said to overshoot when its immediate response to a disturbance is greater than its long-run response.
  - It helps explain why exchange rates move so sharply form day to day.
  - It is a direct result of sluggish short-run price level adjustment and the interest parity condition.

Summary

- Money is held because of its liquidity.

- Aggregate real money demand depends negatively on the opportunity cost of holding money and positively on the volume of transactions in the economy.

- The money market is in equilibrium when the real money supply equals aggregate real money demand.

- By lowering the domestic interest rate, an increase in the money supply causes the domestic currency to depreciate in the foreign exchange market.

Summary

- Permanent changes in the money supply push the long-run equilibrium price level proportionally in the same direction.
  - These changes do not influence the long-run values of output, the interest rate, or any relative prices.
- An increase in the money supply can cause the exchange rate to overshoot its long-run level in the short run.

Price Levels and the Exchange Rate in the Long Run
Chapter 15

Prepared by **Iordanis Petsas**

To Accompany

International Economics: Theory and Policy, Sixth Edition
by **Paul R. Krugman and Maurice Obstfeld**

Chapter Organization

- Introduction
- The Law of One Price
- Purchasing Power Parity
- A Long-Run Exchange Rate Model Based on PPP
- Empirical Evidence on PPP and the Law of One Price
- Explaining the Problems with PPP

Chapter Organization

- Beyond Purchasing Power Parity: A General Model of Long-Run Exchange Rates
- International Interest Rate Differences and the Real Exchange Rate
- Real Interest Parity
- Summary
- Appendix: The Fisher Effect, the Interest Rate, and the Exchange Rate Under the Flexible-Price Monetary Approach

Introduction

- The model of long-run exchange rate behavior provides the framework that actors in asset markets use to forecast future exchange rates.

- Predictions about long-run movements in exchange rates are important even in the short run.

- In the long run, national price levels play a key role in determining both interest rates and the relative prices at which countries' products are traded.

  - The theory of **purchasing power parity (PPP)** explains movements in the exchange rate between two countries' currencies by changes in the countries' price levels.

The Law of One Price

- **Law of one price**
  - Identical goods sold in different countries must sell for the same price when their prices are expressed in terms of the same currency.
    - This law applies only in competitive markets free of transport costs and official barriers to trade.
      - Example: If the dollar/pound exchange rate is $1.50 per pound, a sweater that sells for $45 in New York must sell for £30 in London.

The Law of One Price

– It implies that the dollar price of good i is the same wherever it is sold:

$$P^i_{US} = (E_{\$/€}) \times (P^i_E)$$

where:

P^i_{US} is the dollar price of good i when sold in the U.S.

P^i_E is the corresponding euro price in Europe

$E_{\$/€}$ is the dollar/euro exchange rate

Purchasing Power Parity

- Theory of Purchasing Power Parity (PPP)
  - The exchange rate between two counties' currencies equals the ratio of the counties' price levels.
  - It compares average prices across countries.
  - It predicts a dollar/euro exchange rate of:

$$E_{\$/€} = P_{US}/P_E \qquad (15\text{-}1)$$

  where:

  P_{US} is the dollar price of a reference commodity basket sold in the United States

  P_E is the euro price of the same basket in Europe

Purchasing Power Parity

- By rearranging Equation (15-1), one can obtain:

$$P_{\text{US}} = (E_{\$/\euro}) \times (P_{\text{E}})$$

- PPP asserts that all countries' price levels are equal when measured in terms of the same currency.

Purchasing Power Parity

- **The Relationship Between PPP and the Law of One Price**

    - The law of one price applies to individual commodities, while PPP applies to the general price level.

    - If the law of one price holds true for every commodity, PPP must hold automatically for the same reference baskets across countries.

    - Proponents of the PPP theory argue that its validity does not require the law of one price to hold exactly.

Purchasing Power Parity

- Absolute PPP and Relative PPP
  - **Absolute PPP**
    - It states that exchange rates equal relative price levels.
  - **Relative PPP**
    - It states that the percentage change in the exchange rate between two currencies over any period equals the difference between the percentage changes in national price levels.
    - Relative PPP between the United States and Europe would be:

$$(E_{\$/€,t} - E_{\$/€,\,t-1})/E_{\$/€,\,t-1} = \pi_{US,\,t} - \pi_{E,\,t} \qquad (15\text{-}2)$$

    where:

$$\pi_t = \text{inflation rate}$$

A Long-Run Exchange Rate Model Based on PPP

- **Monetary approach to the exchange rate**
  - A theory of how exchange rates and monetary factors interact in the long run.

- The Fundamental Equation of the Monetary Approach
  - Price levels can be expressed in terms of domestic money demand and supplies:
    - In the United States:
    $$P_{US} = M^s_{US}/L\,(R_\$, Y_{US}) \qquad (15\text{-}3)$$
    - In Europe:
    $$P_E = M^s_E/L\,(R_\mathrm{\epsilon}, Y_E) \qquad (15\text{-}4)$$

A Long-Run Exchange Rate Model Based on PPP

- The monetary approach makes a number of specific predictions about the long-run effects on the exchange rate of changes in:
    - Money supplies
        - An increase in the U.S. (European) money supply causes a proportional long-run depreciation (appreciation) of the dollar against the euro.
    - Interest rates
        - A rise in the interest rate on dollar (euro) denominated assets causes a depreciation (appreciation) of the dollar against the euro.
    - Output levels
        - A rise in U.S. (European) output causes an appreciation (depreciation) of the dollar against the euro.

A Long-Run Exchange Rate Model Based on PPP

- **Ongoing Inflation, Interest Parity, and PPP**
  - Money supply growth at a constant rate eventually results in ongoing inflation (i.e., continuing rise in the price level) at the same rate.
    - Changes in this long-run inflation rate do not affect the full-employment output level or the long-run relative prices of goods and services.
  - The interest rate is not independent of the money supply growth rate in the long run.

A Long-Run Exchange Rate Model Based on PPP

- The international interest rate difference is the difference between expected national inflation rates:

$$R_\$ - R_{\mbox{€}} = \pi^e_{US} - \pi^e \qquad (15\text{-}5)$$

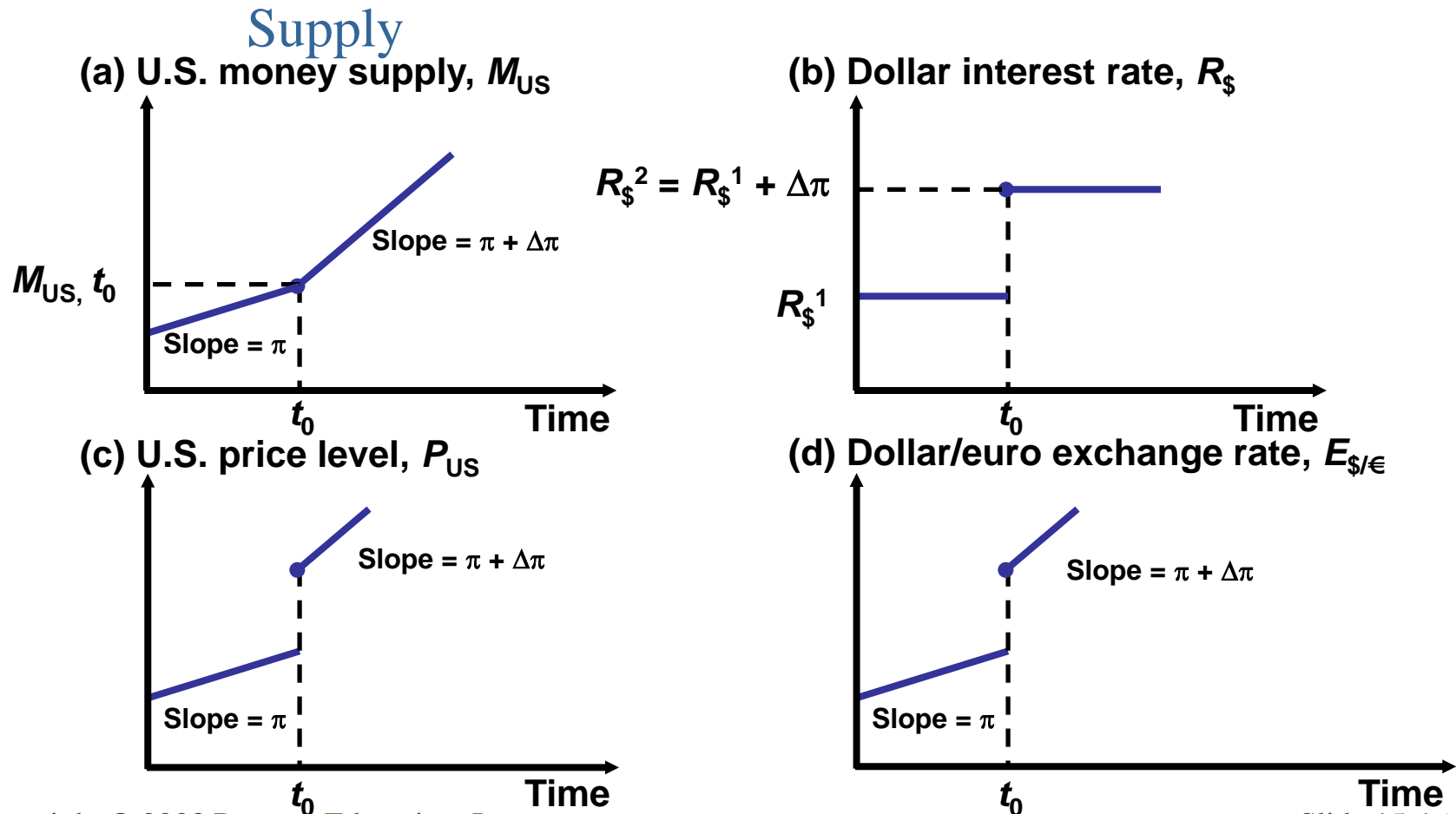# A Long-Run Exchange Rate Model Based on PPP

- ■ The Fisher Effect

  - • A rise (fall) in a country's expected inflation rate will eventually cause an equal rise (fall) in the interest rate that deposits of its currency offer.

    - – Figure 15-1 illustrates an example, where at time t_0 the Federal Reserve unexpectedly increases the growth rate of the U.S. money supply to a higher level.

A Long-Run Exchange Rate Model Based on PPP

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

(a) U.S. money supply, M_{US}

Slope = $\pi + \Delta\pi$

M_{US, t_0}

Slope = π

t_0 Time

(b) Dollar interest rate, $R_\$$

$R_\$^2 = R_\$^1 + \Delta\pi$

$R_\$^1$

t_0 Time

(c) U.S. price level, P_{US}

Slope = $\pi + \Delta\pi$

Slope = π

t_0 Time

(d) Dollar/euro exchange rate, $E_{\$/€}$

Slope = $\pi + \Delta\pi$

Slope = π

t_0 Time
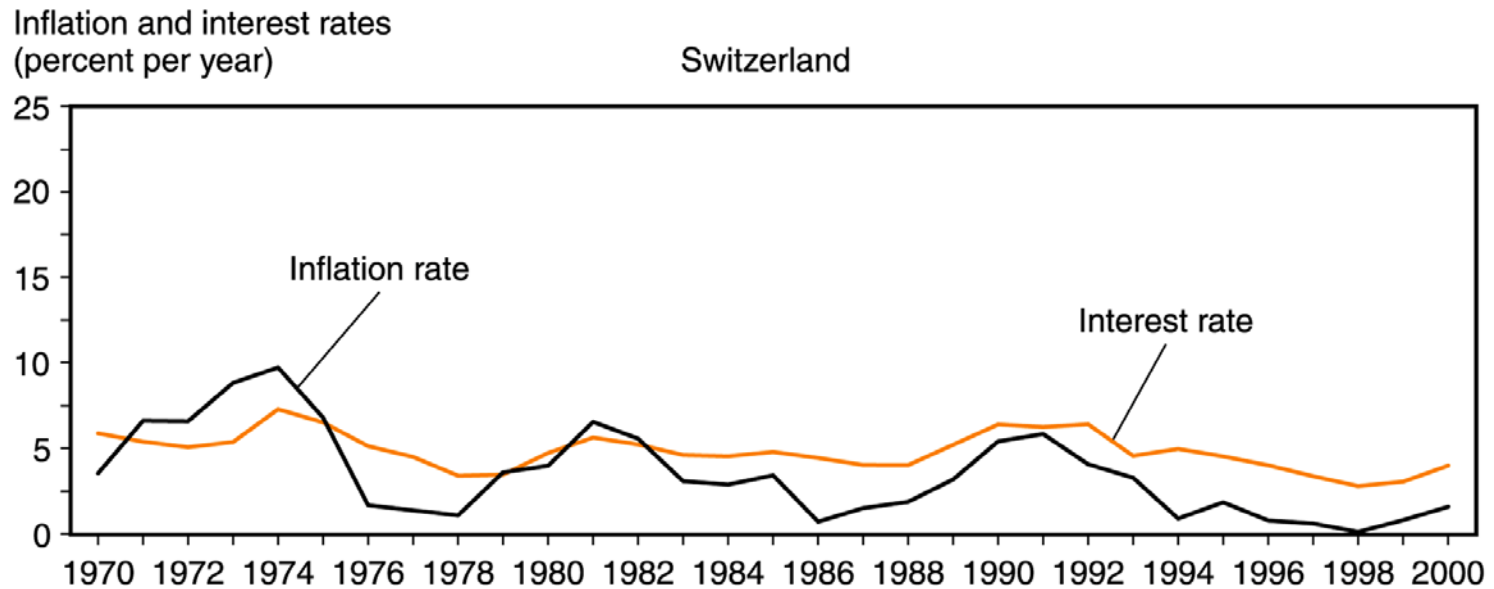
A Long-Run Exchange Rate Model Based on PPP

- In this example, the dollar interest rate rises because people expect more rapid future money supply growth and dollar depreciation.

- The interest rate increase is associated with higher expected inflation and an immediate currency depreciation.

- Figure 15-2 confirms the main long-run prediction of the Fisher effect.

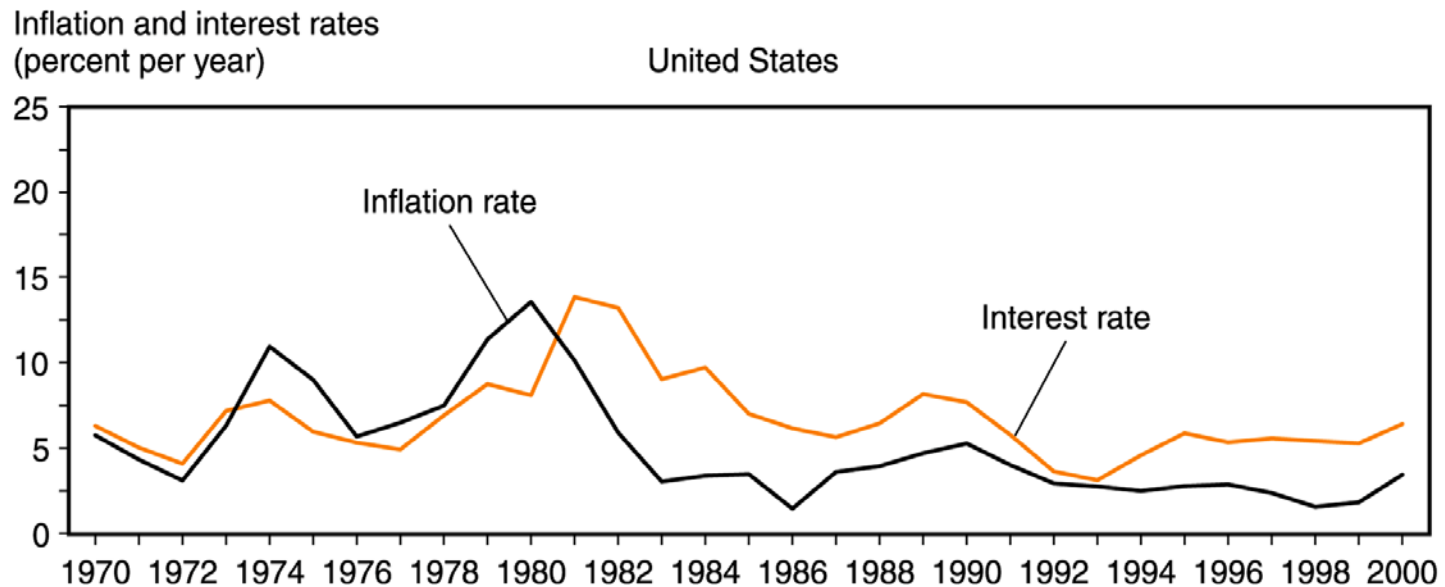# A Long-Run Exchange Rate Model Based on PPP

Figure 15-2: Inflation and Interest Rates in Switzerland, the United States, and Italy, 1970-2000

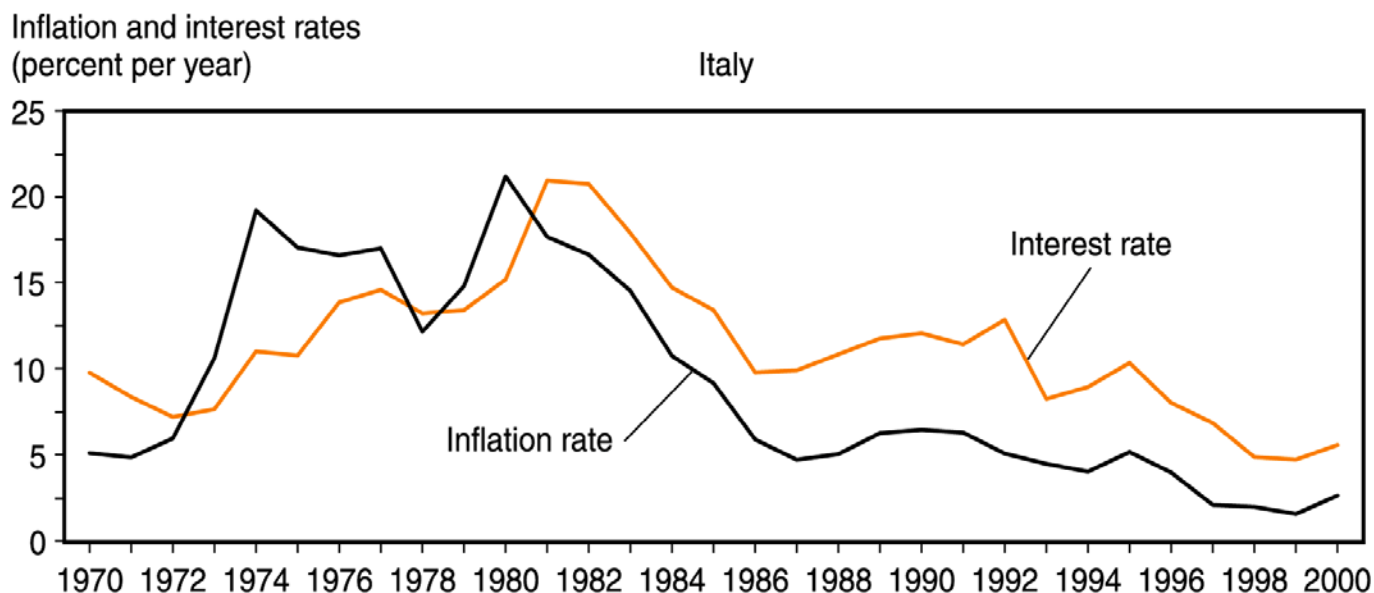# A Long-Run Exchange Rate Model Based on PPP

Figure 15-2: Continued

A Long-Run Exchange Rate Model Based on PPP

Figure 15-2: Continued

Inflation and interest rates show a long-run tendency to move together, as the Fisher effect suggests.

Source: OECD, *Main Economic Indicators.*
Inflation rates are year-to-year percentage changes in consumer price indexes.

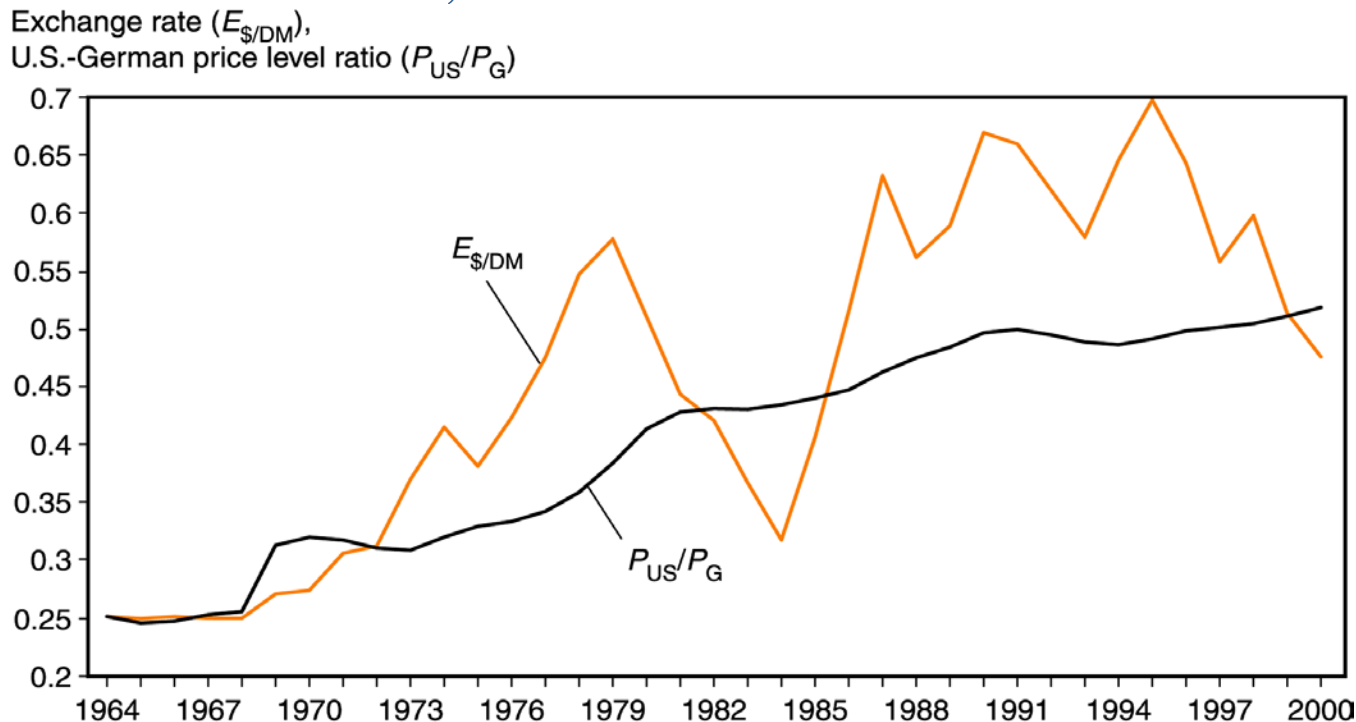# Empirical Evidence on PPP and the Law of One Price

- The empirical support for PPP and the law of one price is weak in recent data.
  - The prices of identical commodity baskets, when converted to a single currency, differ substantially across countries.
  - Relative PPP is sometimes a reasonable approximation to the data, but it performs poorly.

Empirical Evidence on PPP and the Law of One Price

Figure 15-3: The Dollar/DM Exchange Rate and Relative U.S./German Price Levels, 1964-2000

Exchange rate ($E_{\$/DM}$),
U.S.-German price level ratio (P_{US}/P_G)

The graph shows that relative PPP did not explain the dollar/DM exchange rate after 1970.

Source: OECD, *Main Economic Indicators*. Exchange rates and price levels are end-of-year data.

Explaining the Problems with PPP

- The failure of the empirical evidence to support the PPP and the law of one price is related to:
  - Trade barriers and nontradables
  - Departures from free competition
  - International differences in price level measurement

Explaining the Problems with PPP

- **Trade Barriers and Nontradables**
  - Transport costs and governmental trade restrictions make trade expensive and in some cases create nontradable goods.
    - The greater the transport costs, the greater the range over which the exchange rate can move.

Explaining the Problems with PPP

■ **Departures from Free Competition**

- When trade barriers and imperfectly competitive market structures occur together, linkages between national price levels are weakened further.

