Lecture 5: Intermediate macroeconomics, autumn 2014

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Literature: ***Krugman–Obstfeld–Melitz, chapters 16 and 17.***

Topics

- **Absolute and relative purchasing power parity (PPP)**
- **The Balassa-Samuelson effect**
- **The monetary approach to the exchange rate**
- **The Fisher effect**
- **The real exchange rate**
- **The relationship between the real exchange rate and the current account**
- **The Marshall-Lerner condition and the J-curve**
- **Short-run equilibrium in a small open economy with a flexible exchange rate (the AA-DD model)**
- **Stabilisation policy in the AA-DD model**

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Purchasing Power parity (PPP)

- **Theory of long-run exchange rate determination**
- **Focus on the importance of goods markets (as opposed to asset markets)**
- **Developed by Swedish economist Gustaf Cassel (1866-1945) in 1920**

Law of one price for a single good *i*:

$$P^i_{US} = E_{\$/€} \times P^i_E$$

$$E_{\$/€} = P^i_{US} \,/\, P^i_E$$

Absolute PPP:

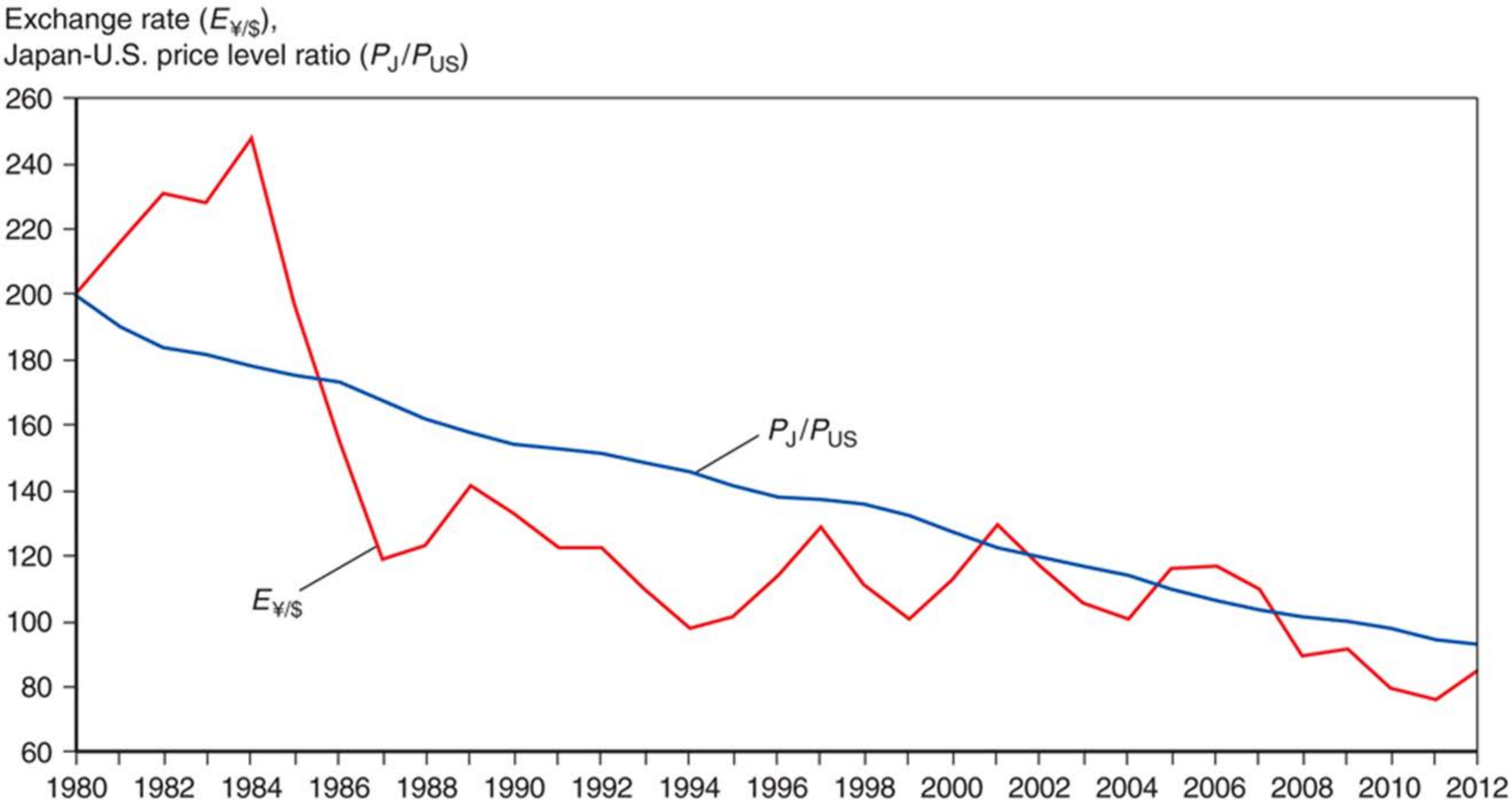
$$E_{\$/€} = P_{US} \,/\, P_E$$

Relative PPP:

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

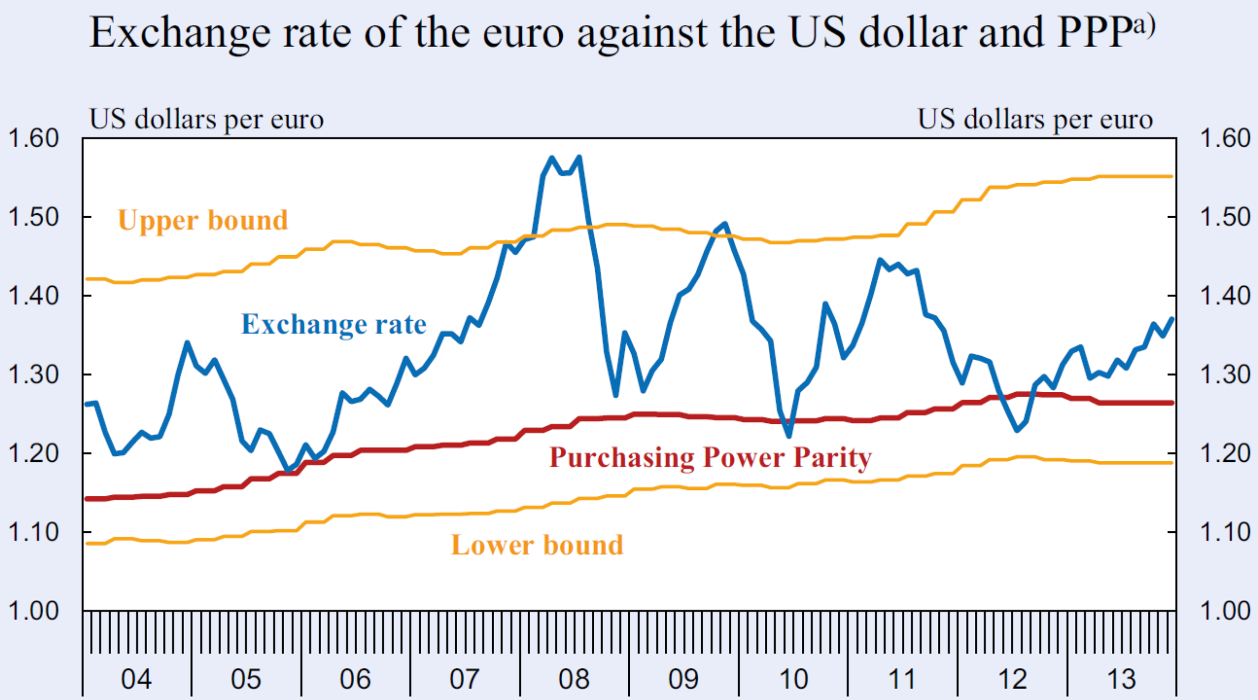
$$\pi_t = (P_t - P_{t\text{-}1}) \,/\, P_{t\text{-}1}$$

Fig. 16-2: The Yen/Dollar Exchange Rate and Relative Japan-U.S. Price Levels, 1980–2009



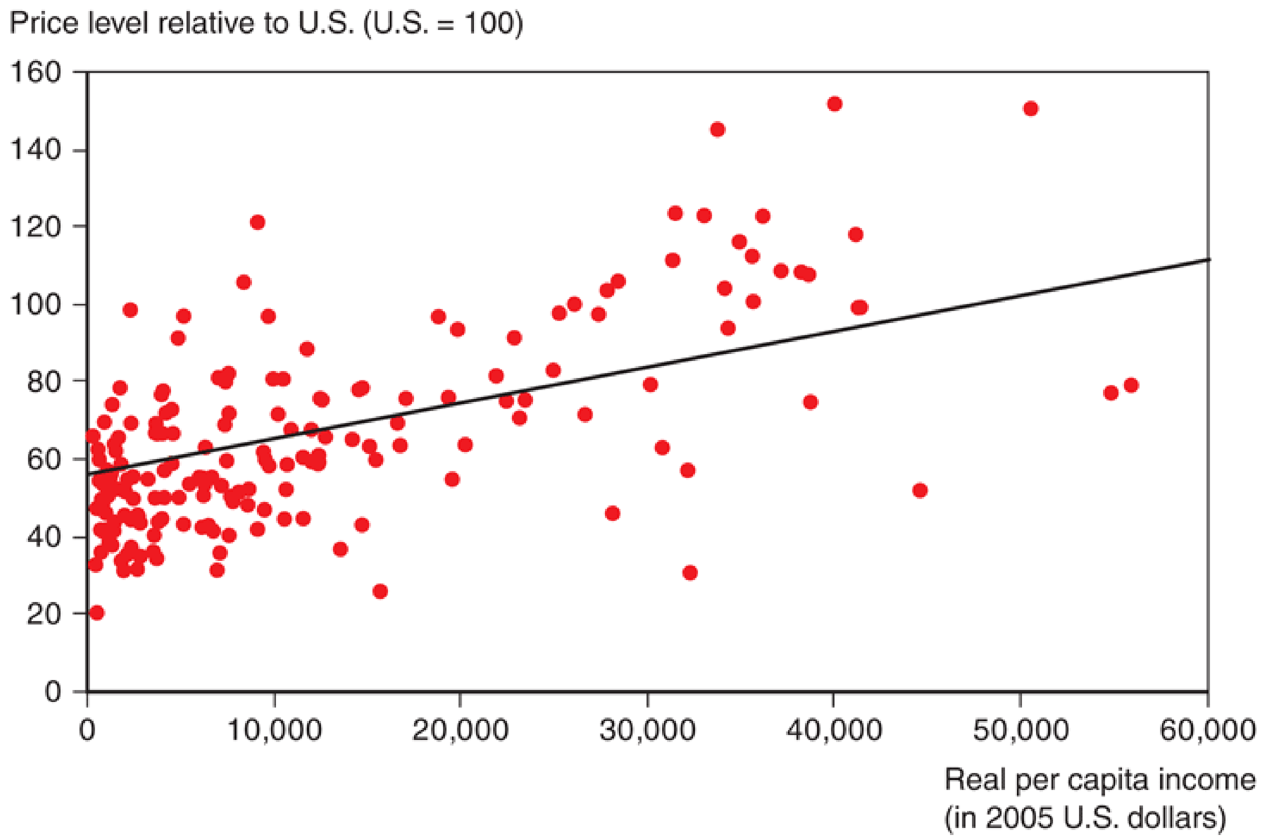
Source: IMF, *International Financial Statistics*. Exchange rates and price levels are end-of-year data.