- **Pricing to market**
  - When a firm sells the same product for different prices in different markets.
  - It reflects different demand conditions in different countries.
    - Example: Countries where demand is more price-inelastic will tend to be charged higher markups over a monopolistic seller's production cost.
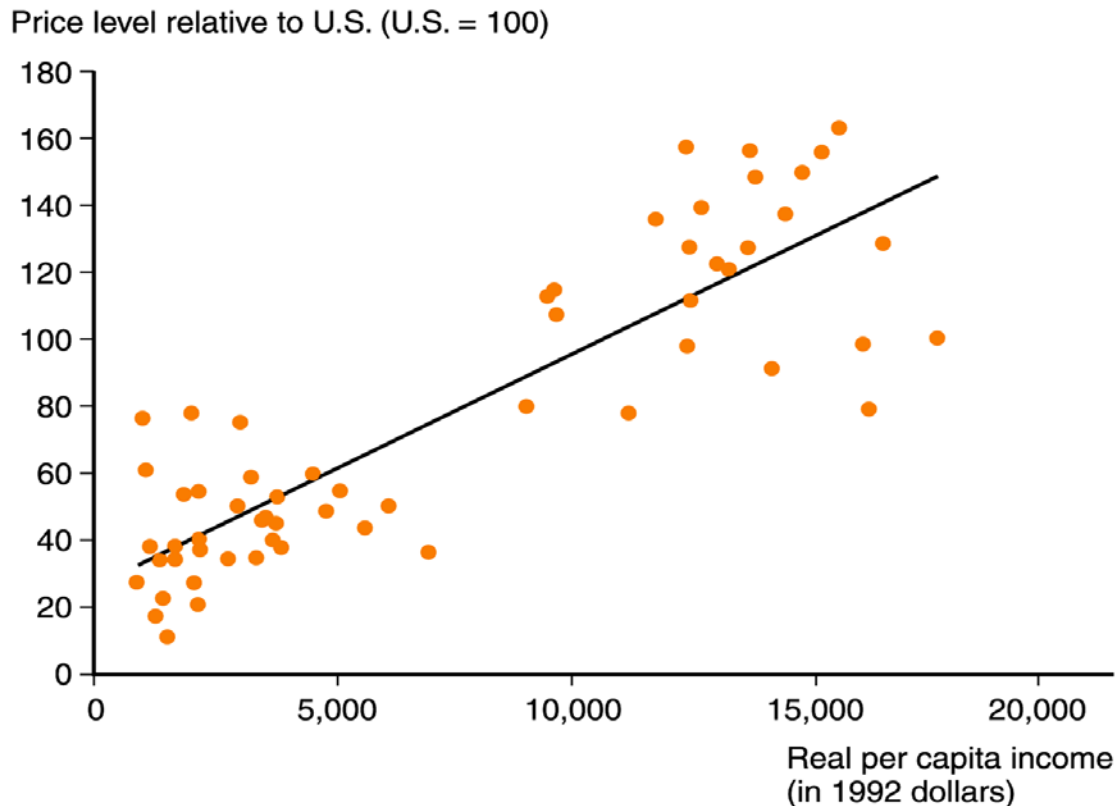
Explaining the Problems with PPP

- **International Differences in Price Level Measurement**
  - Government measures of the price level differ from country to country because people living in different counties spend their income in different ways.
- **PPP in the Short Run and in the Long Run**
  - Departures from PPP may be even greater in the short-run than in the long run.
    - Example: An abrupt depreciation of the dollar against foreign currencies causes the price of farm equipment in the U.S. to differ from that of foreign's until markets adjust to the exchange rate change.

Explaining the Problems with PPP

Figure 15-4: Price Levels and Real Incomes, 1992

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.

Beyond Purchasing Power Parity: A General Model of Long-Run Exchange Rates

- ■ **The Real Exchange Rate**
  - It is a broad summary measure of the prices of one country's goods and services relative to the other's.
  - It is defined in terms of **nominal exchange rates** and price levels.
  - The real dollar/euro exchange rate is the dollar price of the European basket relative to that of the American:

  $$q_{\$/\text{€}} = (E_{\$/\text{€}} \times P_E)/P_{US} \qquad (15\text{-}6)$$

    – Example: If the European reference commodity basket costs €100, the U.S. basket costs $120, and the nominal exchange rate is $1.20 per euro, then the real dollar/euro exchange rate is 1 U.S. basket per European basket.

Beyond Purchasing Power Parity: A General Model of Long-Run Exchange Rates

- **Real depreciation** of the dollar against the euro
  - A rise in the real dollar/euro exchange rate
    - That is, a fall in the purchasing power of a dollar within Europe's borders relative to its purchasing power within the United States
    - Or alternatively, a fall in the purchasing power of America's products in general over Europe's.
- A **real appreciation** of the dollar against the euro is the opposite of a real depreciation.

Beyond Purchasing Power Parity: A General Model of Long-Run Exchange Rates

- **Demand, Supply, and the Long-Run Real Exchange Rate**
  - In a world where PPP does not hold, the long-run values of real exchange rates depend on demand and supply conditions.

Beyond Purchasing Power Parity: A General Model of Long-Run Exchange Rates

- There are two specific causes that explain why the long-run values of real exchange rates can change:
  - A change in world relative demand for American products
    - An increase (fall) in world relative demand for U.S. output causes a long-run real appreciation (depreciation) of the dollar against the euro.
  - A change in relative output supply
    - A relative expansion of U.S (European) output causes a long-run real depreciation (appreciation) of the dollar against the euro.

Beyond Purchasing Power Parity: A General Model of Long-Run Exchange Rates

- ■ **Nominal and Real Exchange Rates in Long-Run Equilibrium**

  - • Changes in national money supplies and demands give rise to the proportional long-run movements in nominal exchange rates and international price level ratios predicted by the relative PPP theory.

  - • From Equation (15-6), one can obtain the nominal dollar/euro exchange rate, which is the real dollar/euro exchange rate times the U.S.-Europe price level ratio:

$$E_{\$/€} = q_{\$/€} \times (P_{US}/P_E) \qquad (15\text{-}7)$$

Beyond Purchasing Power Parity: A General Model of Long-Run Exchange Rates

- Equation (15-7) implies that for a given real dollar/euro exchange rate, changes in money demand or supply in Europe or the U.S. affect the long-run nominal dollar/euro exchange rate as in the monetary approach.

  – Changes in the long-run real exchange rate, however, also affect the long-run nominal exchange rate.

Beyond Purchasing Power Parity: A General Model of Long-Run Exchange Rates

- The most important determinants of long-run swings in nominal exchange rates (assuming that all variables start out at their long-run levels):
  - A shift in relative money supply levels
  - A shift in relative money supply growth rates
  - A change in relative output demand
  - A change in relative output supply

Beyond Purchasing Power Parity: A General Model of Long-Run Exchange Rates

- When all disturbances are monetary in nature, exchange rates obey relative PPP in the long run.
  - In the long run, a monetary disturbance affects only the general purchasing power of a currency.
    - This change in purchasing power changes equally the currency's value in terms of domestic and foreign goods.
  - When disturbances occur in output markets, the exchange rate is unlikely to obey relative PPP, even in the long run.
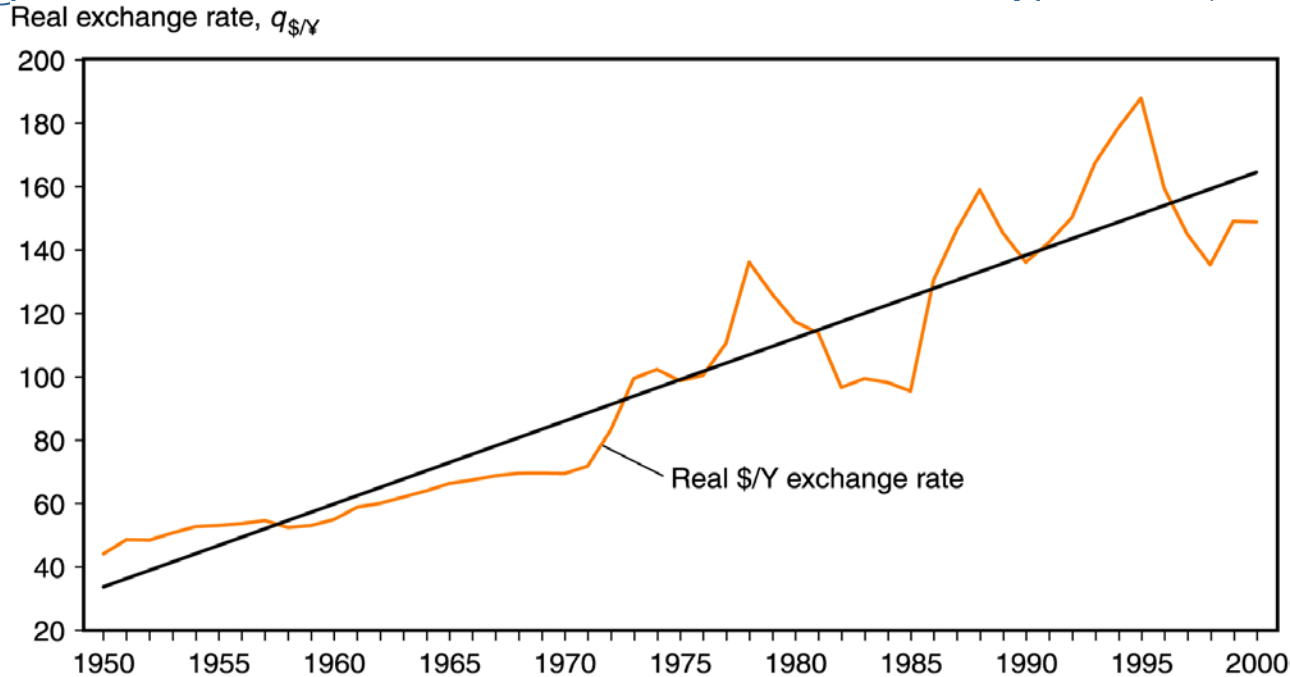
Table 15-1: Effects of Money Market and Output Market Changes on the Long-Run Nominal Dollar/Euro Exchange Rate, $E_{\$/€}$

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

Beyond Purchasing Power Parity: A General Model of Long-Run Exchange Rates

Figure 15-5: The Real Dollar/Yen Exchange Rate, 1950-2000

The U.S. dollar has steadily depreciated in real terms against Japan's yen. (The straight line indicates the average trend over time in the real exchange rate.)
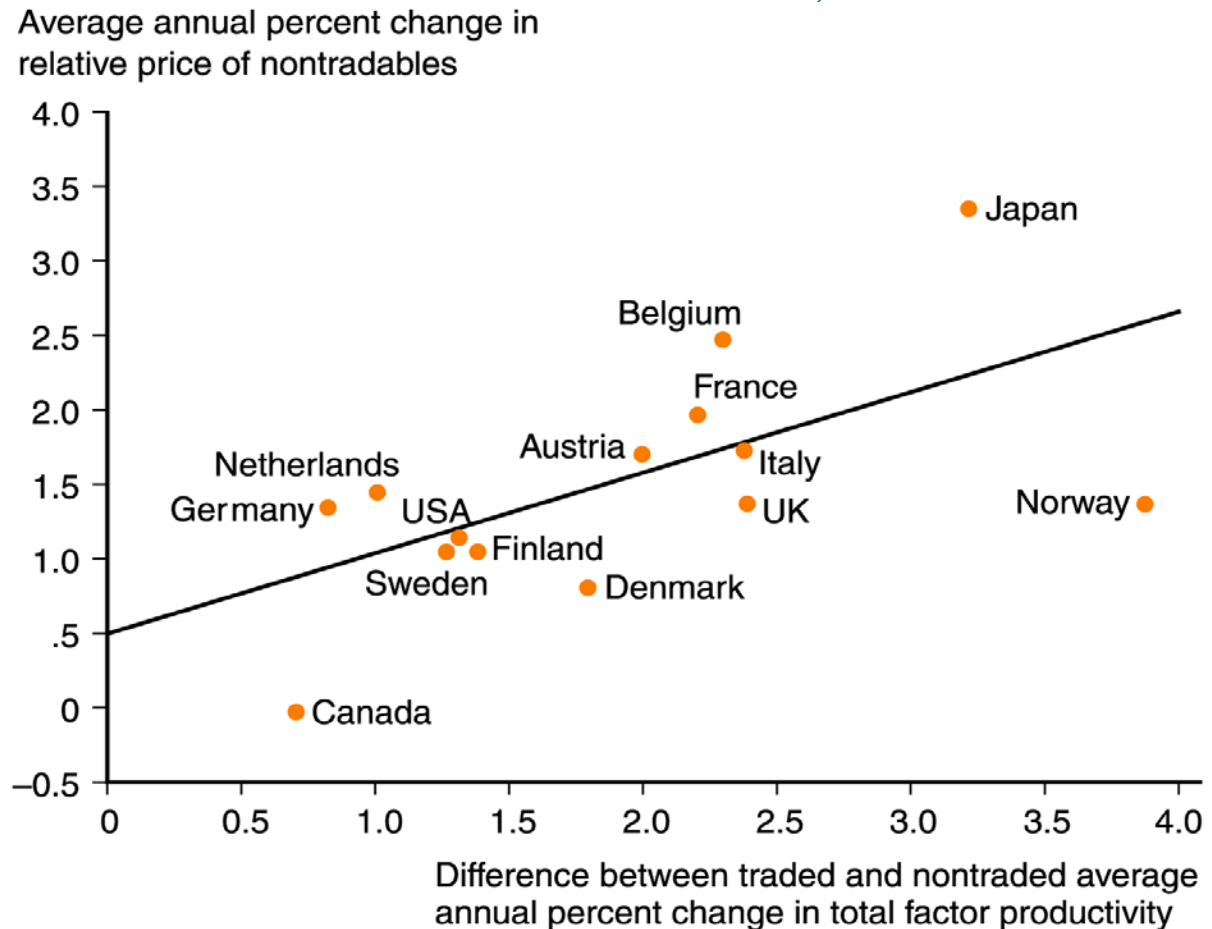
Source: Penn World Table, Mark 5.6, as described by Robert Summers and Alan Heston, "The Penn World Table (Mark 5); An Expanded Set of International Comparisons, 1950–1988." *Quarterly Journal of Economics* 106 (May 1991), pp. 327–368. Data for 1993–2000 from International Monetary Fund, *International Financial Statistics Yearbook 1997, 2001*.

Beyond Purchasing Power Parity: A General Model of Long-Run Exchange Rates

Figure 15-6: Sectoral Productivity Growth Differences and the Change in the Relative Price of Nontraded Goods, 1970-1985

A higher traded–nontraded productivity growth difference is associated with a higher rate of increase in the relative price of nontradables.

International Interest Rate Differences and the Real Exchange Rate

- In general, interest rate differences between countries depend not only on differences in expected inflation, but also on expected changes in the real exchange rate.

- Relationship between the *expected* change in the real exchange rate, the *expected* change in the nominal rate, and *expected* inflation:

$$(q^e_{\$/€} - q_{\$/€})/q_{\$/€} = [(E^e_{\$/€} - E_{\$/€})/E_{\$/€}] - (\pi^e_{US} - \pi^e_{E}) \quad (15\text{-}8)$$

International Interest Rate Differences and the Real Exchange Rate

- Combining Equation (15-8) with the interest parity condition, the international interest gap is equal to:

$$R_\$ - R_\euro = [(q^e_{\$/\euro} - q_{\$/\euro})/q_{\$/\euro}] + (\pi^e_{US} - \pi^e_E) \qquad (15\text{-}9)$$

  - Thus, the dollar-euro interest difference is the sum of two components:
    - The expected rate of real dollar depreciation against the euro
    - The expected inflation difference between the U.S. and Europe
  - When the market expects relative PPP to prevail, the dollar-euro interest difference is just the expected inflation difference between U.S. and Europe.

Real Interest Parity

- Economics makes an important distinction between two types of interest rates:
  - **Nominal interest rates**
    - Measured in monetary terms
  - **Real interest rates**
    - Measured in real terms (in terms of a country's output)
    - Referred to as expected real interest rates

Real Interest Parity

- The expected real interest rate (r^e) is the nominal interest rate (r) less the expected inflation rate (π^e).

- Thus, the difference in expected real interest rates between U.S. and Europe is equal to:

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

- By combining this equation with Equation (15-9), one can obtain the desired real interest parity condition:

$$r^e_{US} - r^e_E = (q^e_{\$/\text{€}} - q_{\$/\text{€}})/q_{\$/\text{€}} \qquad (15\text{-}10)$$

Real Interest Parity

- The real interest parity condition explains differences in expected real interest rates between two countries by expected movements in the real exchange rates.

- Expected real interest rates in different countries need not be equal, even in the long run, if continuing change in output markets is expected.

Summary

- Absolute PPP states that the purchasing power of any currency is the same in any country and implies relative PPP.

- Relative PPP predicts that percentage changes in exchange rates equal differences in national inflation rates.

- The law of one price is a building block of the PPP theory.

  - It states that under free competition and in the absence of trade impediments, a good must sell for a single price regardless of where in the world it is sold.

Summary

- The monetary approach to the exchange rate uses PPP to explain long-term exchange rate behavior exclusively in terms of money supply and demand.
  - The Fisher effect predicts that long-run international interest differentials result from different national rates of ongoing inflation.
- The empirical support for PPP and the law of one price is weak in recent data.
  - The failure of these propositions in the real world is related to trade barriers, departure from free competition and international differences in price level measurement.
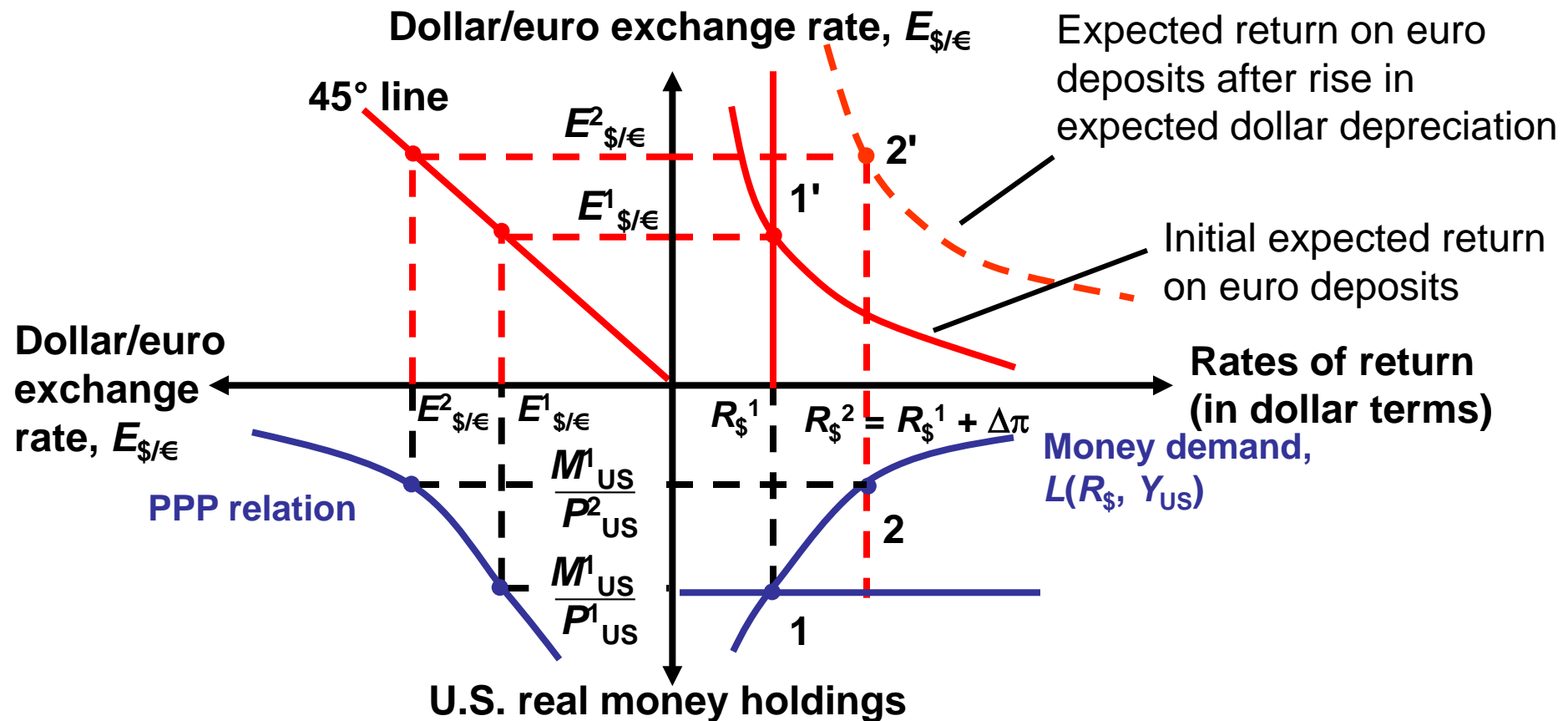
Summary

- Deviations from relative PPP can be viewed as changes in a country's real exchange rate.

- A stepwise increase in a country's money stock leads to a proportional increase in its price level and a proportional fall in its currency's foreign exchange value.

- The (real) interest parity condition equates international differences in nominal (real) interest rates to the expected percentage change in the nominal (real) exchange rate.

Figure 15A-1: How a Rise in U.S. Monetary Growth Affects When Goods Prices are Flexible

Chapter 16
Output and the Exchange Rate in the Short Run

Prepared by **Iordanis Petsas**

To Accompany

International Economics: Theory and Policy, Sixth Edition
by **Paul R. Krugman and Maurice Obstfeld**

Chapter Organization

- Determinants of Aggregate Demand in an Open Economy

- The Equation of Aggregate Demand

- How Output Is Determined in the Short Run

- Output Market Equilibrium in the Sort Run: The *DD* Schedule

- Asset Market Equilibrium in the Short Run: The *AA* Schedule

- Short-Run Equilibrium for an Open Economy: Putting the *DD* and *AA* Schedules Together

Chapter Organization

- Temporary Changes in Monetary and Fiscal Policy
- Inflation Bias and Other Problems of Policy Formulation
- Permanent Shifts in Monetary and Fiscal Policy
- Macroeconomic Policies and the Current Account
- Gradual Trade Flow Adjustment and Current Account Dynamics
- Summary

Chapter Organization

- Appendix I: The *IS-LM* Model and the *DD-AA* Model

- Appendix II: Intertemporal Trade and Consumption Demand

- Appendix III: The Marshall-Lerner Condition and Empirical Estimates of Trade Elasticities

Introduction

- Macroeconomic changes that affect exchange rates, interest rates, and price levels may also affect output.
  - This chapter introduces a new theory of how the output market adjusts to demand changes when product prices are themselves slow to adjust.
- A short-run model of the output market in an open economy will be utilized to analyze:
  - The effects of macroeconomic policy tools on output and the current account
  - The use of macroeconomic policy tools to maintain full employment

Determinants of Aggregate Demand in an Open Economy

- **Aggregate demand**
  - The amount of a country's goods and services demanded by households and firms throughout the world.

- The aggregate demand for an open economy's output consists of four components:
  - Consumption demand (C)
  - Investment demand (I)
  - Government demand (G)
  - Current account (CA)

Determinants of Aggregate Demand in an Open Economy

- **Determinants of Consumption Demand**
  - Consumption demand increases as disposable income (i.e., national income less taxes) increases at the aggregate level.
    - The increase in consumption demand is less than the increase in the disposable income because part of the income increase is saved.

Determinants of Aggregate Demand in an Open Economy

- **Determinants of the Current Account**
  - The *CA* balance is viewed as the demand for a country's exports (*EX*) less that country's own demand for imports (*IM*).
  - The *CA* balance is determined by two main factors:
    - The domestic currency's real exchange rate against foreign currency ($q = EP^*/P$)
    - Domestic disposable income (Y^d)

Determinants of Aggregate Demand in an Open Economy

- **How Real Exchange Rate Changes Affect the Current Account**
  - An increase in q raises EX and improves the domestic country's CA.
    - Each unit of domestic output now purchases fewer units of foreign output, therefore, foreign will demand more exports.
  - An increase q can raise or lower IM and has an ambiguous effect on CA.
    - IM denotes the value of imports measured in terms of domestic output.

Determinants of Aggregate Demand in an Open Economy

- There are two effects of a real exchange rate:
  - Volume effect
    - The effect of consumer spending shifts on export and import quantities
  - Value effect
    - It changes the domestic output worth of a given volume of foreign imports.
- Whether the *CA* improves or worsens depends on which effect of a real exchange rate change is dominant.
- We assume that the volume effect of a real exchange rate change always outweighs the value effect.

Determinants of Aggregate Demand in an Open Economy

- **How Disposable Income Changes Affect the Current Account**

  - An increase in disposable income (Y^d) worsens the *CA*.

  - A rise in Y^d causes domestic consumers to increase their spending on all goods.

Determinants of Aggregate Demand in an Open Economy

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, $Y^d\downarrow$	$CA\uparrow$

The Equation of Aggregate Demand

- The four components of aggregate demand are combined to get the total aggregate demand:

$$D = C(Y - T) + I + G + CA(EP^*/P, Y - T)$$

- This equation shows that aggregate demand for home output can be written as:

$$D = D(EP^*/P, Y - T, I, G)$$

The Equation of Aggregate Demand

- **The Real Exchange Rate and Aggregate Demand**
  - An increase in q raises CA and D.
    - It makes domestic goods and services cheaper relative to foreign goods and services.
    - It shifts both domestic and foreign spending from foreign goods to domestic goods.
    - A real depreciation of the home currency raises aggregate demand for home output.
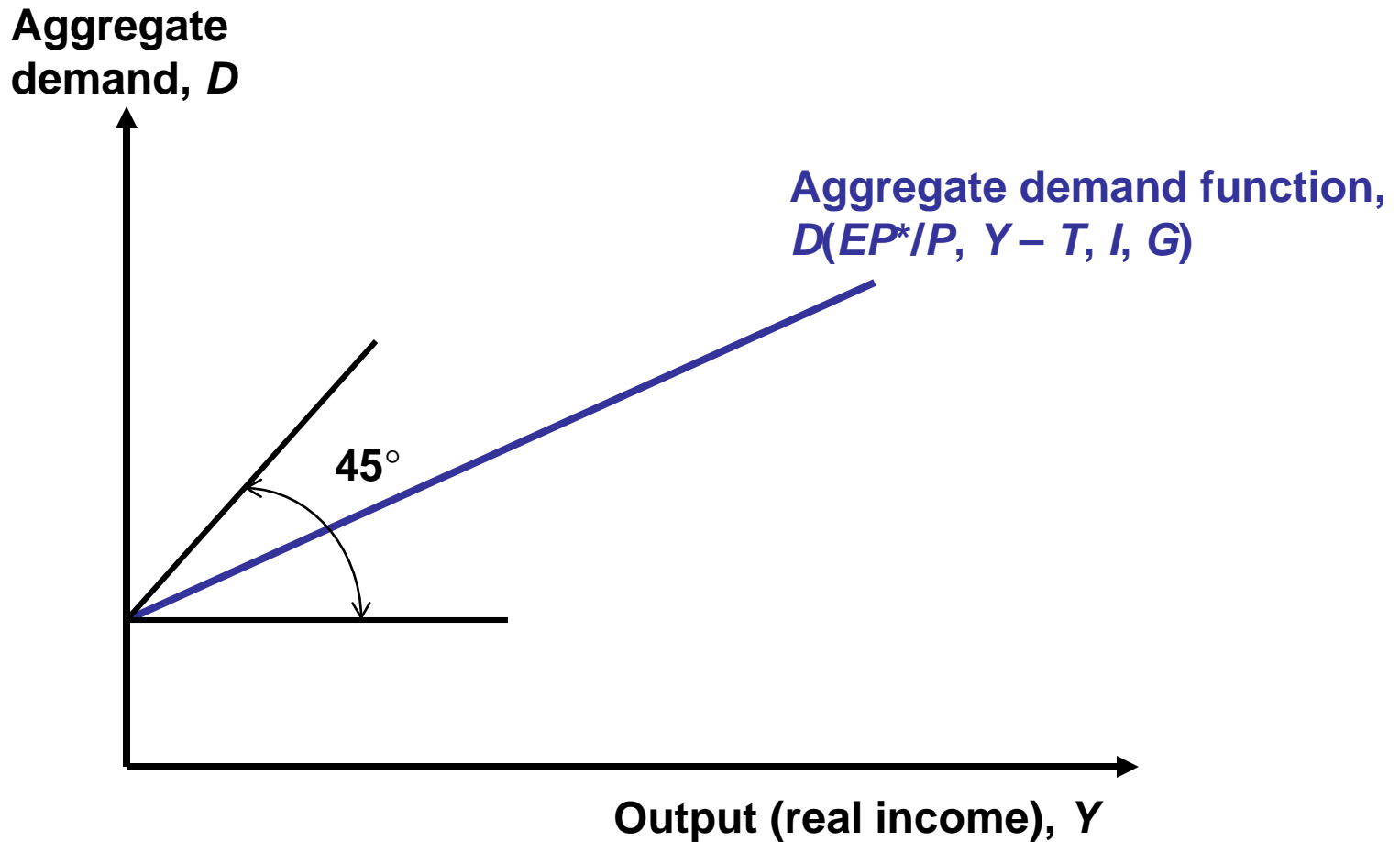   - A real appreciation lowers aggregate demand for home output.

The Equation of Aggregate Demand

■ **Real Income and Aggregate Demand**

- A rise in domestic real income raises aggregate demand for home output.

- A fall in domestic real income lowers aggregate demand for home output.

The Equation of Aggregate Demand

Figure 16-1: Aggregate Demand as a Function of Output
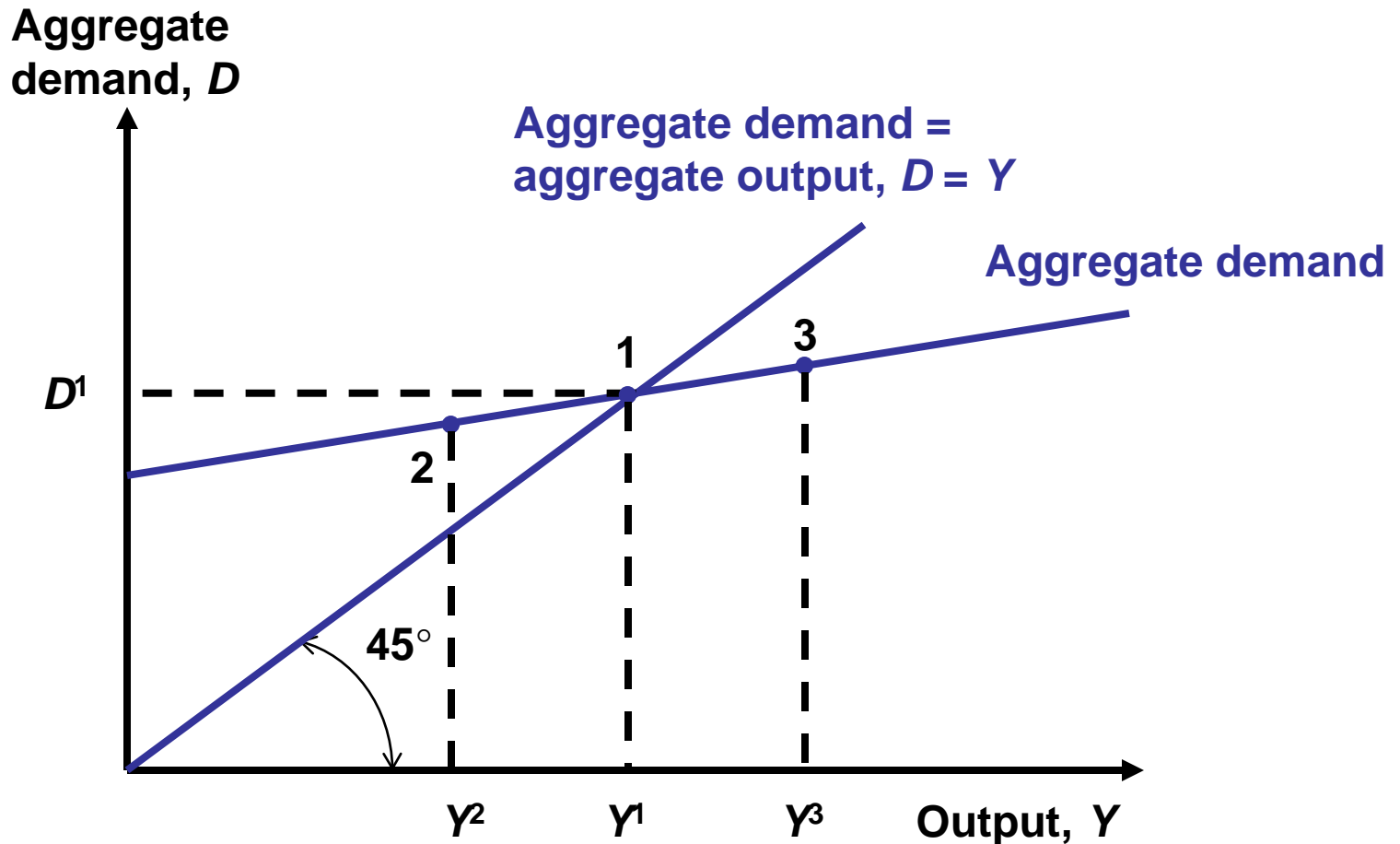
How Output Is Determined in the Short Run

- Output market is in equilibrium in the short-run when real output, Y, equals the aggregate demand for domestic output:

$$Y = D(EP^*/P, Y - T, I, G) \qquad (16\text{-}1)$$

How Output Is Determined in the Short Run

Figure 16-2: The Determination of Output in the Short Run

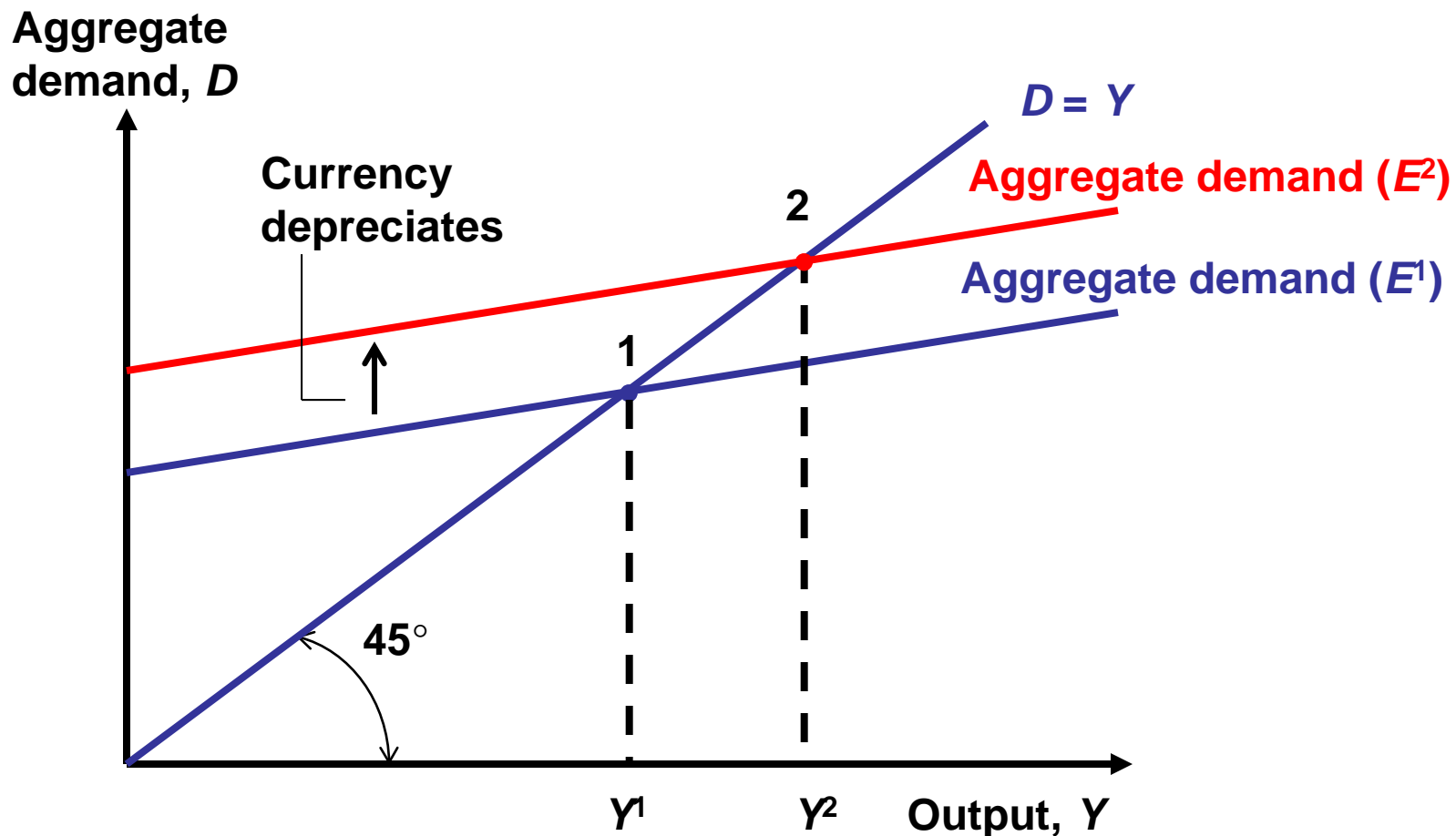# Output Market Equilibrium in the Short Run: The *DD* Schedule

■ Output, the Exchange Rate, and Output Market Equilibrium

- With fixed price levels at home and abroad, a rise in the nominal exchange rate makes foreign goods and services more expensive relative to domestic goods and services.

  – Any rise in *q* will cause an upward shift in the aggregate demand function and an expansion of output.

  – Any fall in *q* will cause output to contract.

Output Market Equilibrium in the Short Run: The *DD* Schedule

Figure 16-3: Output Effect of a Currency Depreciation with Fixed Output Prices

Output Market Equilibrium in the Short Run: The *DD* Schedule
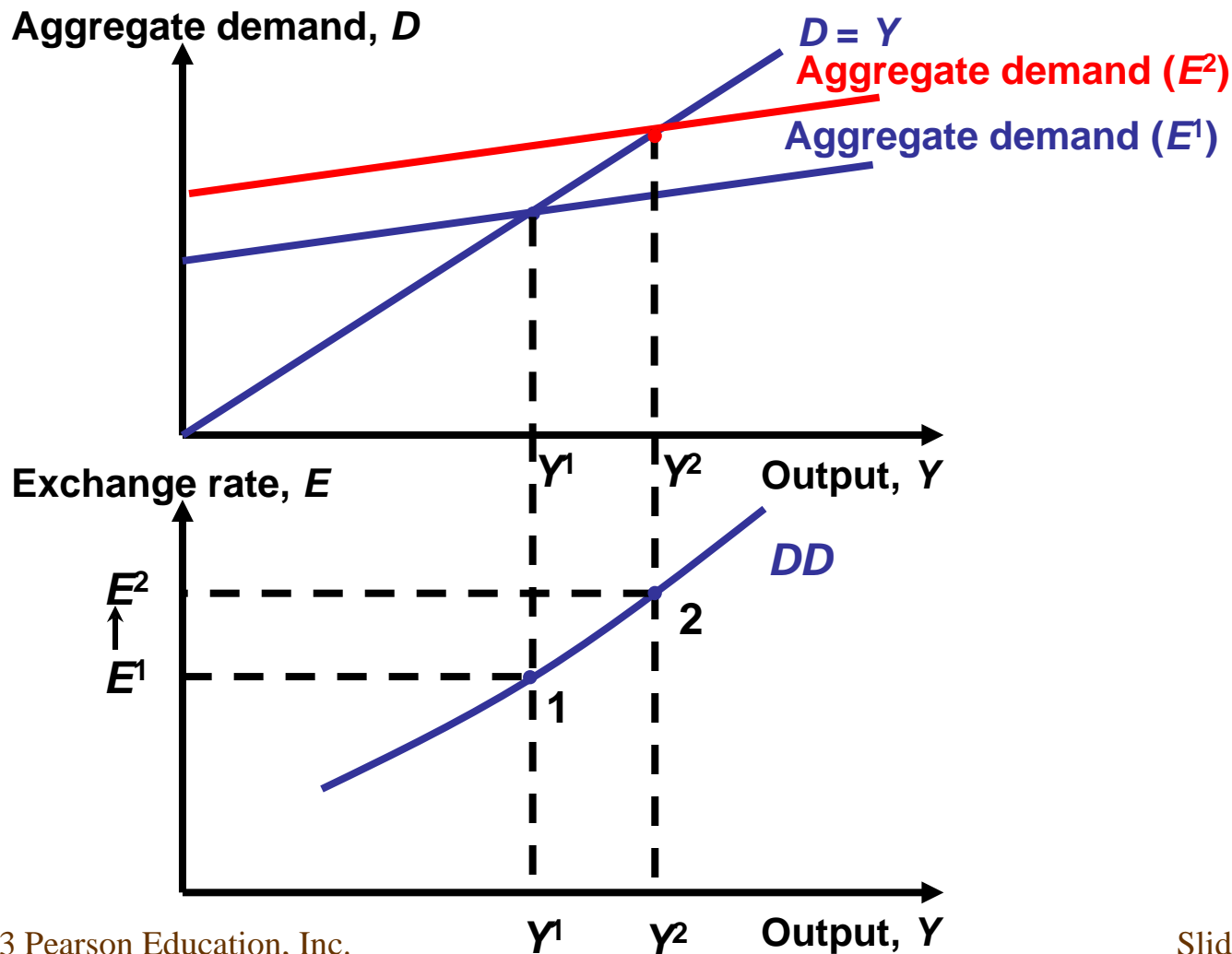
- Deriving the *DD* Schedule
  - ***DD* schedule**
    - It shows all combinations of output and the exchange rate for which the output market is in short-run equilibrium (aggregate demand = aggregate output).
    - It slopes upward because a rise in the exchange rate causes output to rise.

Output Market Equilibrium in the Short Run: The *DD* Schedule

Figure 16-4: Deriving the *DD* Schedule

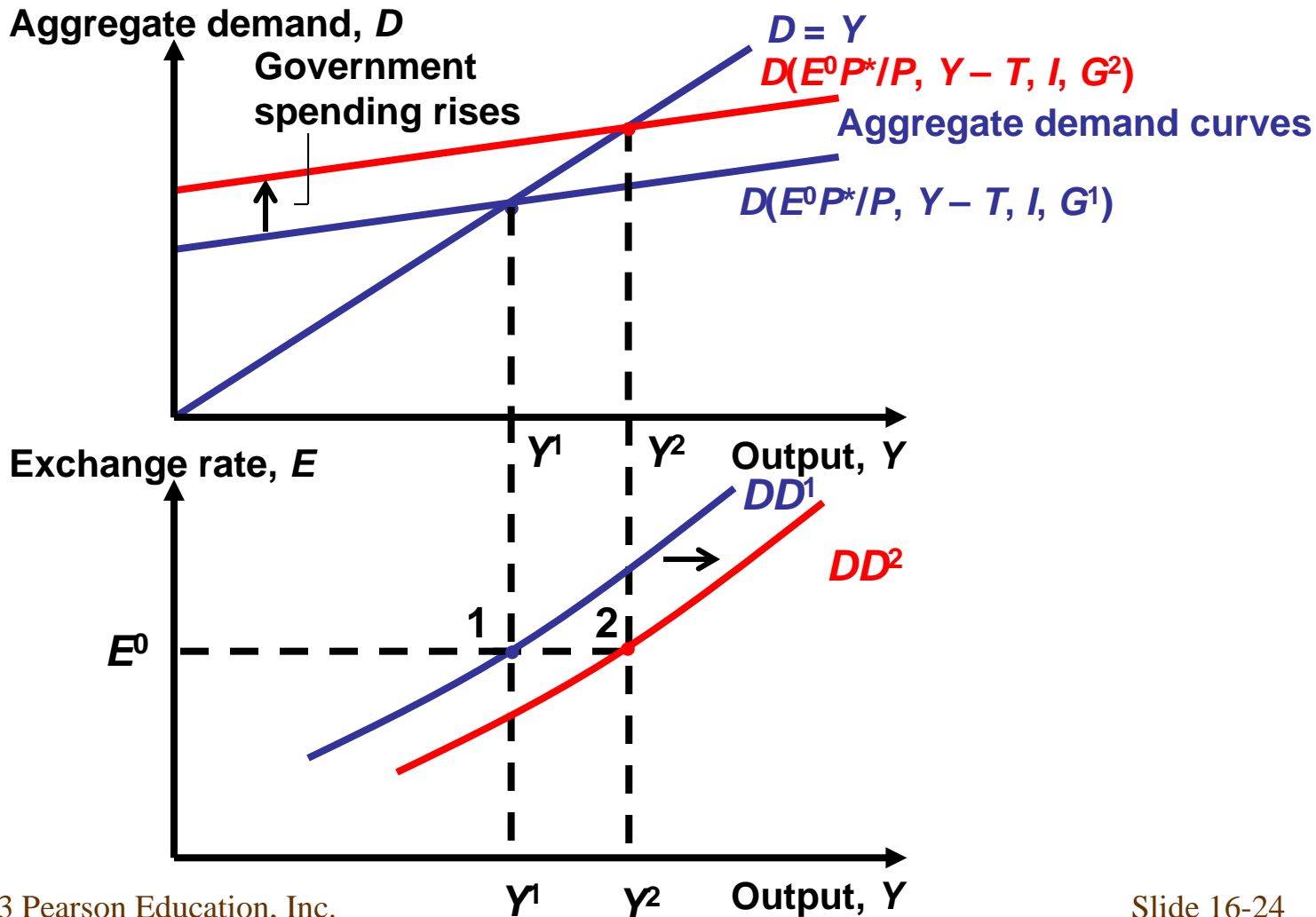# Output Market Equilibrium in the Short Run: The *DD* Schedule

- **Factors that Shift the *DD* Schedule**
  - Government purchases
  - Taxes
  - Investment
  - Domestic price levels
  - Foreign price levels
  - Domestic consumption
  - Demand shift between foreign and domestic goods
- A disturbance that raises (lowers) aggregate demand for domestic output shifts the *DD* schedule to the right (left).

Output Market Equilibrium in the Short Run: The *DD* Schedule

Figure 16-5: Government Demand and the Position of the *DD* Schedule

Asset Market Equilibrium in the Short Run: The *AA* Schedule

- ## *AA* **Schedule**
  - It shows all combinations of exchange rate and output that are consistent with equilibrium in the domestic money market and the foreign exchange market.

Asset Market Equilibrium in the Short Run: The *AA* Schedule

- **Output, the Exchange Rate, and Asset Market Equilibrium**
    - We will combine the interest parity condition with the money market to derive the asset market equilibrium in the short-run.
    - The interest parity condition describing foreign exchange market equilibrium is:

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

where: E^e is the expected future exchange rate

R is the interest rate on domestic currency deposits

R^* is the interest rate on foreign currency deposits

Asset Market Equilibrium in the Short Run: The *AA* Schedule

- The *R* satisfying the interest parity condition must also equate the real domestic money supply to aggregate real money demand:
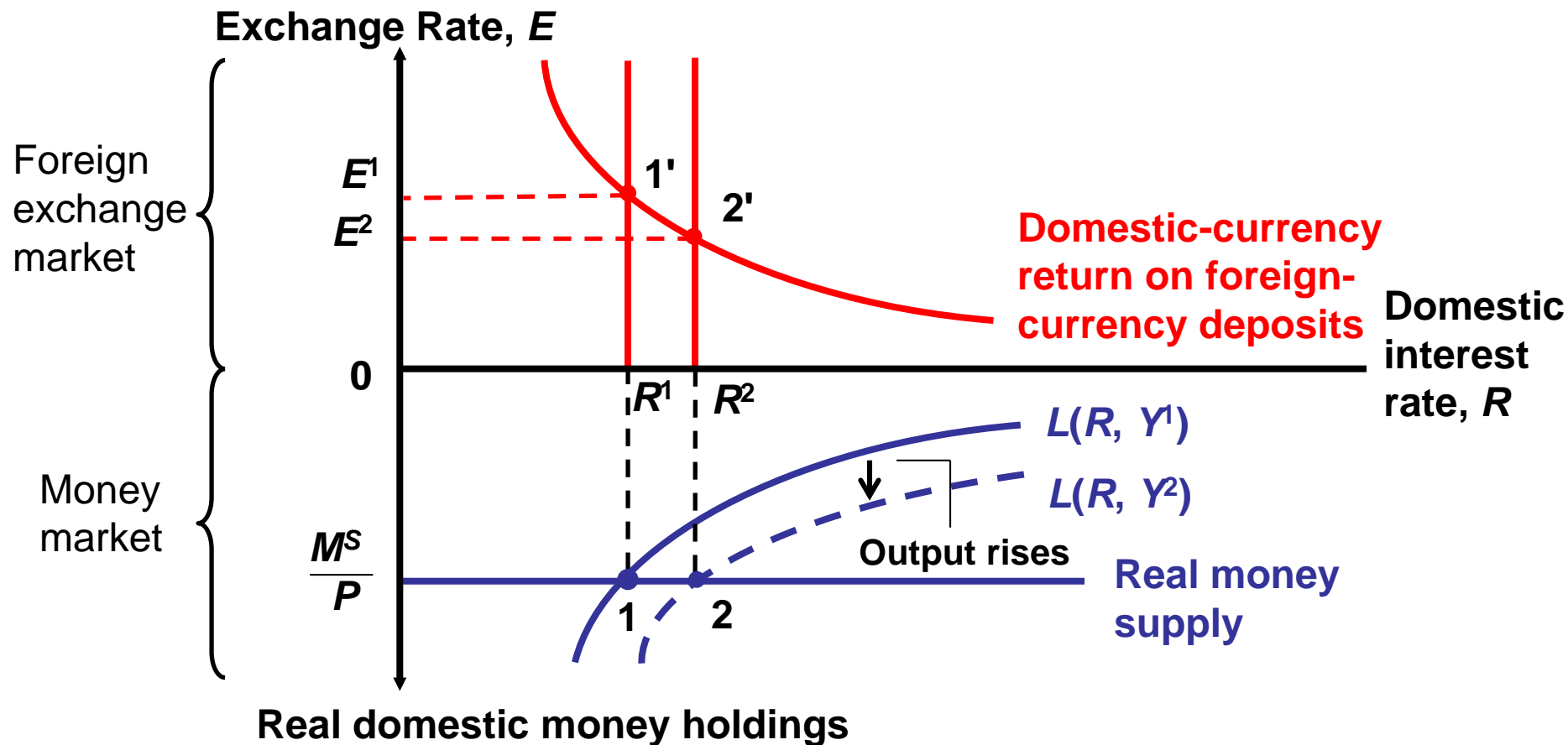
$$M^s/P = L(R, Y)$$

- Aggregate real money demand $L(R, Y)$ rises when the interest rate falls because a fall in *R* makes interest-bearing nonmoney assets less attractive to hold.