<u>Figure 1.24 EEAG report 2014</u>



a) The nominal exchange rate is based on monthly data, while the exchange rate based on purchasing power parity (PPP) is given at a quarterly frequency. The PPP upper bound represents the 75th percentile of the euro country-specific PPP estimates vis-à-vis the US dollar; the lower bound the 25th percentile. The US dollar-euro PPP rate is calculated as the GDP-weighted average of the euro country-specific PPP estimates vis-à-vis the US dollar.
Source: OECD Economic Outlook 93, June 2013, European Central Bank, last accessed on 3 January 2014.

Fig. 16-3: Price Levels and Real Incomes, 2010



Source: Penn World Table, version 7.1.

<u>Causes of deviations from PPP</u>

1. **Transport costs and trade barriers**
2. **Differences in consumption baskets**
3. **Imperfect competition – price discrimination - pricing to market**

<u>Different types of goods and services</u>

- **Tradables or traded goods**
- **Non-tradables or non-traded goods (primarily services and building)**

<u>The Balassa-Samuelson effect</u>

The price level is higher in countries with high per capita income, because prices of non-tradables are higher.

(1) $P_T = EP_T^*$ **(international goods arbitrage)**

(2) $W_T = P_T \cdot MPL_T$ **(profit maximisation in tradables sector)**

(3) $W_N = W_T$ **(homogenous labour market)**

(4) $P_N = W_N / MPL_N$ **(price = marginal cost for non-tradables)**

(5) $P_C = P_T{}^{\alpha} P_N{}^{1-\alpha}$ **(consumer price index)**

<u>The Balassa-Samuelson effect implies a higher relative price for non-tradables in rich than in poor countries:</u>

Substitutions from the above equations imply:

$$\frac{P_N}{P_T} = \frac{1}{P_T} \cdot \frac{W_N}{MPL_N} = \frac{1}{P_T} \cdot \frac{W_T}{MPL_N} = \frac{P_T \cdot MPL_T}{P_T \cdot MPL_N} = \frac{MPL_T}{MPL_N}$$

$$\frac{MPL_T}{MPL_N} \uparrow \;\Rightarrow\; \frac{P_N}{P_T} \uparrow$$

<u>The Balassa-Samuelson effect cont.</u>

- **Compare countries with the same currency (for example countries in the euro area)**
- P_T **is the same everywhere because of goods arbitrage**
- MPL_T **is higher in rich than in poor countries (more real and human capital gives higher productivity).**
- **Higher** MPL_T **implies higher** $W_T = P_T \cdot MPL_T$.
- **A homogenous labour market implies** $W_N = W_T$
- **Differences in** MPL_N **(the marginal product of labour in the non-tradables sector) between countries are small (a hair cut takes more or less the same time everywhere)**
- **Because** $P_N = W_N / MPL_N$, **the price level for non-tradables must be higher in rich than in poor countries**
- **Hence** P_C **(CPI) must be higher.**

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<u>The monetary approach to the exchange rate</u>

$$E = P_{US} \;/\; P_E$$

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

$$P_E = M^S_E \;/\; L\,(R_{€}, Y_E)$$

<u>The fundamental exchange rate equation</u>

$$E = P_{US}/P_E = (M^S_{US}/M^S_E) \times [L(R_{€}, Y_E)/L(R_{\$}, Y_{US})]$$

An increase in money supply in the US relative to Europe $(M^S_{US} \;/\; M^S_E \uparrow)$ causes a nominal depreciation of the dollar ($E\uparrow$).

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<u>The Fisher effect</u>

(1) $R_{\$} = R_{€} + (E^{e} - E) / E$ **Interest rate parity**

(2) $\dfrac{E^{e} - E}{E} = \pi^{e}_{US} - \pi^{e}_{E}$ **Relative PPP**

Substitution of (2) in (1):

$$R_{\$} - R_{€} = \pi^{e}_{US} - \pi^{e}_{E}$$

<u>The Fisher effect</u>: a 1 percentage point rise in inflation in one country causes a 1 percentage point increase in the nominal interest rate.

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<u>Figure 5-3: Inflation and nominal interest rates over time</u>

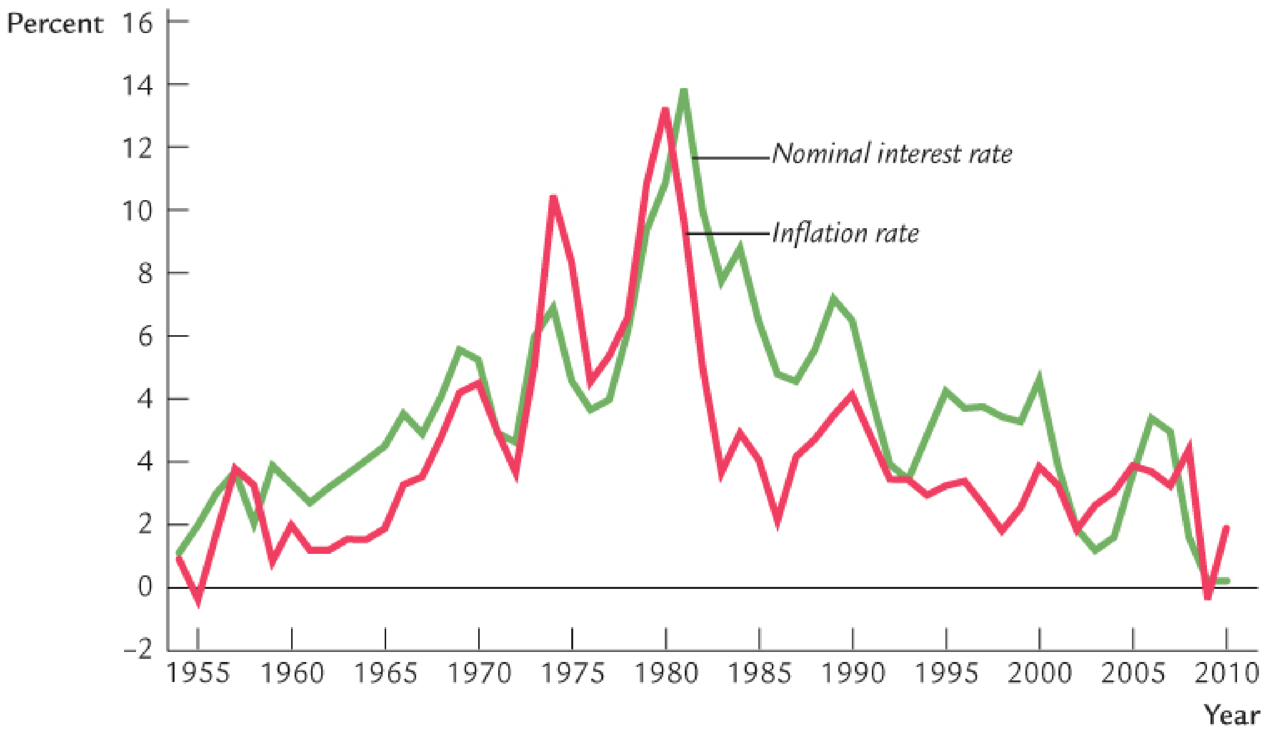
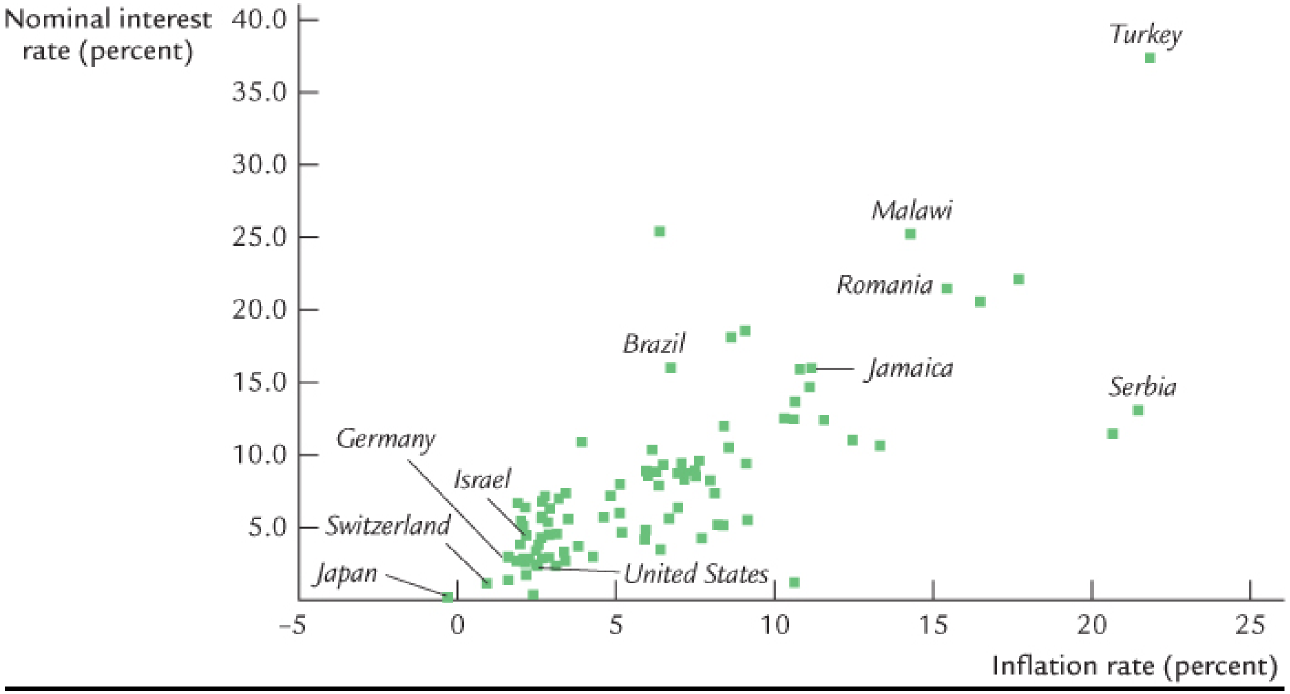