Asset Market Equilibrium in the Short Run: The *AA* Schedule

Figure 16-6: Output and the Exchange Rate in Asset Market Equilibrium

Asset Market Equilibrium in the Short Run: The *AA* Schedule

- For asset markets to remain in equilibrium:
  - A rise in domestic output must be accompanied by an appreciation of the domestic currency.
  - A fall in domestic output must be accompanied by a depreciation of the domestic currency.

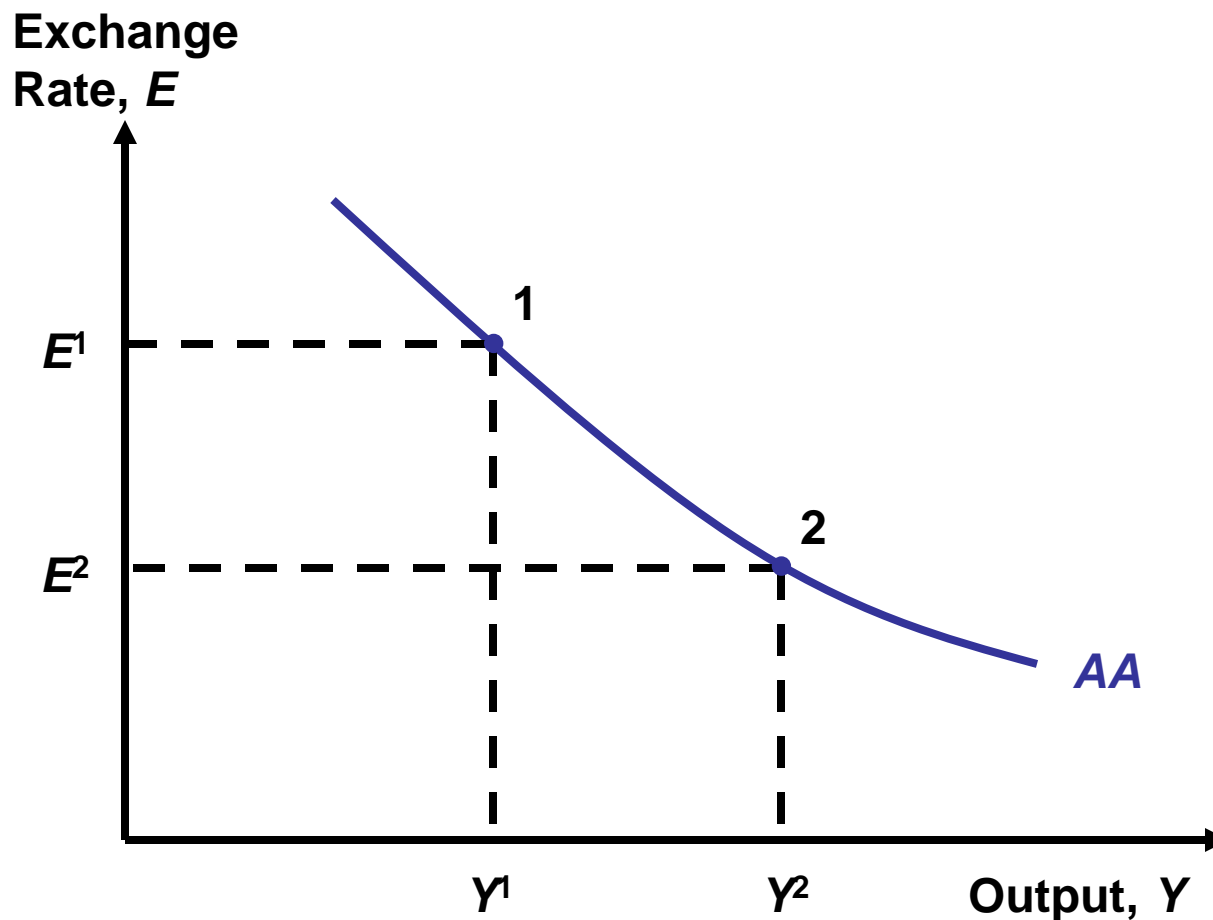# Asset Market Equilibrium in the Short Run: The *AA* Schedule

- **Deriving the *AA* Schedule**
  - It relates exchange rates and output levels that keep the money and foreign exchange markets in equilibrium.
  - It slopes downward because a rise in output causes a rise in the home interest rate and a domestic currency appreciation.

Asset Market Equilibrium in the Short Run: The *AA* Schedule

Figure 16-7: The *AA* Schedule

Asset Market Equilibrium in the Short Run: The *AA* Schedule

- **Factors that Shift the *AA* Schedule**
  - Domestic money supply
  - Domestic price level
  - Expected future exchange rate
  - Foreign interest rate
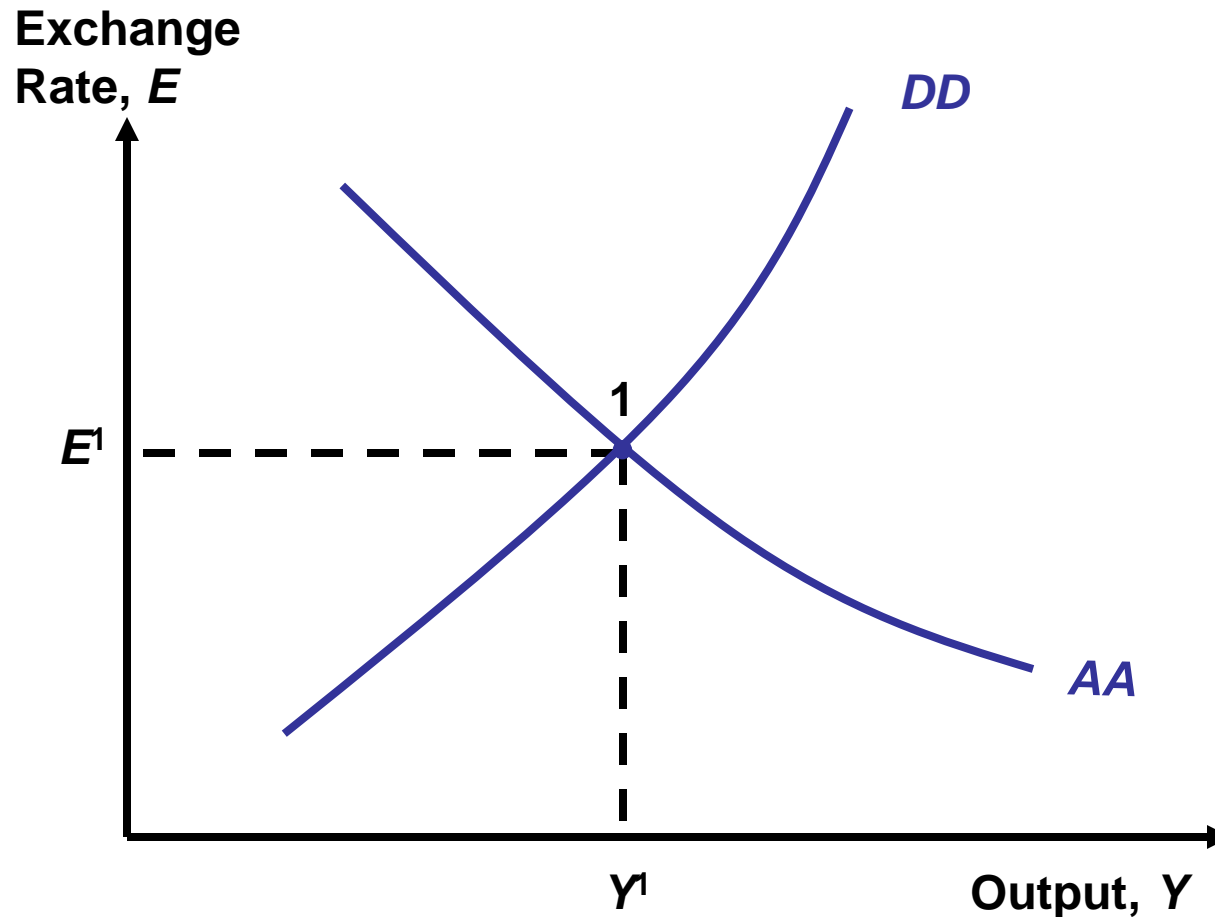 - Shifts in the aggregate real money demand schedule

Short-Run Equilibrium for an Open Economy: Putting the *DD* and *AA* Schedules Together

- A short-run equilibrium for the economy as a whole must bring equilibrium simultaneously in the output and asset markets.
  - That is, it must lie on both *DD* and *AA* schedules.

Figure 16-8: Short-Run Equilibrium: The Intersection of *DD* and *AA*

Figure 16-9: How the Economy Reaches Its Short-Run Equilibrium
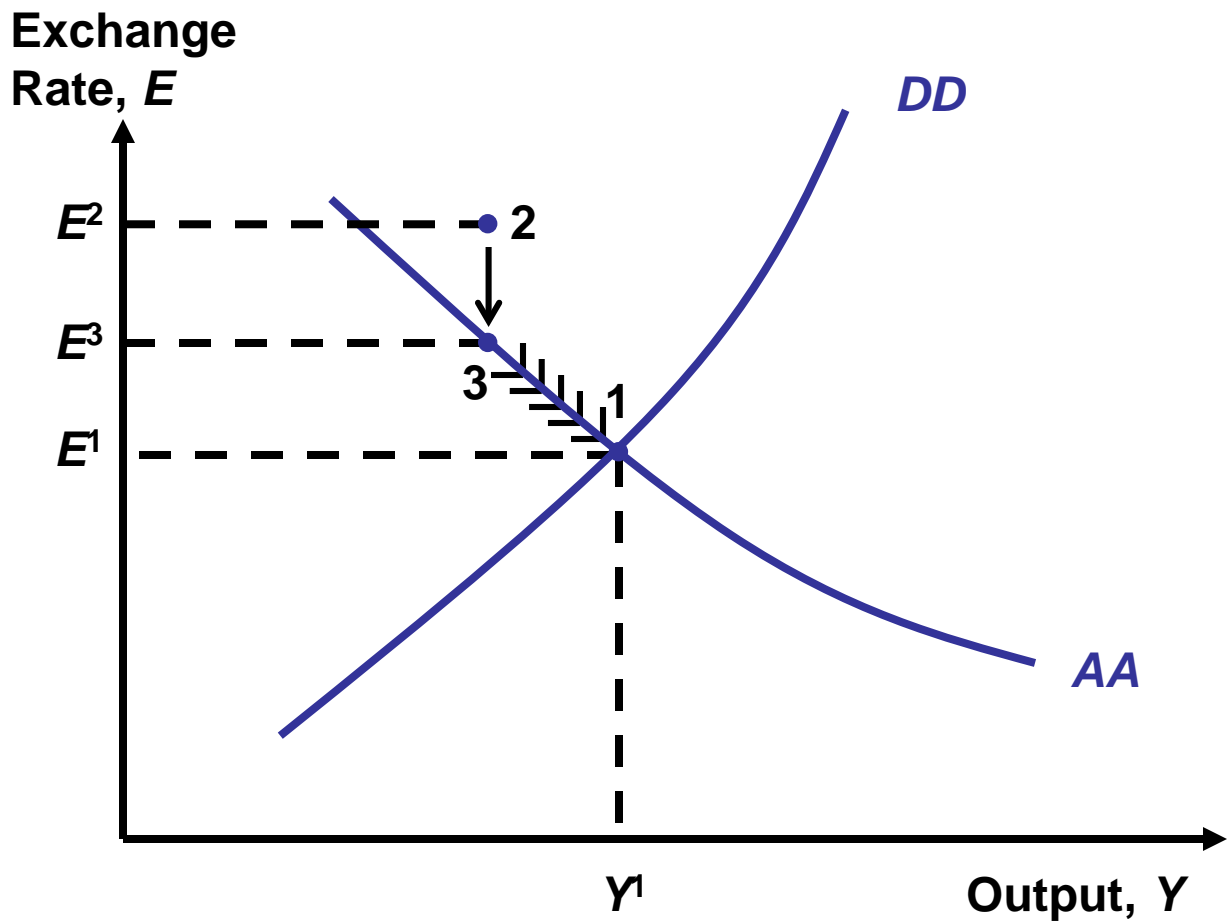
Temporary Changes
in Monetary and Fiscal Policy

- Two types of government policy:
    - **Monetary policy**
        - It works through changes in the money supply.
    - **Fiscal policy**
        - It works through changes in government spending or taxes.
    - Temporary policy shifts are those that the public expects to be reversed in the near future and do not affect the long-run expected exchange rate.
    - Assume that policy shifts do not influence the foreign interest rate and the foreign price level.

Temporary Changes
in Monetary and Fiscal Policy

- **Monetary Policy**
  - An increase in money supply (i.e., expansionary monetary policy) raises the economy's output.
    - The increase in money supply creates an excess supply of money, which lowers the home interest rate.
      - As a result, the domestic currency must depreciate (i.e., home products become cheaper relative to foreign products) and aggregate demand increases.

Figure 16-10: Effects of a Temporary Increase in the Money Supply
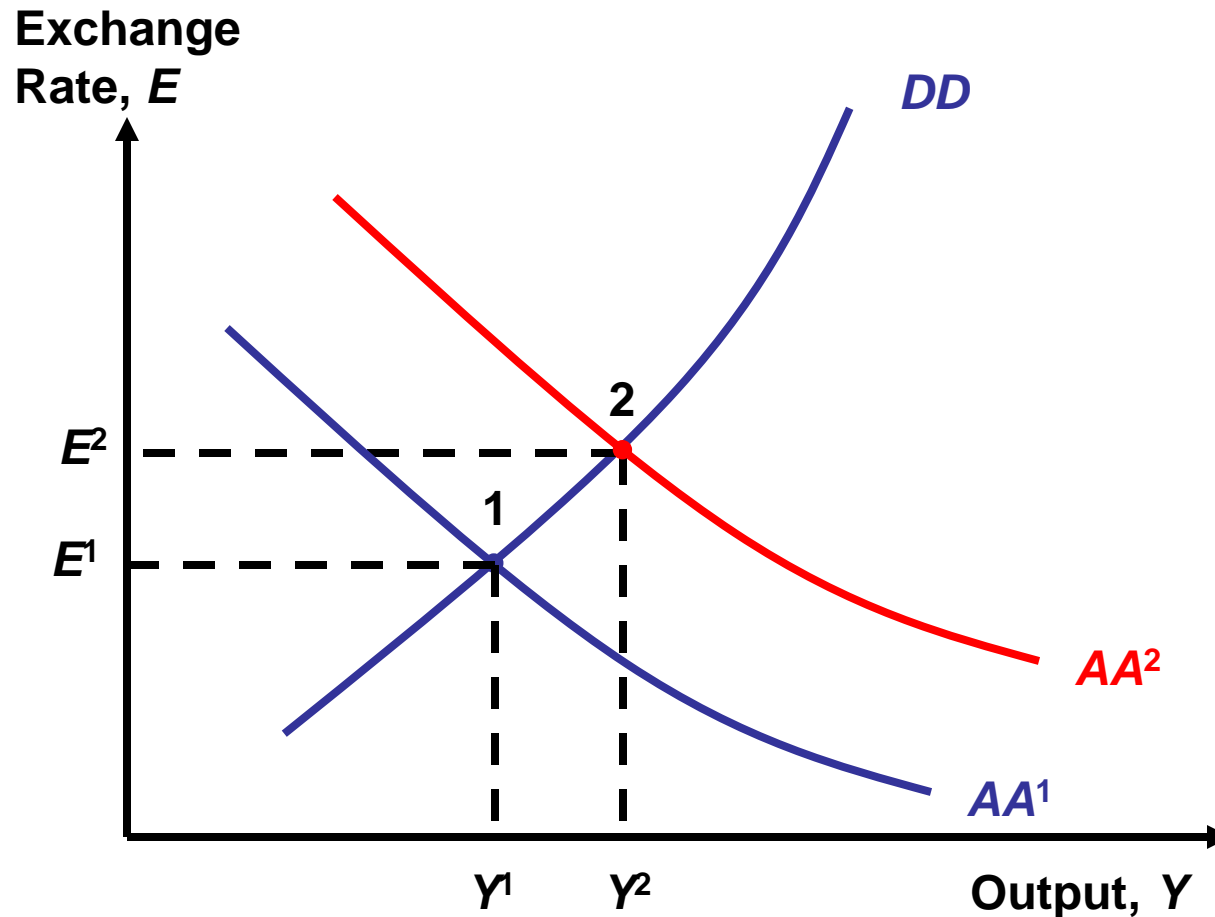
Temporary Changes
in Monetary and Fiscal Policy

- **Fiscal Policy**
  - An increase in government spending, a cut in taxes, or some combination of the two (i.e, expansionary fiscal policy) raises output.
    - The increase in output raises the transactions demand for real money holdings, which in turn increases the home interest rate.
      - As a result, the domestic currency must appreciate.

Temporary Changes in Monetary and Fiscal Policy

Figure 16-11: Effects of a Temporary Fiscal Expansion
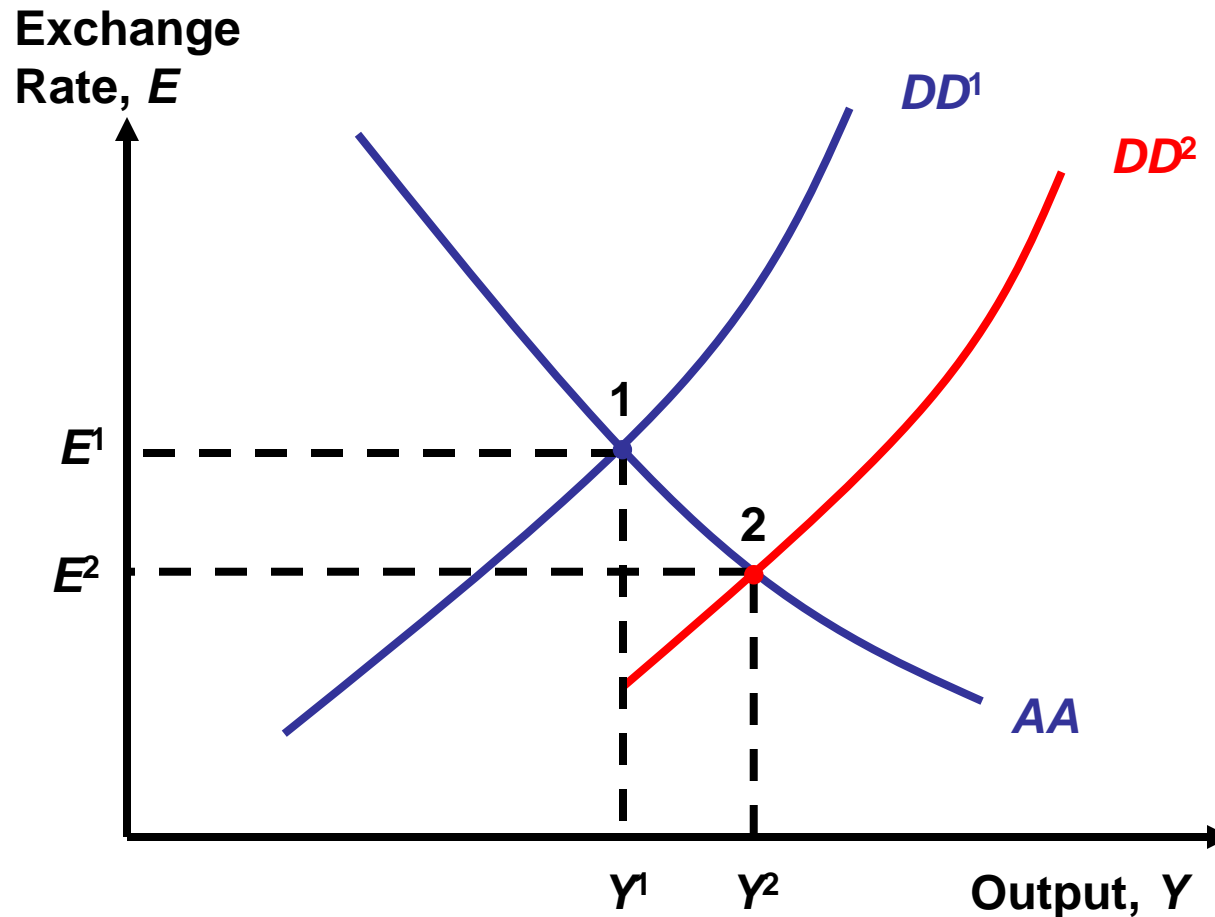
Temporary Changes in Monetary and Fiscal Policy

- **Policies to Maintain Full Employment**
  - Temporary disturbances that lead to recession can be offset through expansionary monetary or fiscal policies.
    - Temporary disturbances that lead to overemployment can be offset through contractionary monetary or fiscal policies.

Temporary Changes in Monetary and Fiscal Policy

Figure 16-12: Maintaining Full Employment After a Temporary Fall in World Demand for Domestic Products
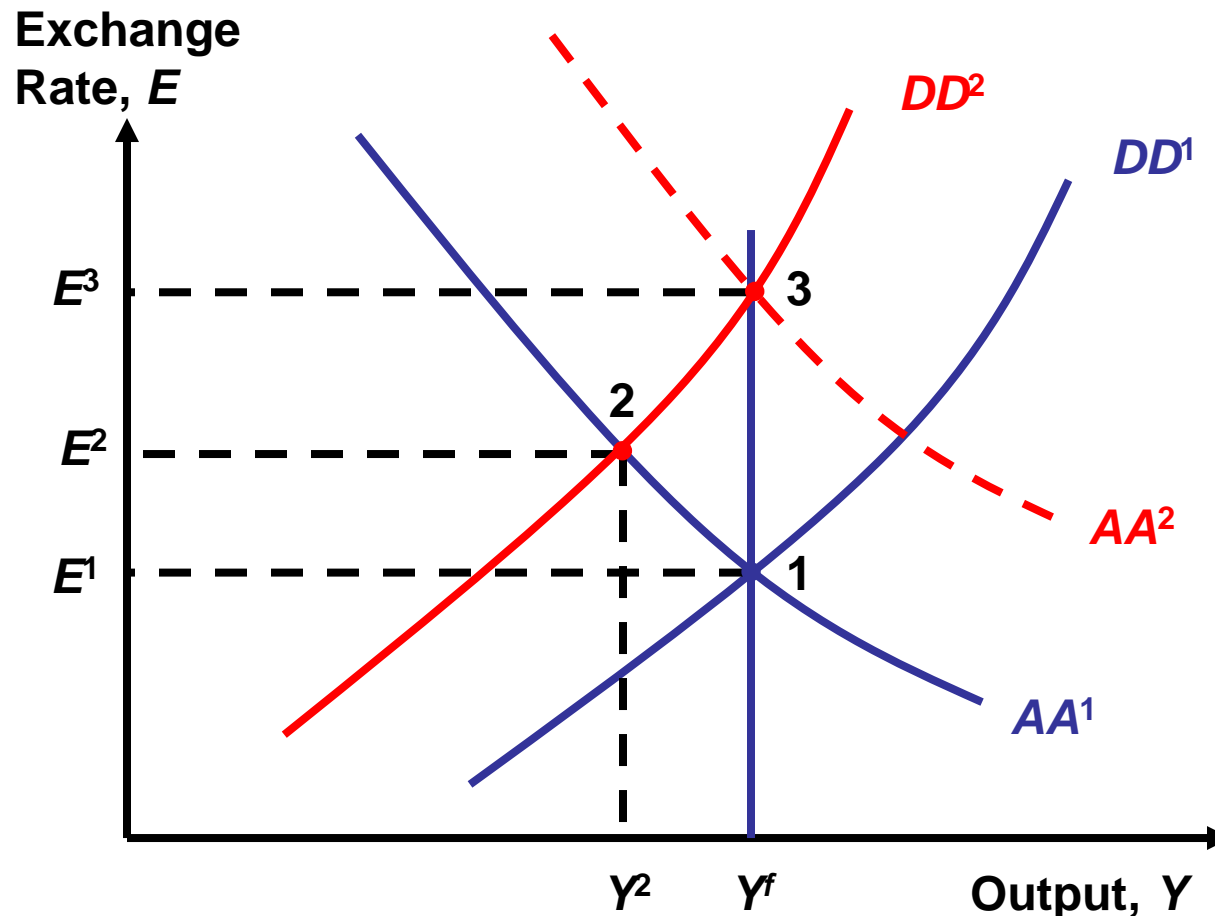
Temporary Changes in Monetary and Fiscal Policy

Figure 16-13: Policies to Maintain Full Employment After a Money-Demand Increase
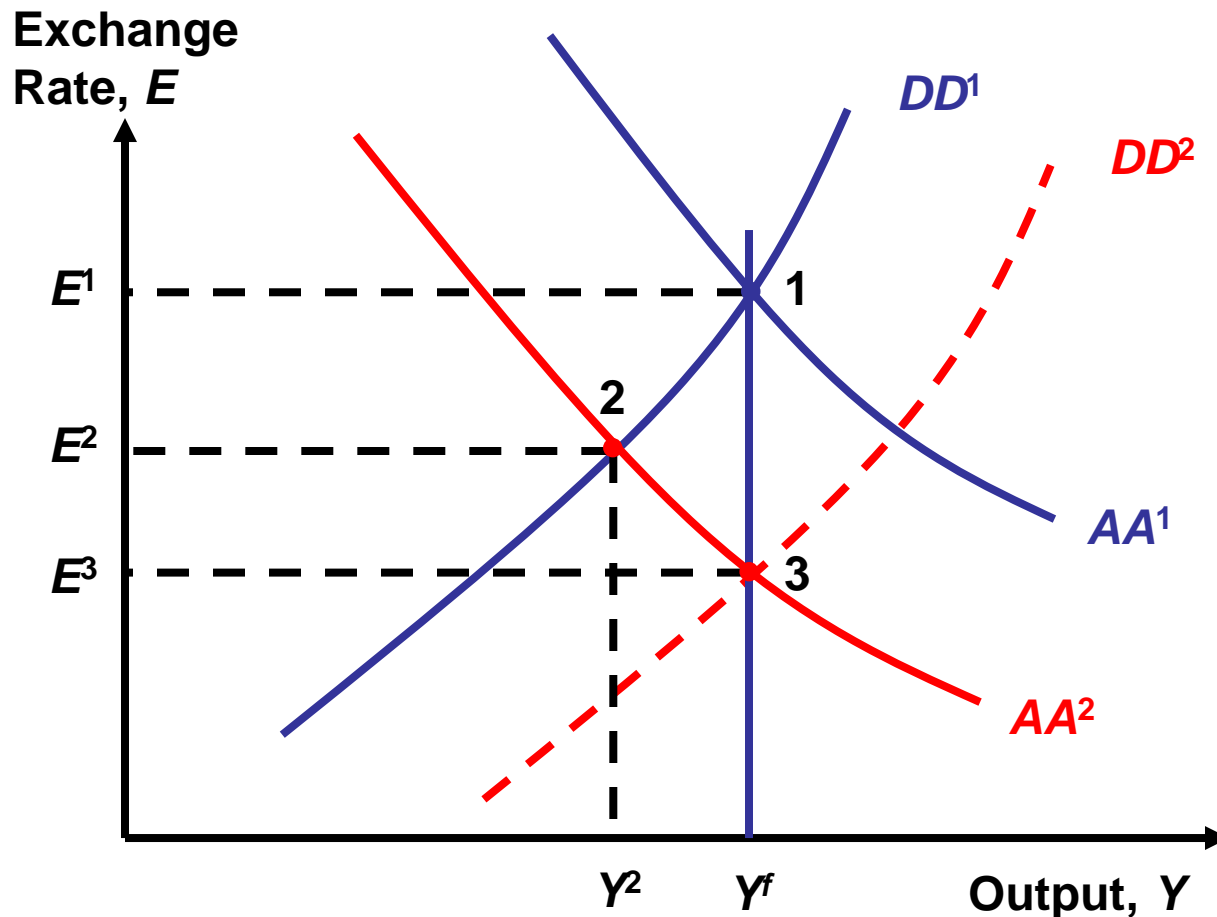
Inflation Bias and Other Problems of Policy Formulation

- Problems of policy formulation:
  - **Inflation bias**
    - High inflation with no average gain in output that results from governments' policies to prevent recession
  - Identifying the sources of economic changes
  - Identifying the durations of economic changes
  - The impact of fiscal policy on the government budget
  - Time lags in implementing policies

Permanent Shifts in Monetary and Fiscal Policy

- A permanent policy shift affects not only the current value of the government's policy instrument but also the *long-run* exchange rate.

  - This affects expectations about future exchange rates.

- A Permanent Increase in the Money Supply

  - A permanent increase in the money supply causes the expected future exchange rate to rise proportionally.

    - As a result, the upward shift in the *AA* schedule is greater than that caused by an equal, but transitory, increase (compare point 2 with point 3 in Figure 16-14).

Permanent Shifts in Monetary and Fiscal Policy

Figure 16-14: Short-Run Effects of a Permanent Increase in the Money Supply
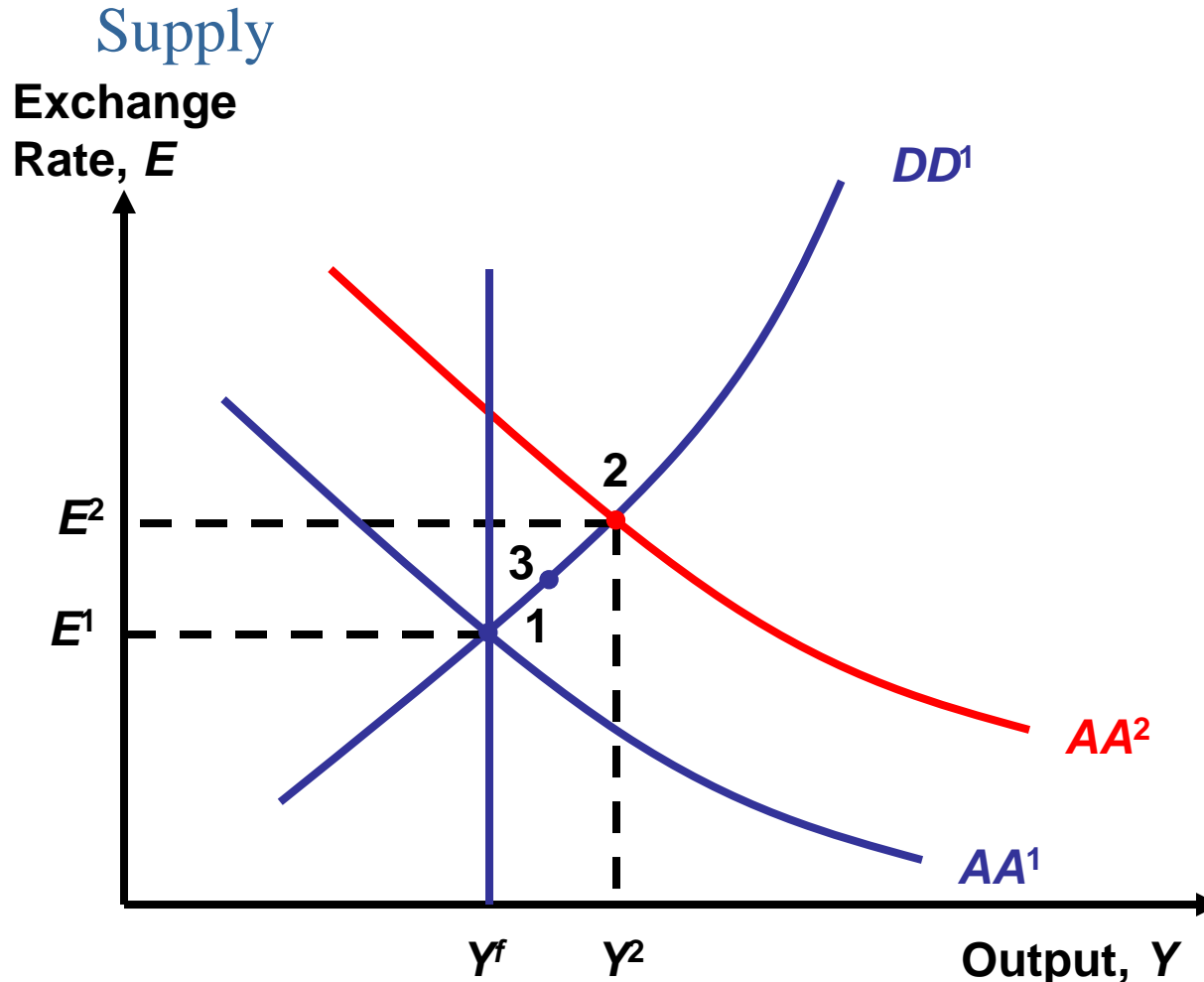
Permanent Shifts in Monetary and Fiscal Policy

- **Adjustment to a Permanent Increase in the Money Supply**

  - The permanent increase in the money supply raises output above its full-employment level.

    - As a result, the price level increases to bring the economy back to full employment.

  - Figure 16-15 shows the adjustment back to full employment.

Permanent Shifts in Monetary and Fiscal Policy

Figure 16-15: Long-Run Adjustment to a Permanent Increase in the Money Supply
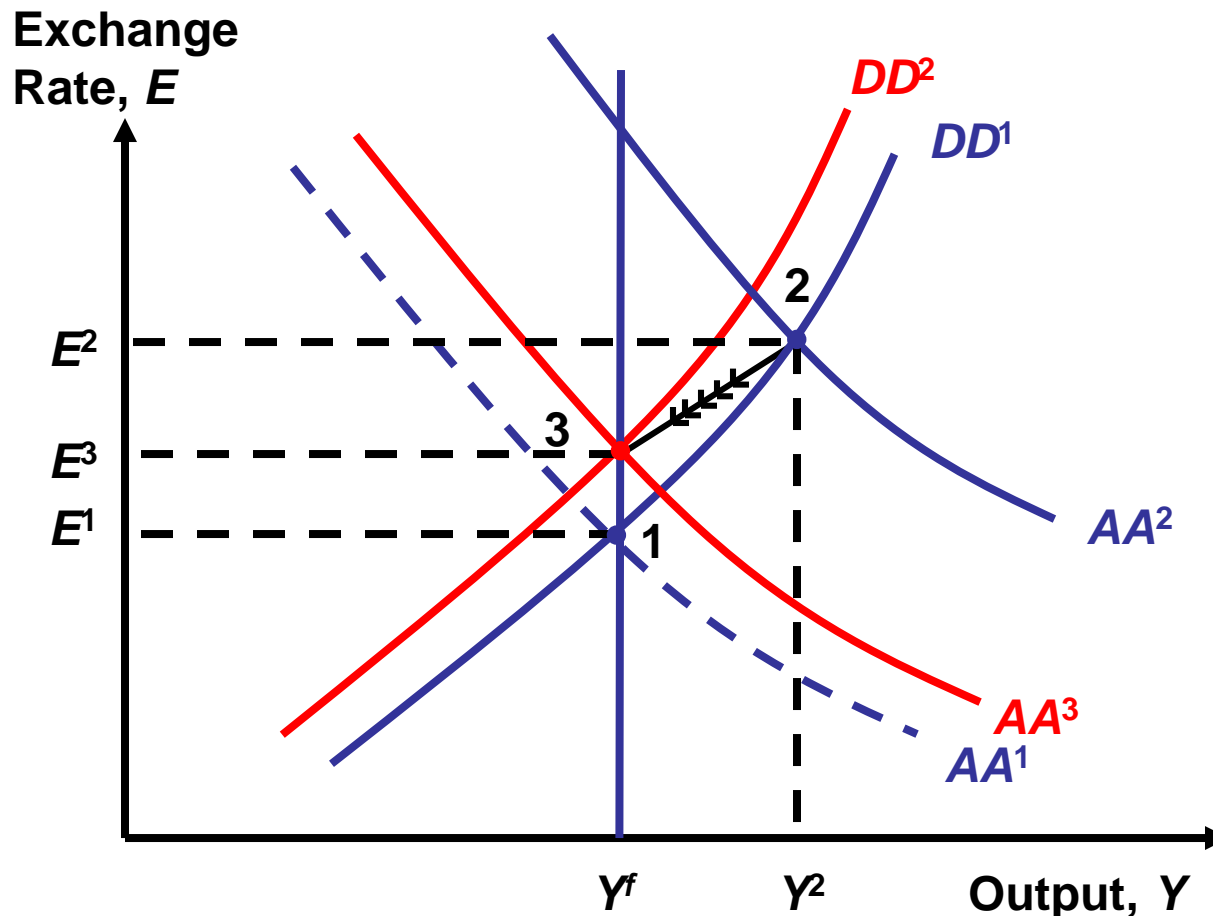
Permanent Shifts in Monetary and Fiscal Policy

- **A Permanent Fiscal Expansion**
  - A permanent fiscal expansion changes the long-run expected exchange rate.
    - If the economy starts at long-run equilibrium, a permanent change in fiscal policy has no effect on output.
      - It causes an immediate and permanent exchange rate jump that offsets exactly the fiscal policy's direct effect on aggregate demand.

Permanent Shifts in Monetary and Fiscal Policy

Figure 16-16: Effects of a Permanent Fiscal Expansion Changing the Capital Stock
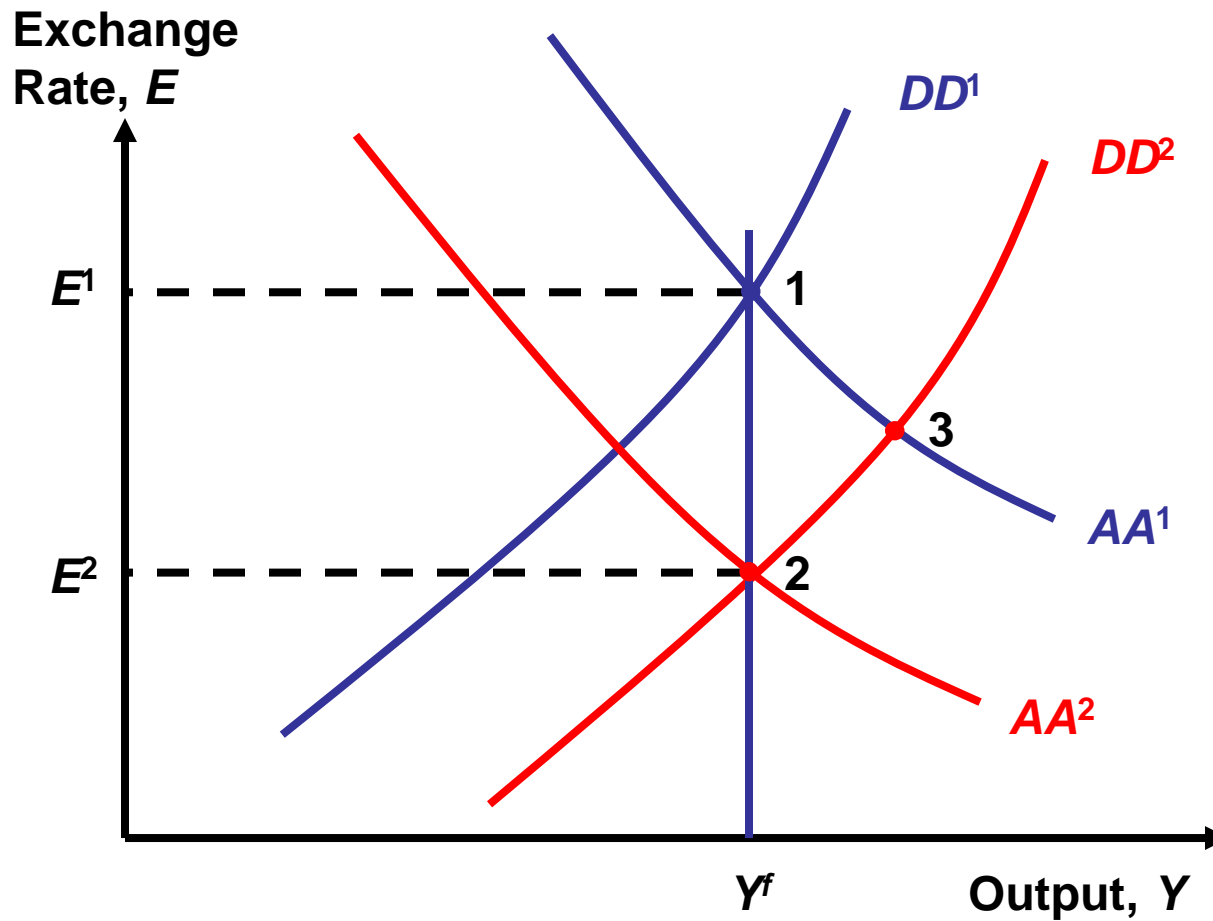
Macroeconomic Policies and the Current Account

- *XX* schedule
  - It shows combinations of the exchange rate and output at which the *CA* balance would be equal to some desired level.
  - It slopes upward because a rise in output encourages spending on imports and thus worsens the current account (if it is not accompanied by a currency depreciation).
  - It is flatter than *DD*.

Macroeconomic Policies and the Current Account

- Monetary expansion causes the *CA* balance to increase in the short run (point 2 in Figure 16-17).

- Expansionary fiscal policy reduces the *CA* balance.

  – If it is temporary, the *DD* schedule shifts to the right (point 3 in Figure 16-17).

  – If it is permanent, both *AA* and *DD* schedules shift (point 4 in Figure 16-17).

Macroeconomic Policies and the Current Account

Figure 16-17: How Macroeconomic Policies Affect the Current Account
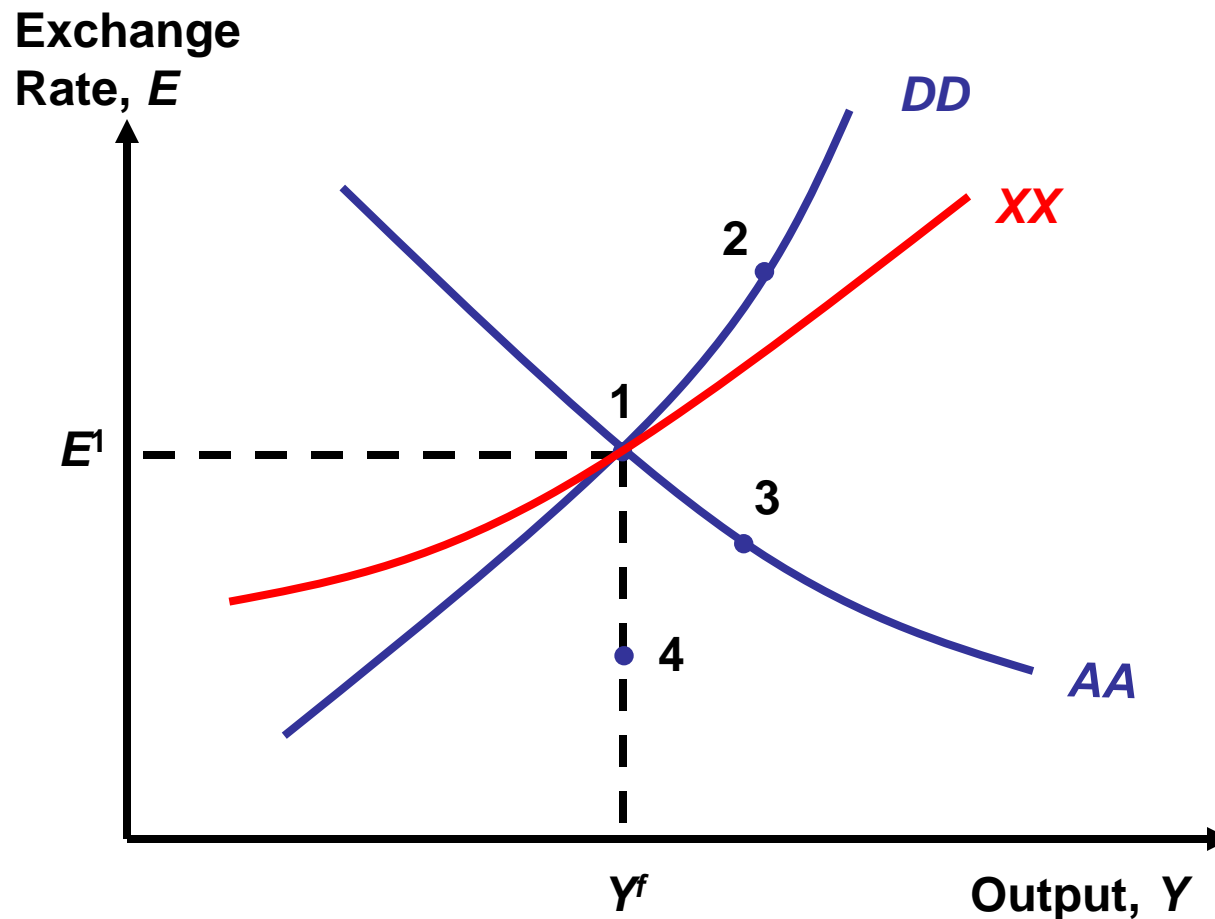
Gradual Trade Flow Adjustment and Current Account Dynamics

- ■ The J-Curve
  - • If imports and exports adjust gradually to real exchange rate changes, the *CA* may follow a J-curve pattern after a real currency depreciation, first worsening and then improving.
    - – Currency depreciation may have a contractionary initial effect on output, and exchange rate overshooting will be amplified.
  - • It describes the time lag with which a real currency depreciation improves the *CA*.

Gradual Trade Flow Adjustment and Current Account Dynamics

Figure 16-18: The J-Curve

Current account (in domestic output units)

Long-run effect of real depreciation on the current account

1

2

3

Real depreciation takes place and J-curve begins

End of J-curve

Time

Gradual Trade Flow Adjustment and Current Account Dynamics

- **Exchange Rate Pass-Through and Inflation**
  - The *CA* in the *DD*-*AA* model has assumed that nominal exchange rate changes cause proportional changes in the real exchange rates in the short run.
  - Degree of **Pass-through**
    - It is the percentage by which import prices rise when the home currency depreciates by 1%.
      - In the *DD*-*AA* model, the degree of pass-through is 1.
    - Exchange rate pass-through can be incomplete because of international market segmentation.
      - Currency movements have less-than-proportional effects on the relative prices determining trade volumes.

Summary

- The aggregate demand for an open economy's output consists of four components: consumption demand, investment demand, government demand, and the current account.

- Output is determined in the short run by the equality of aggregate demand and aggregate supply.

- The economy's short-run equilibrium occurs at the exchange rate and output level.

Summary

- A temporary increase in the money supply causes a depreciation of the currency and a rise in output.