Figure 5-4: Inflation and nominal interest rates across countries



Interest rate differentials and real exchange rate changes

Definition of real exchange rate: $q = EP_E / P_{US}$

Expected real exchange rate change:

$$(q^e - q) / q = (E^e - E) / E + \pi^e_E - \pi^e_{US}$$

Interest rate parity: $(E^e - E) / E = R_\$ - R_€$

Substitution implies:

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

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

Nominal interest rate differential = inflation differential + real depreciation

$$(R_\$ - \pi^e_{US}) - (R_€ - \pi^e_E) = (q^e - q) / q$$

$$r^e_{US} - r^e_E = (q^e - q) / q$$

***r* = real interest rate**

Real interest rate differential = real depreciation (this is called real interest rate parity)

<u>A short-run general equilibrium model for an open economy with a flexible exchange rate</u>

Aggregate demand for domestically produced goods

$D = C + G + I + CA$

$C = C(Y - T)$	**Consumption function**
$G = \overline{G}$	**Exogenous government expenditure**
$T = \overline{T}$	**Exogenous lump-sum tax**
$I = \overline{I}$	**Exogenous investment**

$CA = EX - IM = EX - qIM^*$

$q = \frac{EP^*}{P} =$ **the real exchange rate**

The current account (net exports) should be measured in terms of the same numéraire (here domestic goods). So *IM* is imports measured in terms of domestic goods. *IM is imports measured in terms of foreign goods.**

$EX = EX(q, Y^*)$

$IM^* = IM^*(q, Y - T)$

$CA = EX(q, Y^*) - qIM^*(q, Y - T) = CA(q, Y^*, Y - T)$

A real depreciation ($q\uparrow$) need not improve the current account ($CA\uparrow$). <u>Volume effects</u> on exports and imports work in this direction, but the <u>value effect</u> on imports works in the reverse direction.

Marshall-Lerner condition

A real depreciation will increase net exports if the Marshall-Lerner condition holds.

The price elasticity of exports + the price elasticity of imports > 1

Then the volume effects dominate the value effect for imports.

All elasticities are defined to be positive.

Mathematical derivation of Marshall-Lerner condition

$$CA(q,\ Y^*,\ Y-T)\ =\ EX(q,\ Y^*)\ -\ qIM^*(q,\ Y-T)$$

Wanted: a condition for when $\dfrac{dCA}{dq} > 0$

Recall the rule of differentiation for a product

$$\frac{d\left[v(x)u(x)\right]}{dx} = v_x(x)u(x) + u_x(x)v(x)$$

This implies that $d\dfrac{\{qIM^*(q,\ Y-T)\}}{dq} = IM^*(q,\ Y-T) + qIM_q^*(q,\ Y-T)$

Hence: $\dfrac{dCA}{dq} = EX_q - IM^* - qIM_q^*$

Multiply the equation by *q/EX*.

$$\frac{q}{EX} \times \frac{dCA}{dq} = \frac{qEX_q}{EX} - \frac{q^2IM_q^*}{EX} - \frac{qIM^*}{EX}$$

Assume that *CA* = 0 initially, so that *EX* = *qIM*=IM*. Then:

$$\frac{q}{EX} \times \frac{dCA}{dq} = \frac{qEX_q}{EX} - \frac{qIM_q^*}{IM^*} - 1$$

$$\frac{dCA}{dq} > 0 \Leftrightarrow \frac{qEX_q}{EX} - \frac{qIM_q^*}{IM^*} > 1$$

$$\frac{qEX_q}{EX} = \frac{q}{EX} \times \frac{\partial EX}{\partial q} = \eta = \text{price elasticity of exports}$$

$$-\frac{qIM_q^*}{IM^*} = -\frac{q}{IM^*} \times \frac{\partial IM^*}{\partial q} = \eta^* = \text{price elasticity of imports}$$

All price elasticities have been defined so that they are positive.