- Permanent shifts in the money supply cause sharper exchange rate movements and therefore have stronger short-run effects on output than transitory shifts.
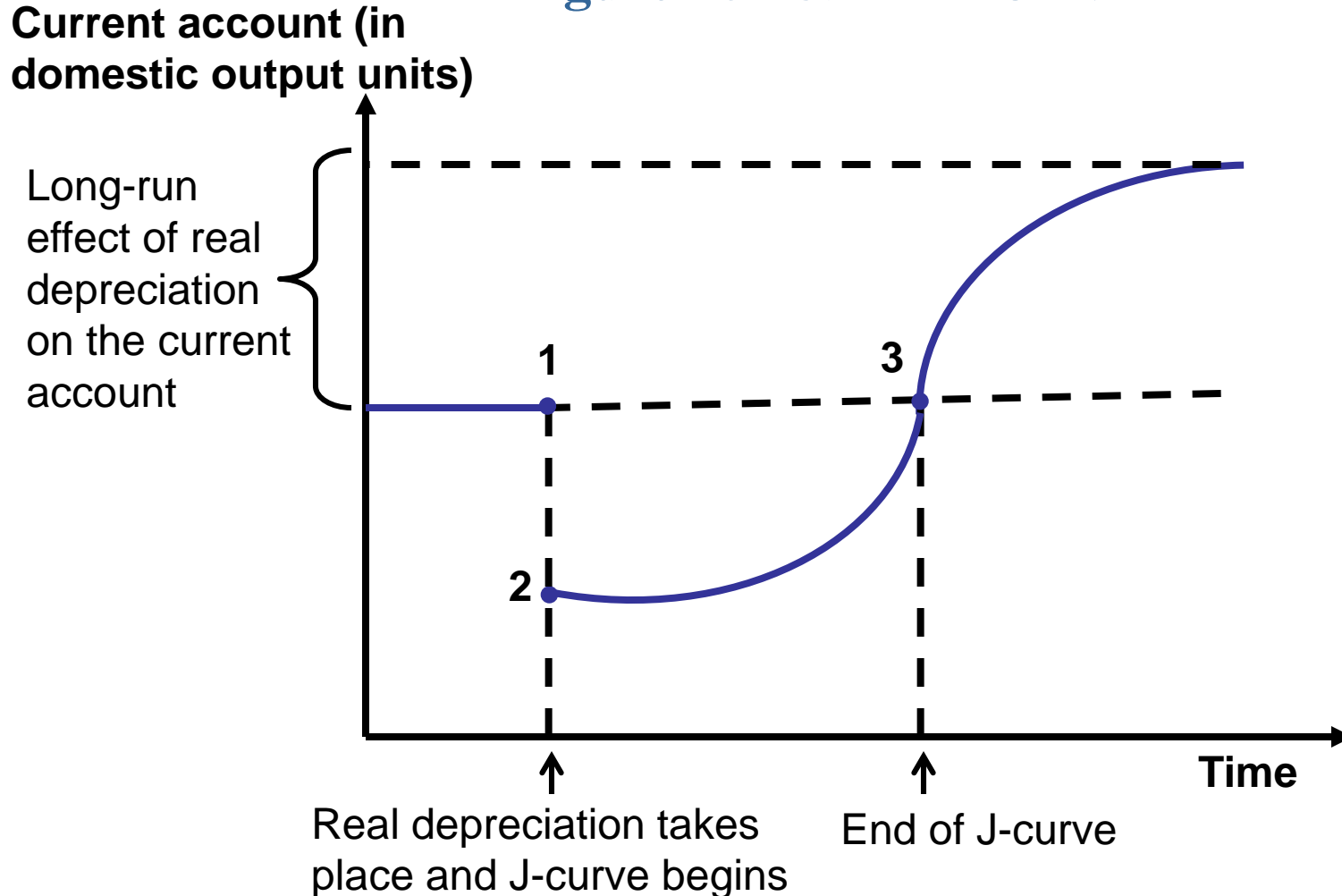
- If exports and imports adjust gradually to real exchange rate changes, the current account may follow a J-curve pattern after a real currency depreciation, first worsening and then improving.

Appendix I: The *IS-LM* Model and the *DD-AA* Model

Figure 16AI-1: Short-Run Equilibrium in the *IS-LM* Model
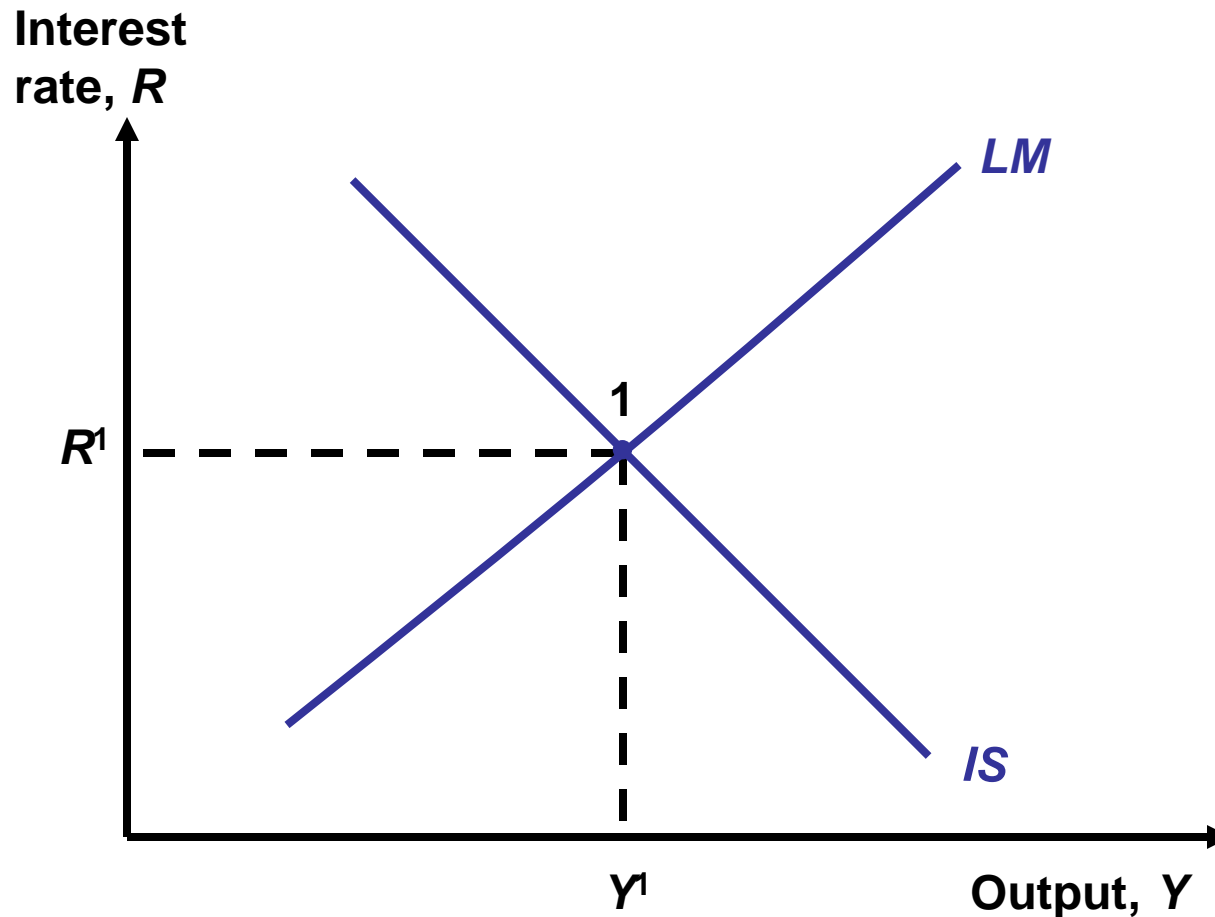
Appendix I: The *IS-LM* Model and the *DD-AA* Model

Figure 16AI-2: Effects of Permanent and Temporary Increases in the Money Supply in the *IS-LM* Model

Figure 16AI-3: Effects of Permanent and Temporary Fiscal Expansions in the *IS-LM* Model
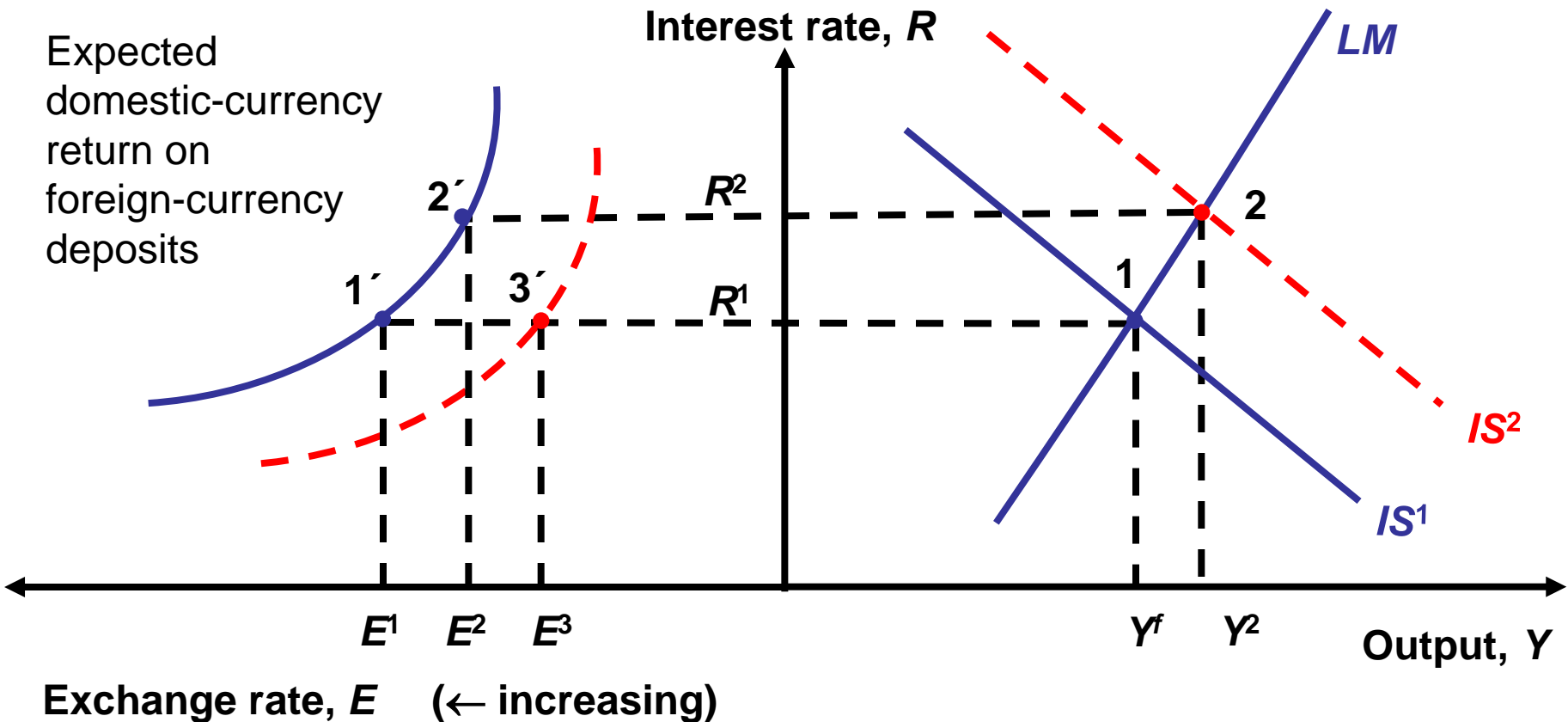
Appendix II: Intertemporal Trade and Consumption Demand

Figure 16AII-1: Change in Output and Saving
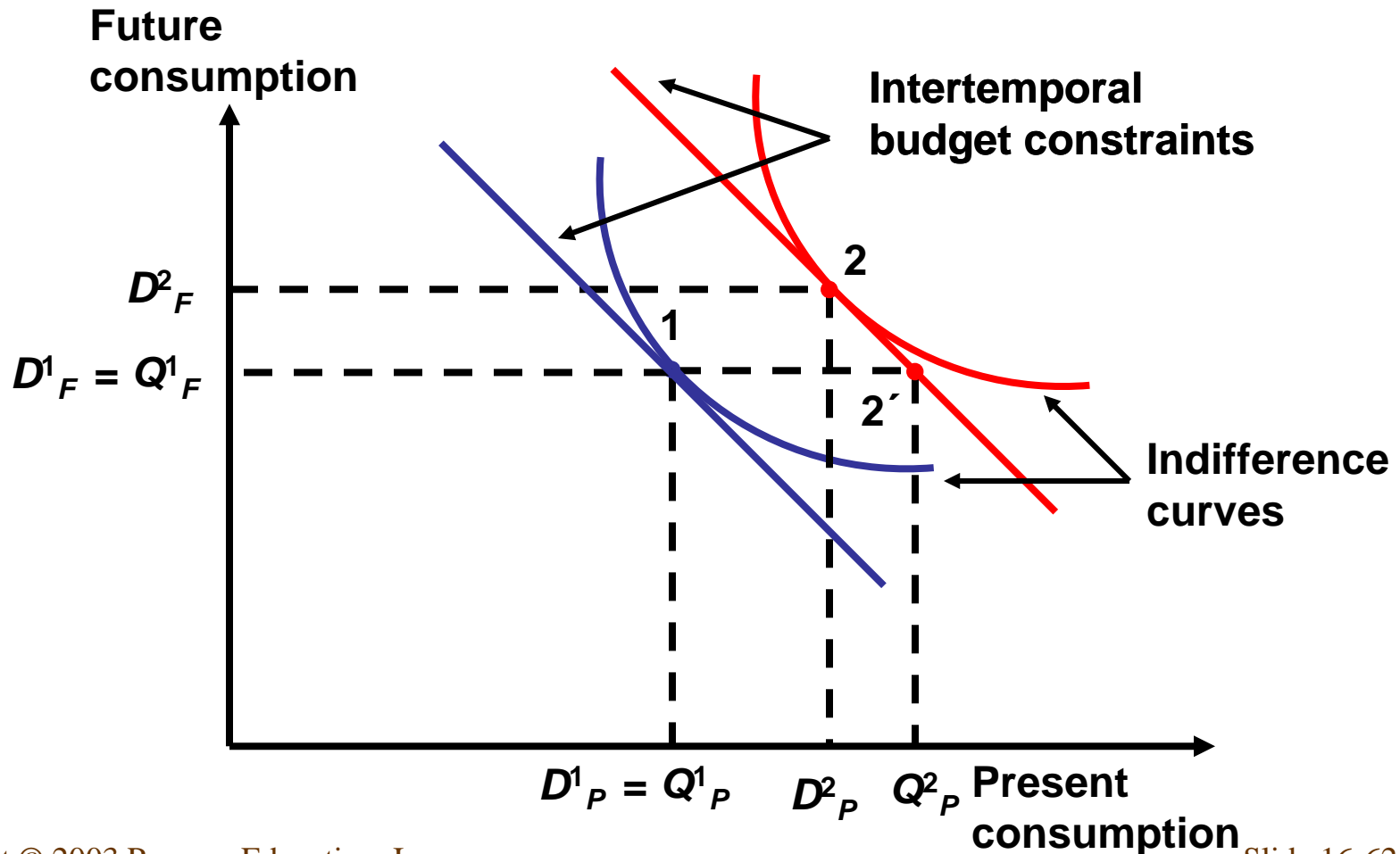
Appendix III: The Marshall-Lerner Condition and Empirical Estimates of Trade Elasticities

Table 16AIII-1: Estimated Price Elasticities for International Trade in Manufactured Goods

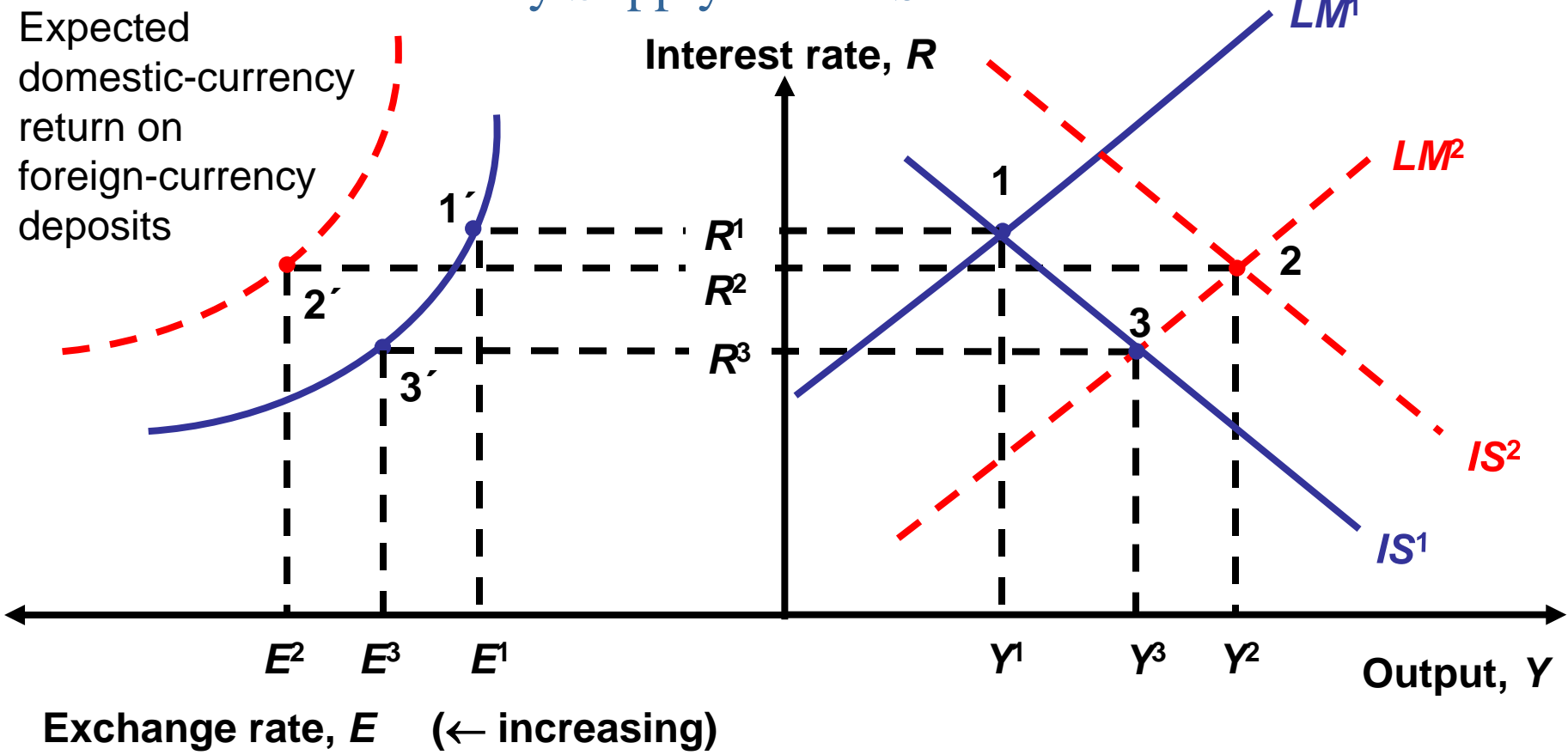| Country	η Impact	η Short-run	η Long-run	η^* Impact	η^* Short-run	η^* Long-run
Austria	0.39	0.71	1.37	0.03	0.36	0.80
Belgium	0.18	0.59	1.55	—	—	0.70
Britain	—	—	0.31	0.60	0.75	0.75
Canada	0.08	0.40	0.71	0.72	0.72	0.72
Denmark	0.82	1.13	1.13	0.55	0.93	1.14
France	0.20	0.48	1.25	—	0.49	0.60
Germany	—	—	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.

Chapter 17
Fixed Exchange Rates and Foreign Exchange Intervention

Prepared by **Iordanis Petsas**

To Accompany

International Economics: Theory and Policy, Sixth Edition
by **Paul R. Krugman and Maurice Obstfeld**

Chapter Organization

- Why Study Fixed Exchange Rates?
- Central Bank Intervention and the Money Supply
- How the Central Bank Fixes the Exchange Rates
- Stabilization Policies with a Fixed Exchange Rate
- Balance of Payments Crises and Capital Flight
- Managed Floating and Sterilized Intervention
- Reserve Currencies in the World Monetary System
- The Gold Standard

Chapter Organization

- Summary
- Appendix I: Equilibrium in the Foreign Exchange Market with Imperfect Asset Substitutability
- Appendix III: The Timing of Balance of Payments Crises

Introduction

- In reality, the assumption of complete exchange rate flexibility is rarely accurate.

  - Industrialized countries operate under a hybrid system of **managed floating exchange rates**.

    – A system in which governments attempt to moderate exchange rate movements without keeping exchange rates rigidly fixed.

  - A number of developing countries have retained some form of government exchange rate fixing.

- How do central banks intervene in the foreign exchange market?

Why Study Fixed Exchange Rates?

- Four reasons to study fixed exchange rates:
    - Managed floating
    - Regional currency arrangements
    - Developing countries and countries in transition
    - Lessons of the past for the future

Why Study Fixed Exchange Rates?

Table 17-1: Exchange Rate Arrangements (As of March 31, 2001)

Exchange Rate Regime (Number of countries)	Monetary Policy Framework				
	Exchange rate anchor	Monetary aggregate target	Inflation targeting framework	Fund-supported or other monetary program	Other
Exchange arrangements with no separate legal tender (39)	**Another currency as legal tender** Ecuador* Kiribati Marshall Islands Rep. of Micronesia, Fed. States of Palau Panama San Marino **ECCU²** Antigua & Barbuda Dominica Grenada St. Kitts & Nevis St. Lucia St. Vincent & the Grenadines **CFA Franc Zone** **WAEMU** Benin* Burkina Faso* Côte d'Ivoire* Guinea-Bissau* Mali* Niger* Senegal* Togo **CAEMC** Cameroon* C. African Rep.* Chad* Congo, Rep. of* Equatorial Guinea Gabon*			Benin* Burkina Faso* Cameroon* Central African Rep.* Chad* Congo, Rep. of* Côte d'Ivoire* Ecuador* Gabon* Guinea-Bissau* Mali* Niger* Senegal*	**Euro Area[3, 4]** Austria Belgium Finland France Germany Greece Ireland Italy Luxembourg Netherlands Portugal Spain

Why Study Fixed Exchange Rates?

Table 17-1: Continued

Exchange Rate Regime (Number of countries)	Monetary Policy Framework			
Currency board arrangements (8)	Argentina* Bosnia and Herzegovina* Brunei Darussalam Bulgaria* China, P.R. Hong Kong Djibouti* Estonia* Lithuania*			Argentina* Bosnia and Herzegovina* Bulgaria* Djibouti* Estonia* Lithuania*	

Table 17-1: Continued

Exchange Rate Regime (Number of countries)	Monetary Policy Framework				
Other conventional fixed peg arrangements (including de facto peg arrangements under managed floating) (44)	**Against a single currency (31)** Aruba Lesotho* Bahamas, The[5] Macedonia, FYR*[6] Bahrain[6,7] Malaysia Barbados Maldives[6] Belize Namibia Bhutan Nepal Cape Verde Netherlands Antilles China, P.R. Mainland*[6] Oman Comoros[8] Qatar[6,7] Congo, Dem. Rep. of Saudi Arabia[6,7] El Salvador[13] Swaziland Eritrea Syrian Arab Republic[5] Iran[5,6] Trinidad & Tobago*[6] Iraq Turkmenistan[6] Jordan*[6] United Arab Emirates[6,7] Lebanon[6] **Against a composite (13)** Bangladesh Myanmar[5] Botswana[5] Samoa Fiji Seychelles Kuwait Solomon Islands Latvia* Tonga Malta Vanuatu Morocco	China, P.R.; Mainland*[6]		Jordan*[6] Latvia* Lesotho* Macedonia, FYR*[6] Trinidad & Tobago*[6]	

**ECCU: Eastern Caribbean Currency Union; WAEMU: West African Economic and Monetary Union; CAEMC: Central African Economic and Monetary Community

Why Study Fixed Exchange Rates?

Table 17-1: Continued

Exchange Rate Regime (Number of countries)	Monetary Policy Framework				
	Exchange rate anchor	Monetary aggregate target	Inflation targeting framework	Fund-supported or other monetary program	Other
Pegged exchange rates within horizontal bands (6)[9]	**Within a coopera-tive arrangement** **ERM II (1)** Denmark **Other band arrangements (5)** Cyprus Egypt[5] Libyan A.J. Suriname[5] Vietnam[6]				
Crawling pegs (4)[6]	Bolivia* Costa Rica Nicaragua* Zimbabwe*			Bolivia* Nicaragua* Zimbabwe*	
Exchange rates within crawling bands (5)[6, 10]	Israel* Honduras* Hungary Uruguay* Venezuela, Rep. Bolivariana		Israel*	Honduras* Uruguay*	

Why Study Fixed Exchange Rates?

Table 17-1: Continued

Exchange Rate Regime (Number of countries)	Monetary Policy Framework				
Managed floating with no preannounced path for exchange rate (33)		Jamaica*[6] Slovenia Tunisia	Czech Republic Norway	Cambodia[5] Croatia Ethiopia Jamaica*[6] Kazakhstan Kenya Kyrgyz Republic Mauritania Nigeria Pakistan Romania Russian Federation Rwanda Sri Lanka Sudan Ukraine Yugoslavia, Fed. Rep. of	Algeria[3] Azerbaijan Belarus[3,5] Burundi[3] Dominican Rep.[3,5] Guatemala[3] India[3] Lao PDR[3,5] Paraguay[3] Singapore Slovak Republic[3] Uzbekistan[3,5]

Why Study Fixed Exchange Rates?

Table 17-1: Continued

Exchange Rate Regime (Number of countries)	Monetary Policy Framework			
Independently floating (47)		Gambia, The* Ghana* Guinea* Guyana* Mauritius[6] Malawi* Mexico Mongolia* Peru* Philippines* São Tomé and Príncipe* Sierra Leone* Turkey* Yemen*	Australia Brazil[12] Canada Chile[5] Colombia* Iceland Korea New Zealand Poland South Africa Sweden Thailand* United Kingdom	Albania Angola Armenia Colombia* Gambia, The* Georgia Ghana* Guinea* Guyana* Haiti Indonesia Madagascar Malawi* Moldova Mongolia*	Afghanistan[5,11] Japan[3] Liberia[3] Somalia[5,11] Switzerland[3] United States[3]

Why Study Fixed Exchange Rates?

Table 17-1: Continued

Exchange Rate Regime (Number of countries)	Monetary Policy Framework				
	Exchange rate anchor	Monetary aggregate target	Inflation targeting framework	Fund-supported or other monetary program	Other
				Mozambique Papua New Guinea Peru* Philippines* São Tomé and Príncipe* Sierra Leone* Tajikistan Tanzania Thailand* Turkey* Uganda Yemen* Zambia	

Source: International Monetary Fund, *International Financial Statistics,* August 2001.

Central Bank Intervention and the Money Supply

- The Central Bank Balance Sheet and the Money Supply

  - **Central bank balance sheet**

    - It records the assets held by the central bank and its liabilities.

    - It is organized according to the principles of double-entry bookkeeping.

      - Any acquisition of an asset by the central bank results in a + change on the assets side of the balance sheet.

      - Any increase in the bank's liabilities results in a + change on the balance sheet's liabilities side.

Central Bank Intervention and the Money Supply

- The assets side of a balance sheet lists two types of assets:
  - Foreign assets
    - Mainly foreign currency bonds owned by the central bank (its official international reserves)
  - Domestic assets
    - Central bank holdings of claims to future payments by its own citizens and domestic institutions
- The liabilities side of a balance sheet lists as liabilities:
  - Deposits of private banks
  - Currency in circulation
- Total assets = total liabilities + net worth

Central Bank Intervention and the Money Supply

- Net worth is constant.
  - The changes in central bank assets cause equal changes in central bank liabilities.
- Any central bank purchase of assets automatically results in an increase in the domestic money supply.
- Any central bank sale of assets automatically causes the money supply to decline.

Central Bank Intervention and the Money Supply

■ Foreign Exchange Intervention and the Money Supply

- The central bank balance sheet shows how foreign exchange intervention affects the money supply because the central bank's liabilities are the base of the domestic money supply process.

- The central bank can negate the money supply effect of intervention though sterilization.

Central Bank Intervention and the Money Supply

- Sterilization
  - **Sterilized foreign exchange intervention**
    - Central banks sometimes carry out equal foreign and domestic asset transactions in opposite directions to nullify the impact of their foreign exchange operations on the domestic money supply.
    - With no sterilization, there is a link between the balance of payments and national money supplies that depends on how central banks share the burden of financing payments gaps.

Central Bank Intervention and the Money Supply

Table 17-2: 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

Central Bank Intervention and the Money Supply

- ■ The Balance of Payments and the Money Supply
  - If central banks are not sterilizing and the home country has a balance of payments surplus:
    - An increase in the home central bank's foreign assets implies an increased home money supply.
    - A decrease in a foreign central bank's claims on the home country implies a decreased foreign money supply.

How the Central Bank Fixes the Exchange Rate

- **Foreign Exchange Market Equilibrium Under a Fixed Exchange Rate**
  - The foreign exchange market is in equilibrium when:

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

  - When the central bank fixes E at E^0, the expected rate of domestic currency depreciation is zero.
  - The interest parity condition implies that E^0 is today's equilibrium exchange rate only if: $R = R*$.

How the Central Bank Fixes the Exchange Rate

- **Money Market Equilibrium Under a Fixed Exchange Rate**

  - To hold the domestic interest rate at R^*, the central bank's foreign exchange intervention must adjust the money supply so that:

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

    – <u>Example</u>: Suppose the central bank has been fixing E at E^0 and that asset markets are in equilibrium. An increase in output would raise the money demand and thus lead to a higher interest rate and an appreciation of the home currency.

How the Central Bank Fixes the Exchange Rate

- The central bank must intervene in the foreign exchange market by buying foreign assets in order to prevent this appreciation.

- If the central bank does not purchase foreign assets when output increases but instead holds the money stock constant, it cannot keep the exchange rate fixed at E^0.

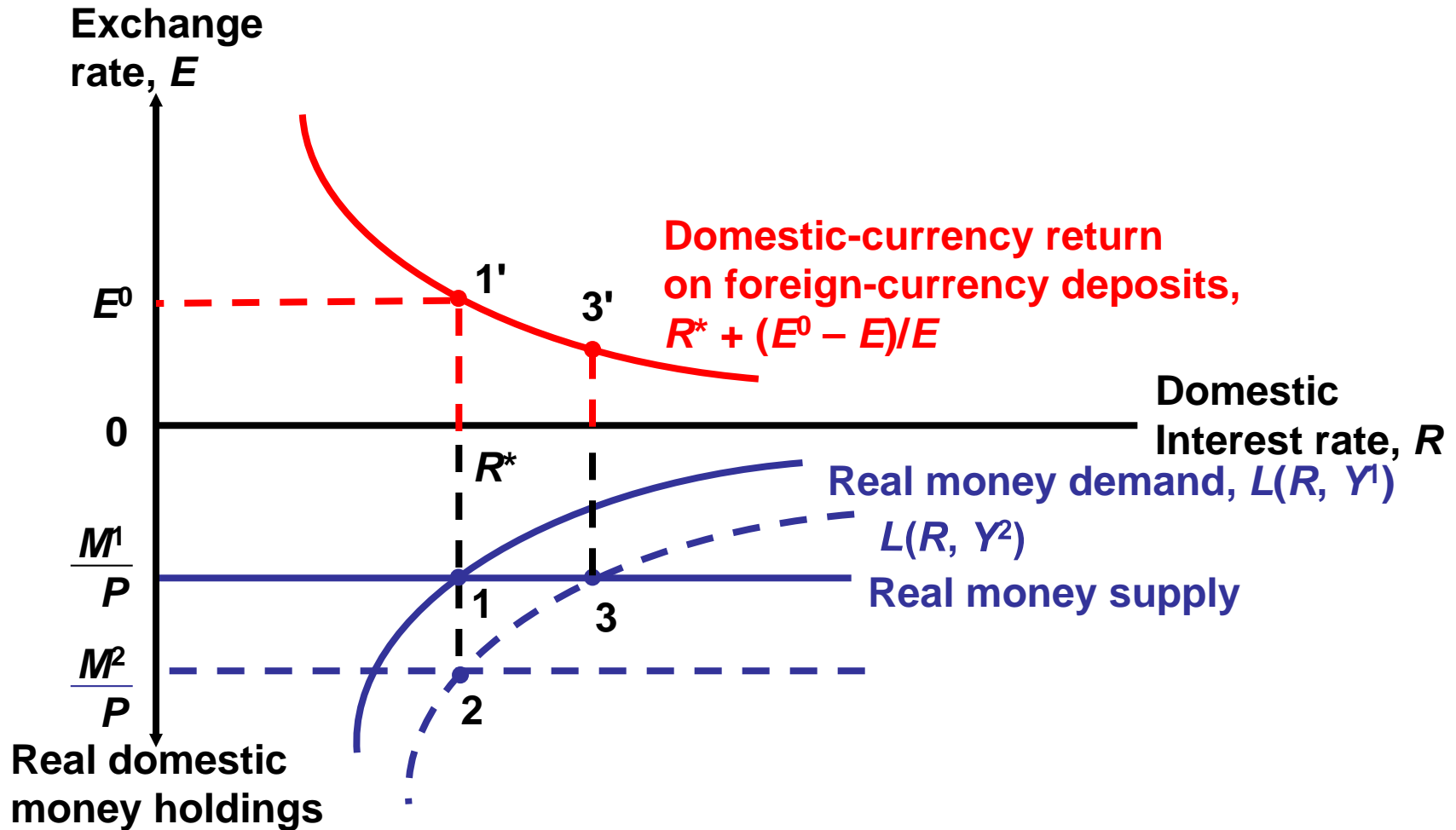# How the Central Bank Fixes the Exchange Rate

- **A Diagrammatic Analysis**
  - To hold the exchange rate fixed at E^0 when output rises, the central bank must purchase foreign assets and thereby raise the money supply.

How the Central Bank Fixes the Exchange Rate

Figure 17-1: Asset Market Equilibrium with a Fixed Exchange Rate, E^0

Stabilization Policies
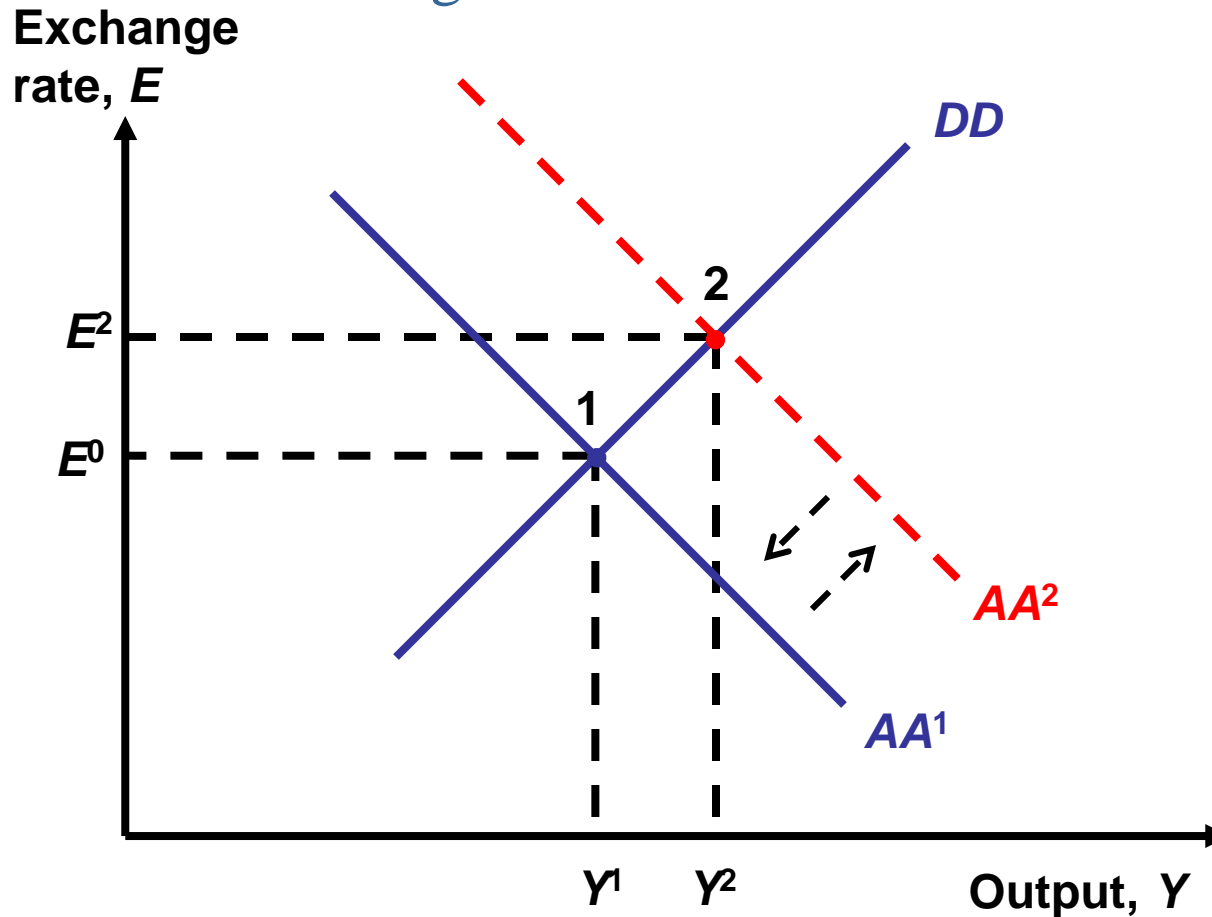# With a Fixed Exchange Rate

■ Monetary Policy

- Under a fixed exchange rate, central bank monetary policy tools are powerless to affect the economy's money supply or its output.

  – Figure 17-2 shows the economy's short-run equilibrium as point 1 when the central bank fixes the exchange rate at the level E^0.

Stabilization Policies With a Fixed Exchange Rate

Figure 17-2: Monetary Expansion Is Ineffective Under a Fixed Exchange Rate

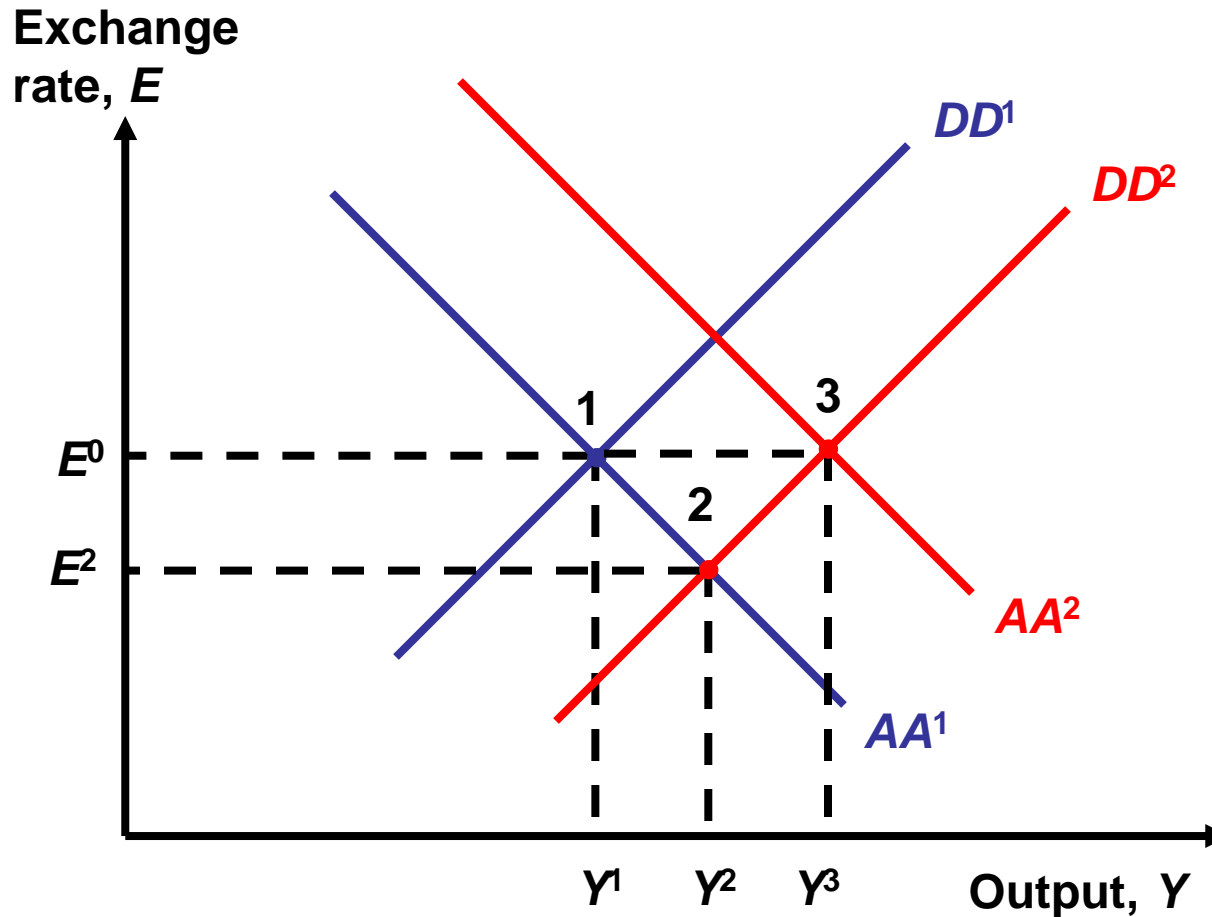# Stabilization Policies With a Fixed Exchange Rate

- **Fiscal Policy**
  - How does the central bank intervention hold the exchange rate fixed after the fiscal expansion?
    - The rise in output due to expansionary fiscal policy raises money demand.
      - To prevent an increase in the home interest rate and an appreciation of the currency, the central bank must buy foreign assets with money (i.e., increasing the money supply).
  - The effects of expansionary fiscal policy when the economy's initial equilibrium is at point 1 are illustrated in Figure 17-3.

Stabilization Policies With a Fixed Exchange Rate

Figure 17-3: Fiscal Expansion Under a Fixed Exchange Rate

Stabilization Policies
With a Fixed Exchange Rate

- **Changes in the Exchange Rate**
  - **Devaluation**
    - It occurs when the central bank raises the domestic currency price of foreign currency, *E*.
    - It causes:
      - A rise in output
      - A rise in official reserves
      - An expansion of the money supply
    - It is chosen by governments to:
      - Fight domestic unemployment
      - Improve the current account
      - Affect the central bank's foreign reserves

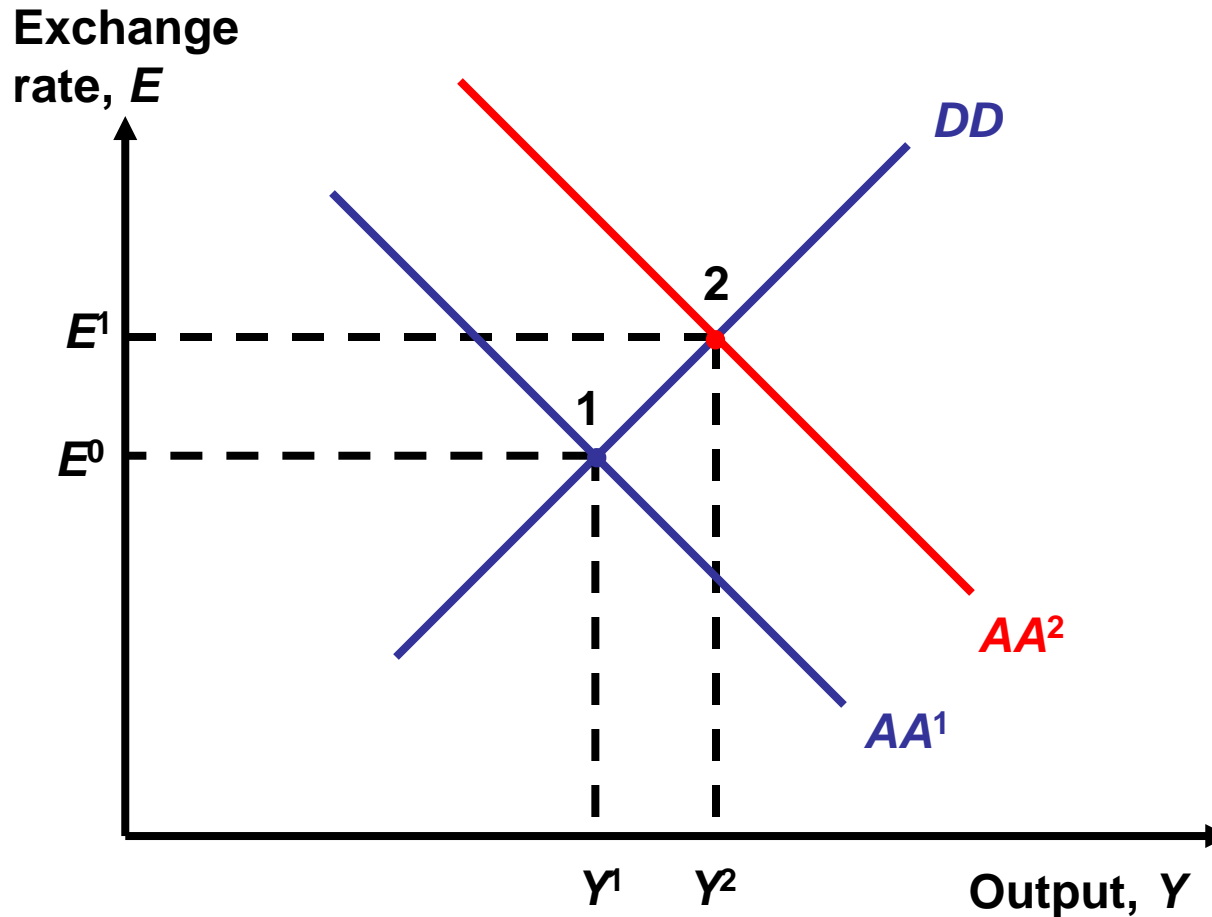# Stabilization Policies With a Fixed Exchange Rate

- **Revaluation**
  - It occurs when the central bank lowers E.

- In order to devalue or revalue, the central bank has to announce its willingness to trade domestic against foreign currency, in unlimited amounts, at the new exchange rate.

Stabilization Policies With a Fixed Exchange Rate

Figure 17-4: Effects of a Currency Devaluation

Stabilization Policies With a Fixed Exchange Rate
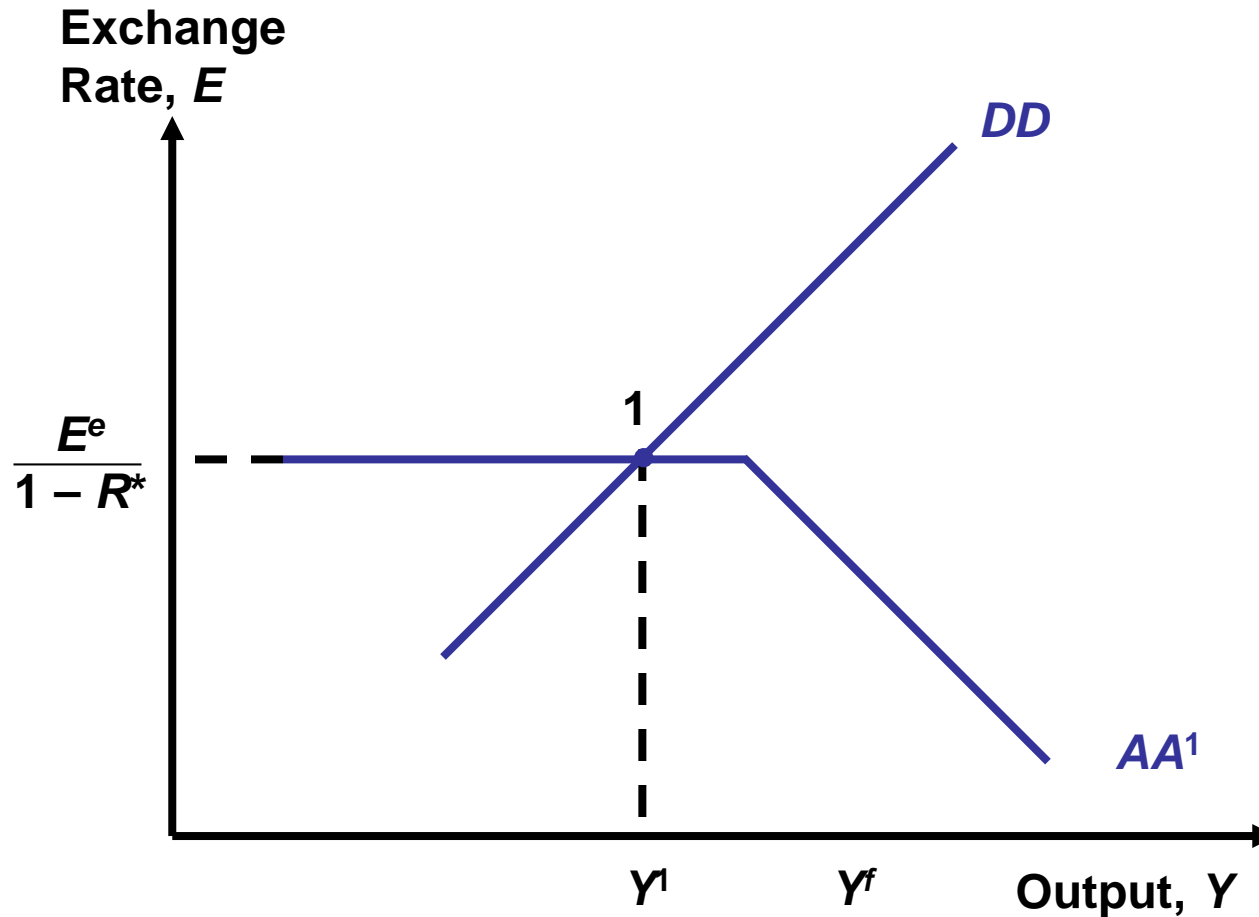
- **Adjustment to Fiscal Policy and Exchange Rate Changes**
    - Fiscal expansion causes P to rise.
        - There is no real appreciation in the short-run
        - There is real appreciation in the long-run
    - Devaluation is neutral in the long-run.

Stabilization Policies With a Fixed Exchange Rate

Figure 17-5: A Low-Output Liquidity Trap

Stabilization Policies With a Fixed Exchange Rate

Figure 17-6: Fixing the Exchange Rate to Restore Full Employment
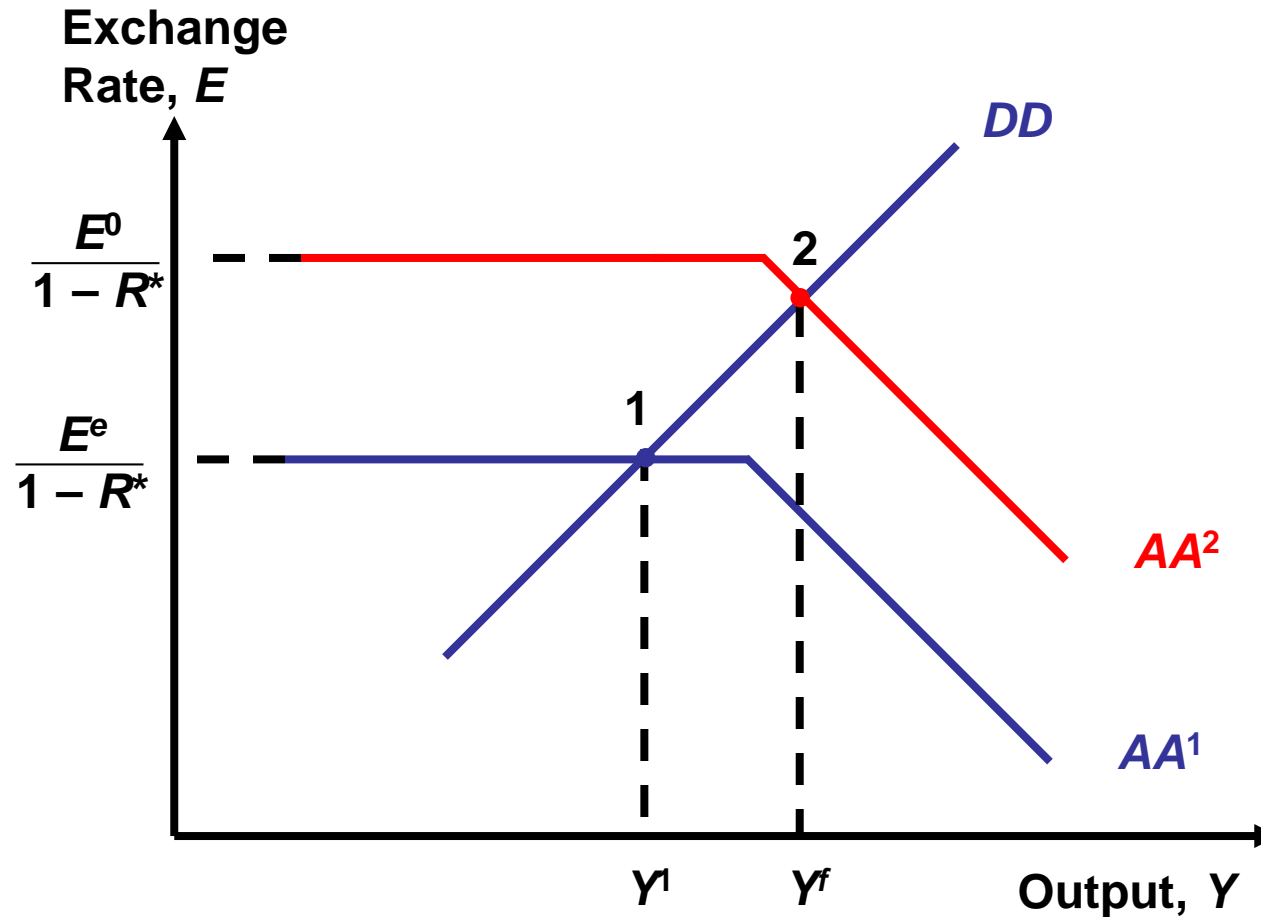
Balance of Payments Crises and Capital Flight

- **Balance of payments crisis**
  - It is a sharp change in official foreign reserves sparked by a change in expectations about the future exchange rate.

Balance of Payments Crises and Capital Flight

Figure 17-7: Capital Flight, the Money Supply, and the Interest Rate
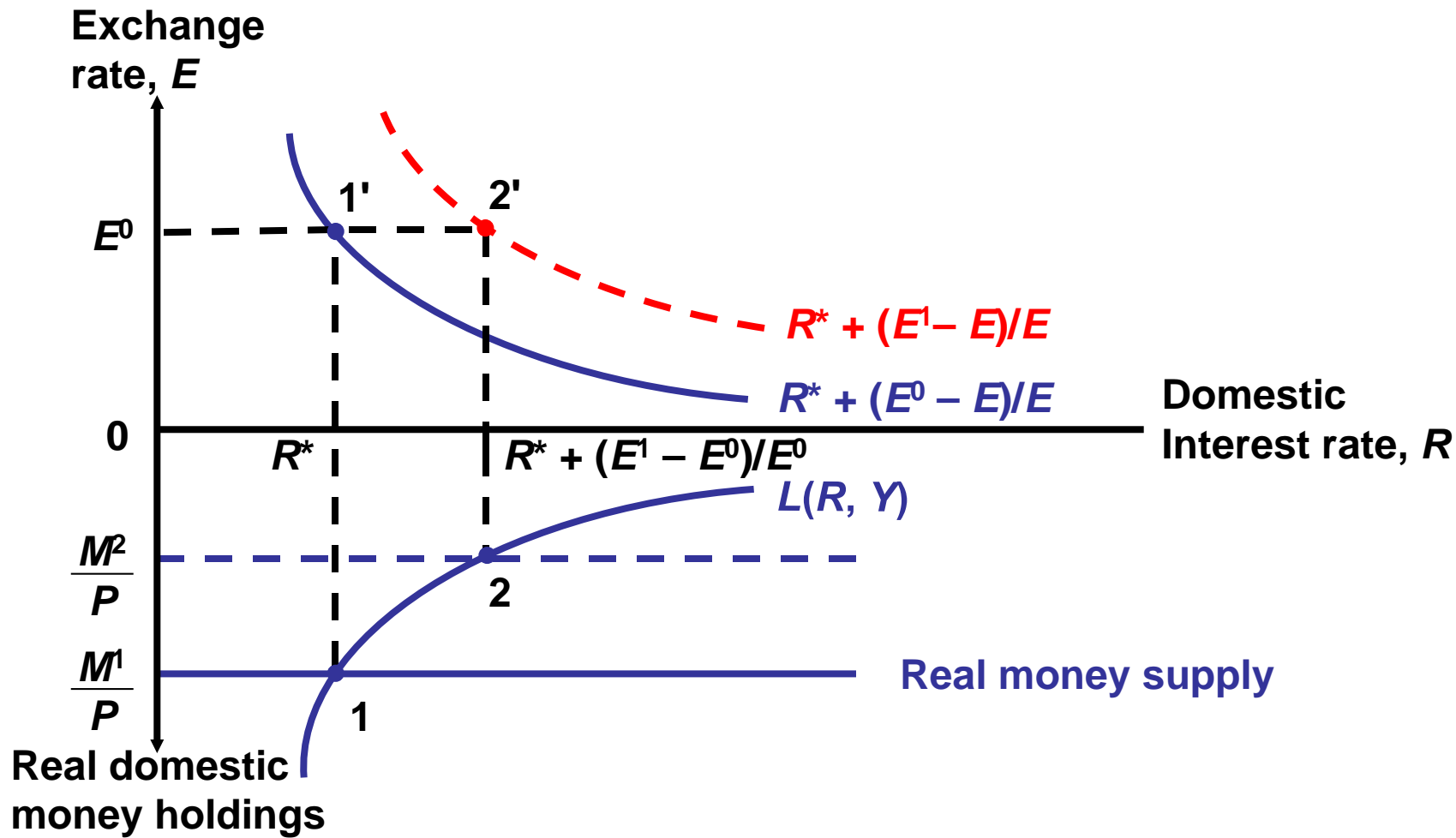
Balance of Payments Crises and Capital Flight

- The expectation of a future devaluation causes:
  - A balance of payments crisis marked by a sharp fall in reserves
  - A rise in the home interest rate above the world interest rate
- An expected revaluation causes the opposite effects of an expected devaluation.

Balance of Payments Crises and Capital Flight

- **Capital flight**
  - The reserve loss accompanying a devaluation scare
    – The associated debit in the balance of payments accounts is a private capital outflow.

- **Self-fulfilling currency crises**
  - It occurs when an economy is vulnerable to speculation.
  - The government may be responsible for such crises by creating or tolerating domestic economic weaknesses that invite speculators to attack the currency.

Managed Floating
and Sterilized Intervention

- Under managed floating, monetary policy is influenced by exchange rate change.

- Perfect Asset Substitutability and the Ineffectiveness of Sterilized Intervention
  - When a central bank carries out a sterilized foreign exchange intervention, its transactions leave the domestic money supply unchanged.

Managed Floating and Sterilized Intervention

- **Perfect asset substitutability**
  - The foreign exchange market is in equilibrium only when the expected return on domestic and foreign currency bonds are the same.
  - Central banks cannot control the money supply and the exchange rate through sterilized foreign exchange intervention.

Managed Floating and Sterilized Intervention

- **Imperfect asset substitutability**
  - Assets' expected returns can differ in equilibrium.
  - Risk is the main factor that may lead to imperfect asset substitutability in foreign exchange markets.
  - Central banks may be able to control both the money supply and the exchange rate through sterilized foreign exchange intervention.

Managed Floating
and Sterilized Intervention

- **Foreign Exchange Market Equilibrium Under Imperfect Asset Substitutability**
  - When domestic and foreign currency bonds are perfect substitutes, the foreign exchange market is in equilibrium only if the interest parity condition holds:

$$R = R^* + (E^e - E)/E \qquad (17\text{-}1)$$

    – This condition does not hold when domestic and foreign currency bonds are imperfects substitutes.

Managed Floating and Sterilized Intervention

- Equilibrium in the foreign exchange market requires that:

$$R = R^* + (E^e - E)/E + \rho \qquad (17\text{-}2)$$

  where:

  > ρ is a **risk premium** that reflects the difference between the riskiness of domestic and foreign bond**s**

- The risk premium depends positively on the stock of domestic government debt:

$$\rho = \rho(B - A) \qquad (17\text{-}3)$$

  where:

  > B is the stock of domestic government debt

  > A is domestic assets of the central bank

Managed Floating and Sterilized Intervention

- **The Effects of Sterilized Intervention with Imperfect Asset Substitutability**

  - A sterilized purchase of foreign assets leaves the money supply unchanged but raises the risk adjusted return that domestic currency deposits must offer in equilibrium.

  - Figure 17-8 illustrates the effects of a sterilized purchase of foreign assets by the central bank.
    - The purchase of foreign assets is matched by a sale of domestic assets (from A^1 to A^2).

Managed Floating and Sterilized Intervention

Figure 17-8: Effect of a Sterilized Central Bank Purchase of Foreign Assets Under Imperfect Asset Substitutability

Exchange rate, *E*

Sterilized purchase of foreign assets

Risk-adjusted domestic-currency return on foreign currency deposits,
$R* + (E^e - E)/E + \rho(B - A^2)$

2'

E^2

1'

E^1

$R* + (E^e - E)/E + \rho(B - A^1)$

0

Domestic Interest rate, *R*

R^1

$L(R, Y)$

$\dfrac{M^s}{P}$

Real money supply

1

Real domestic money holdings
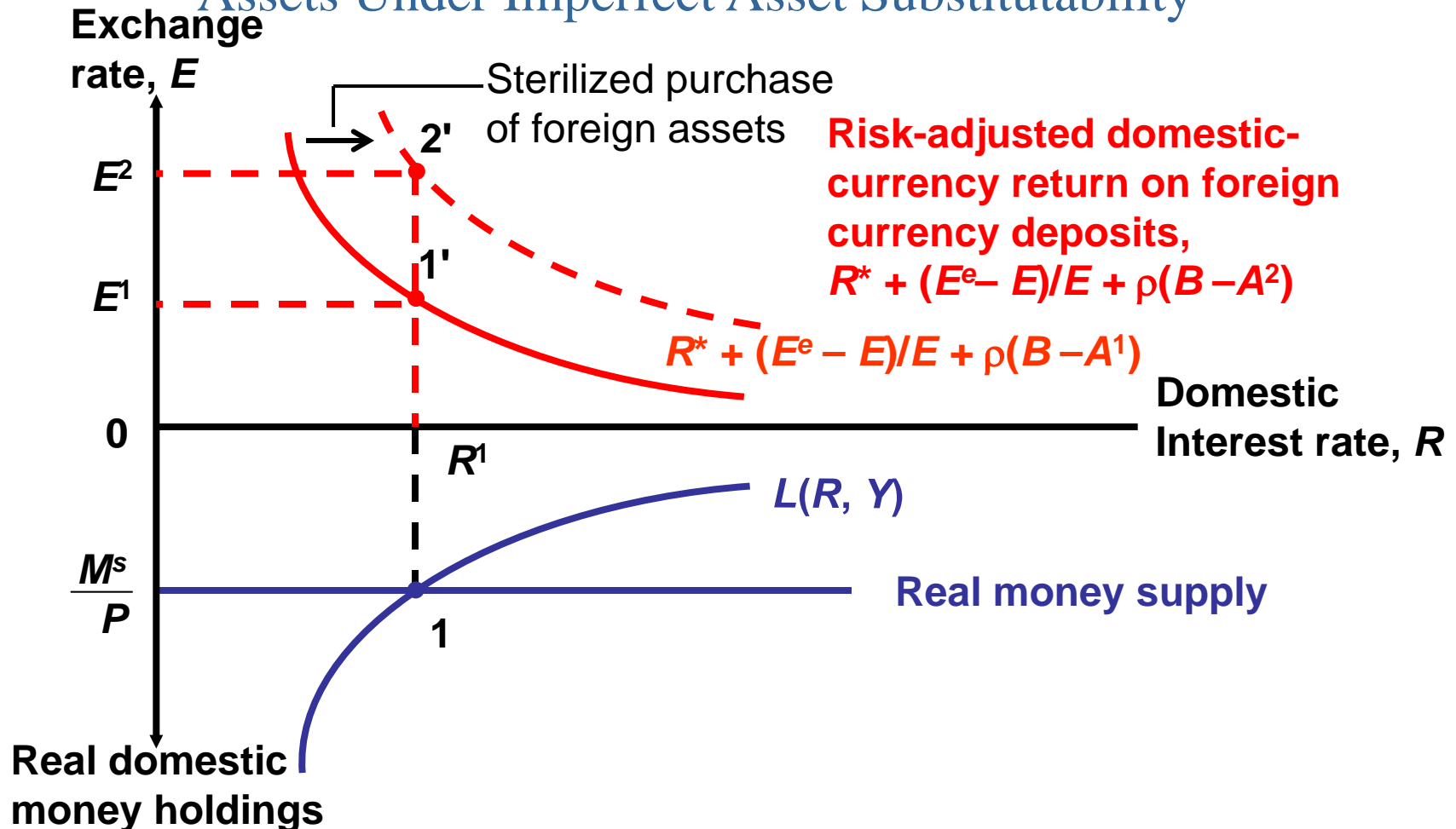
Managed Floating and Sterilized Intervention

■ Evidence on the Effects of Sterilized Intervention

- Empirical evidence provides little support for the idea that sterilized intervention has a significant direct effect on exchange rates.

Managed Floating
and Sterilized Intervention

■ The Signaling Effect of Intervention

- **Signaling effect of foreign exchange intervention**

  – An important complicating factor in econometric efforts to study the effects of sterilization

  – Sterilized intervention may give an indication of where the central bank expects (or desires) the exchange rate to move.

    – This signal can change market views of future policies even when domestic and foreign bonds are perfect substitutes.

Reserve Currencies in the World Monetary System

- Two possible systems for fixing the exchange rates:
  - **Reserve currency standard**
    - Central banks peg the prices of their currencies in terms of a reserve currency.
      - The currency central banks hold in their international reserves.
  - **Gold standard**
    - Central banks peg the prices of their currencies in terms of gold.

Reserve Currencies in the World Monetary System

- The two systems have very different implications about:
  - How countries share the burden of balance of payments financing
  - The growth and control of national money supplies

Reserve Currencies in the World Monetary System

- ■ The Mechanics of a Reserve Currency Standard
  - • The workings of a reserve currency system can be illustrated by the system based on the U.S. dollar set up at the end of World War II.
    - – Every central bank fixed the dollar exchange rate of its currency through foreign exchange market trades of domestic currency for dollar assets.
    - – Exchange rates between any two currencies were fixed.

Reserve Currencies in the World Monetary System

- **The Asymmetric Position of the Reserve Center**
  - The reserve-issuing country can use its monetary policy for macroeconomic stabilization even though it has fixed exchange rates.
  - The purchase of domestic assets by the central bank of the reverse currency country leads to:
    – Excess demand for foreign currencies in the foreign exchange market
    – Expansionary monetary policies by all other central banks
    – Higher world output

The Gold Standard

- Each country fixes the price of its currency in terms of gold.

- No single country occupies a privileged position within the system.

- The Mechanics of a Gold Standard

  - Exchange rates between any two currencies were fixed.

    - Example: If the dollar price of gold is pegged at $35 per ounce by the Federal Reserve while the pound price of gold is pegged at £14.58 per ounce by the Bank of England, the dollar/pound exchange rate must be constant at $2.40 per pound.

The Gold Standard

- **Symmetric Monetary Adjustment Under a Gold Standard**
  - Whenever a country is losing reserves and its money supply shrinks as a consequence, foreign countries are gaining reserves and their money supplies expand.
- **Benefits and Drawbacks of the Gold Standard**
  - Benefits:
    - It avoids the asymmetry inherent in a reserve currency standard.
    - It places constraints on the growth of countries' money supplies.

The Gold Standard

- Drawbacks:
  - It places undesirable constraints on the use of monetary policy to fight unemployment.
  - It ensures a stable overall price level only if the relative price of gold and other goods and services is stable.
  - It makes central banks compete for reserves and bring about world unemployment.
  - It could give gold producing countries (like Russia and South Africa) too much power.

The Gold Standard

- **Bimetallic standard**
  - The currency was based on both silver and gold.
  - The U.S. was bimetallic from 1837 until the Civil War.
  - In a bimetallic system, a country's mint will coin specified amounts of gold or silver into the national currency unit.
    - Example: 371.25 grains of silver or 23.22 grains of gold could be turned into a silver or a gold dollar. This made gold worth $371.25/23.22 = 16$ times as much as silver.
  - It might reduce the price-level instability resulting from use of one of the metals alone.

The Gold Standard

- **The Gold Exchange Standard**
  - Central banks' reserves consist of gold and currencies whose prices in terms of gold are fixed.
    - Each central bank fixes its exchange rate to a currency with a fixed gold price.
  - It can operate like a gold standard in restraining excessive monetary growth throughout the world, but it allows more flexibility in the growth of international reserves.

Summary

- There is a direct link between central bank intervention in the foreign exchange market and the domestic money supply.
  - When a country's central bank purchases (sells) foreign assets, the country's money supply automatically increases (decreases).
- The central bank balance sheet shows how foreign exchange intervention affects the money supply.
- The central bank can negate the money supply effect of intervention through sterilization.

Summary

- A central bank can fix the exchange rate of its currency against foreign currency if it trades unlimited amounts of domestic money against foreign assets at that rate.

- A commitment to fix the exchange rate forces the central bank to sacrifice its ability to use monetary policy for stabilization.

- Fiscal policy has a more powerful effect on output under fixed exchange rates than under floating rates.

- Balance of payments crises occur when market participants expect the central bank to change the exchange rate from its current level.

Summary

- Self-fulfilling currency crises can occur when an economy is vulnerable to speculation.

- A system of managed floating allows the central bank to retain some ability to control the domestic money supply.

- A world system of fixed exchange rates in which countries peg the prices of their currencies in terms of a reserve currency involves a striking asymmetry.

- A gold standard avoids the asymmetry inherent in a reserve currency standard.
  - A related arrangement was the bimetallic standard based on both silver and gold.

Appendix I: Equilibrium in the Foreign Exchange Market with Imperfect Asset Substitutability

Figure 17AI-1: The Domestic Bond Supply and the Foreign Exchange Risk Premium Under Imperfect Asset Substitutability
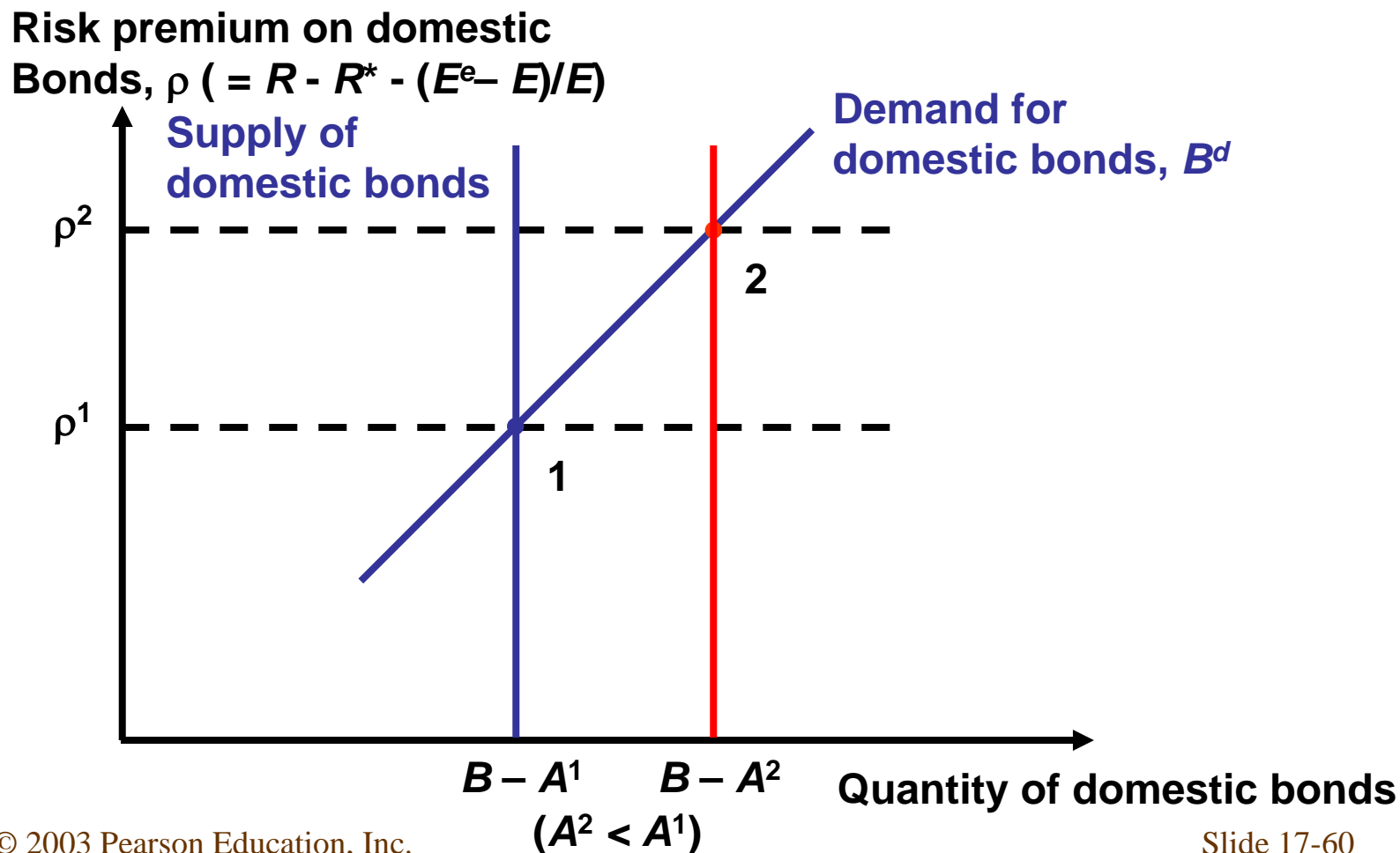
Appendix III: The Timing of Balance of Payments Crises

Figure 17AIII-1: The Timing of a Balance of Payments Crisis