$\because\ \eta + \eta^* > 1 \Leftrightarrow dCA/dq > 0.$

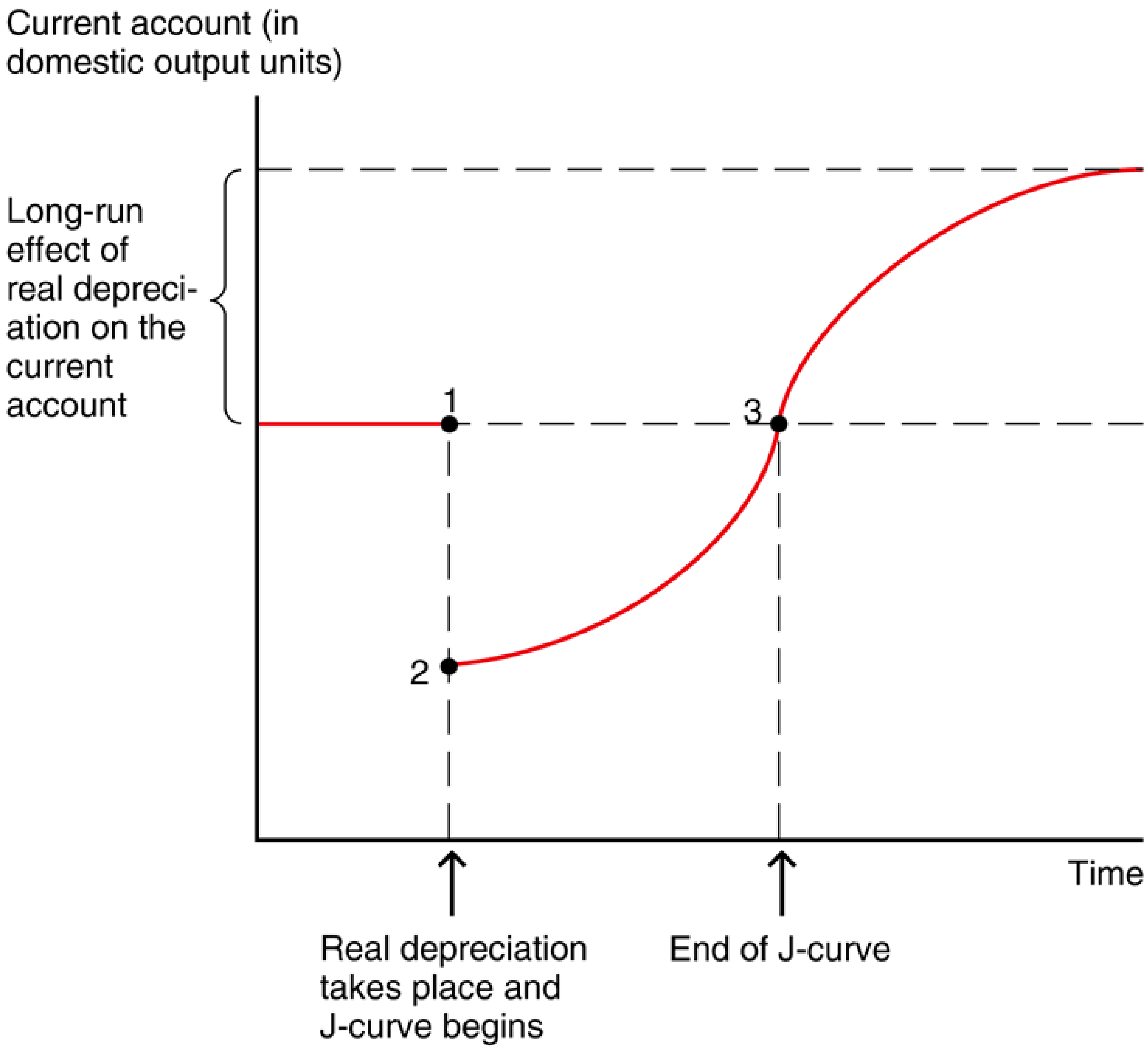
Table 17A2-1: Estimated Price Elasticities for International Trade in Manufactured Goods

TABLE 17A2-1 **Estimated Price Elasticities for International Trade in Manufactured Goods**

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

Source: 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.

Fig. 17-18: The J-Curve



Aggregate demand

Aggregate demand is given by:

$$D = C(Y-T) + G + I + CA\left(\frac{EP^*}{P}, Y^*, Y-T\right) \Rightarrow$$

This implies:

$$D = D\left(\frac{EP^*}{P}, Y-T, G, I, Y^*\right)$$

$$\frac{EP^*}{P}\uparrow \Rightarrow D\uparrow$$

$$Y-T\uparrow \Rightarrow D\uparrow$$

$$G\uparrow \Rightarrow D\uparrow$$

$$I\uparrow \Rightarrow D\uparrow$$

$$Y^*\uparrow \Rightarrow D\uparrow$$

Fig. 17-1: Aggregate Demand as a Function of Output

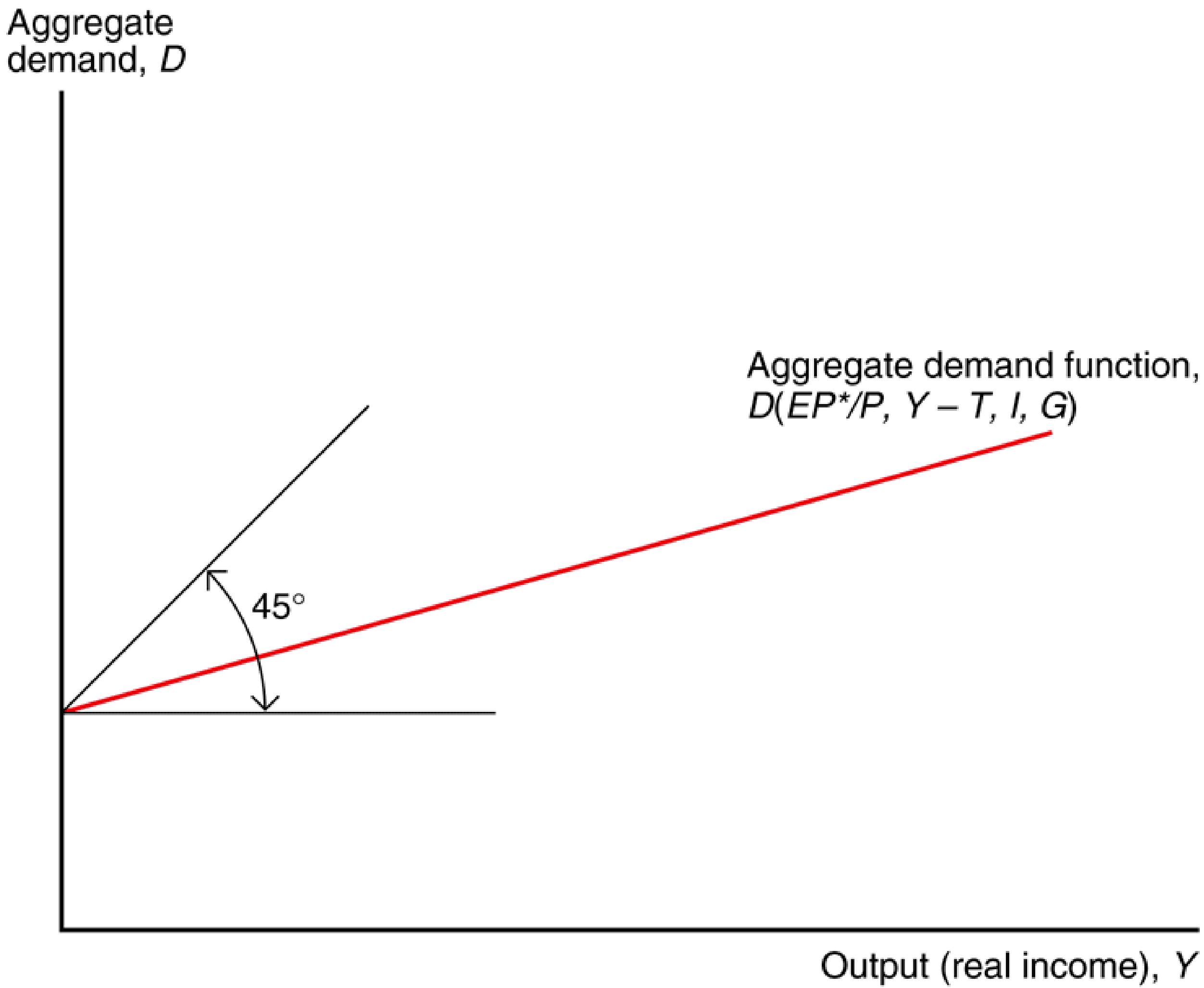


Fig. 17-2: The Determination of Output in the Short Run

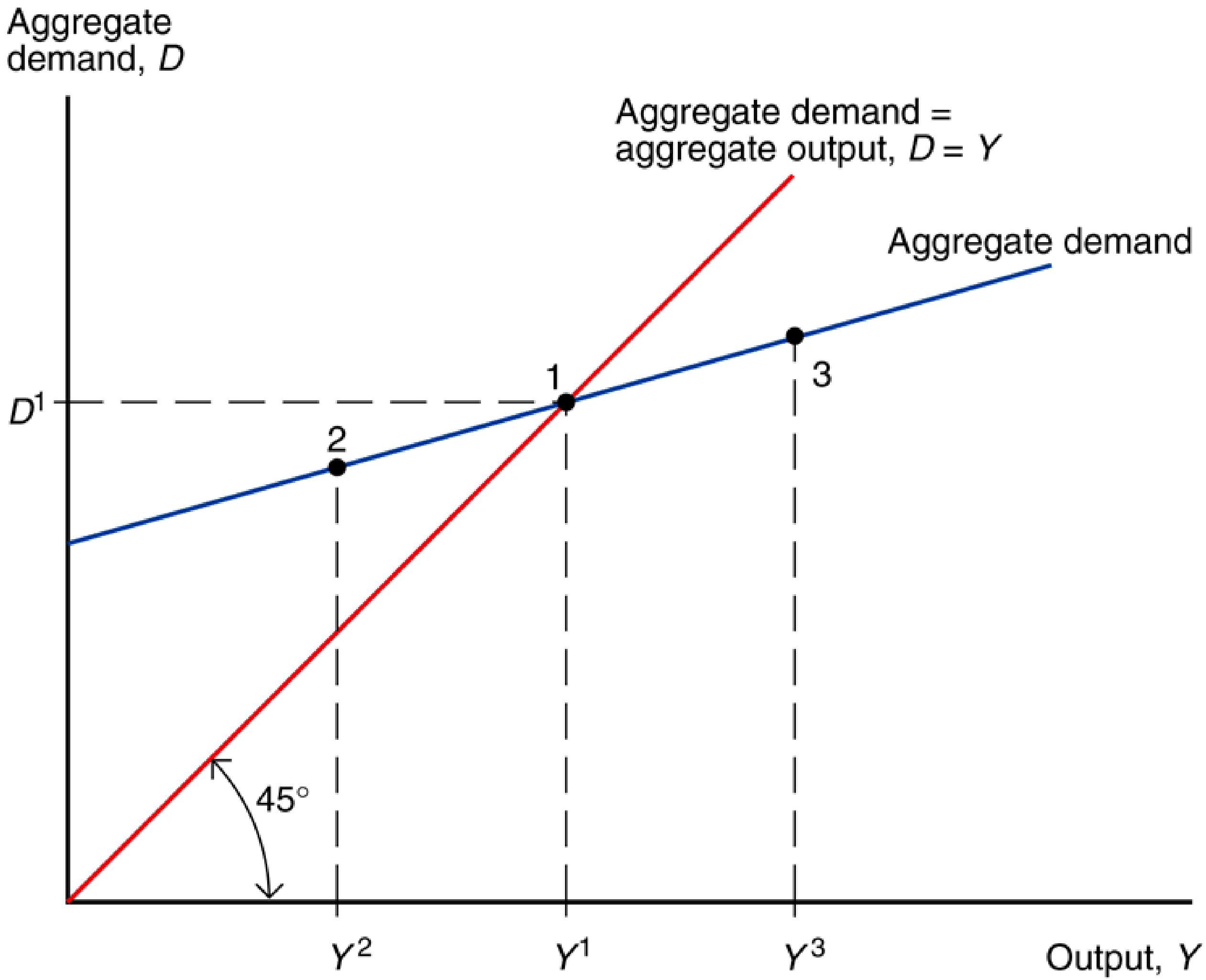


Fig. 17-3: Output Effect of a Currency Depreciation with Fixed Output Prices

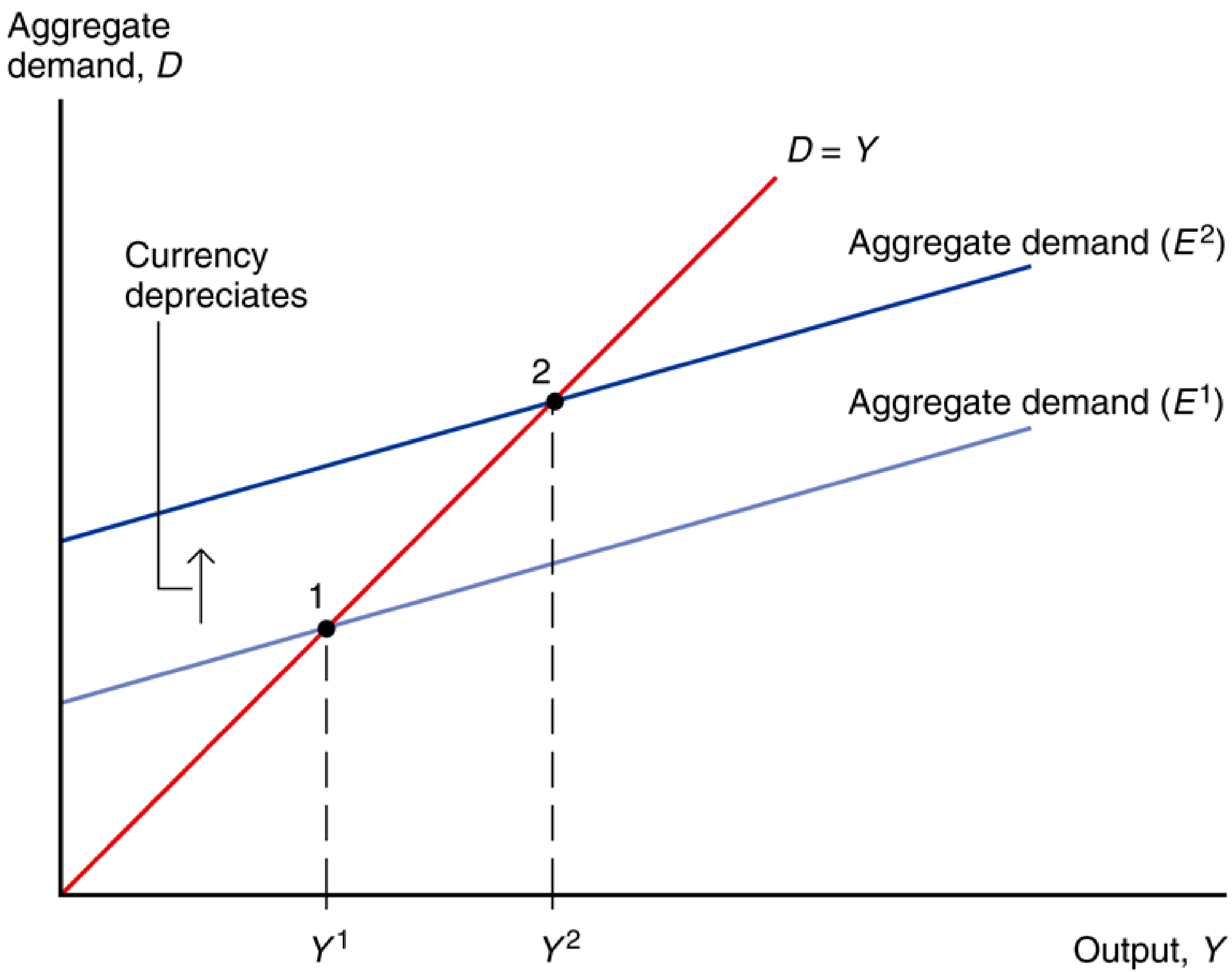


Fig. 17-4: Deriving the *DD* Schedule

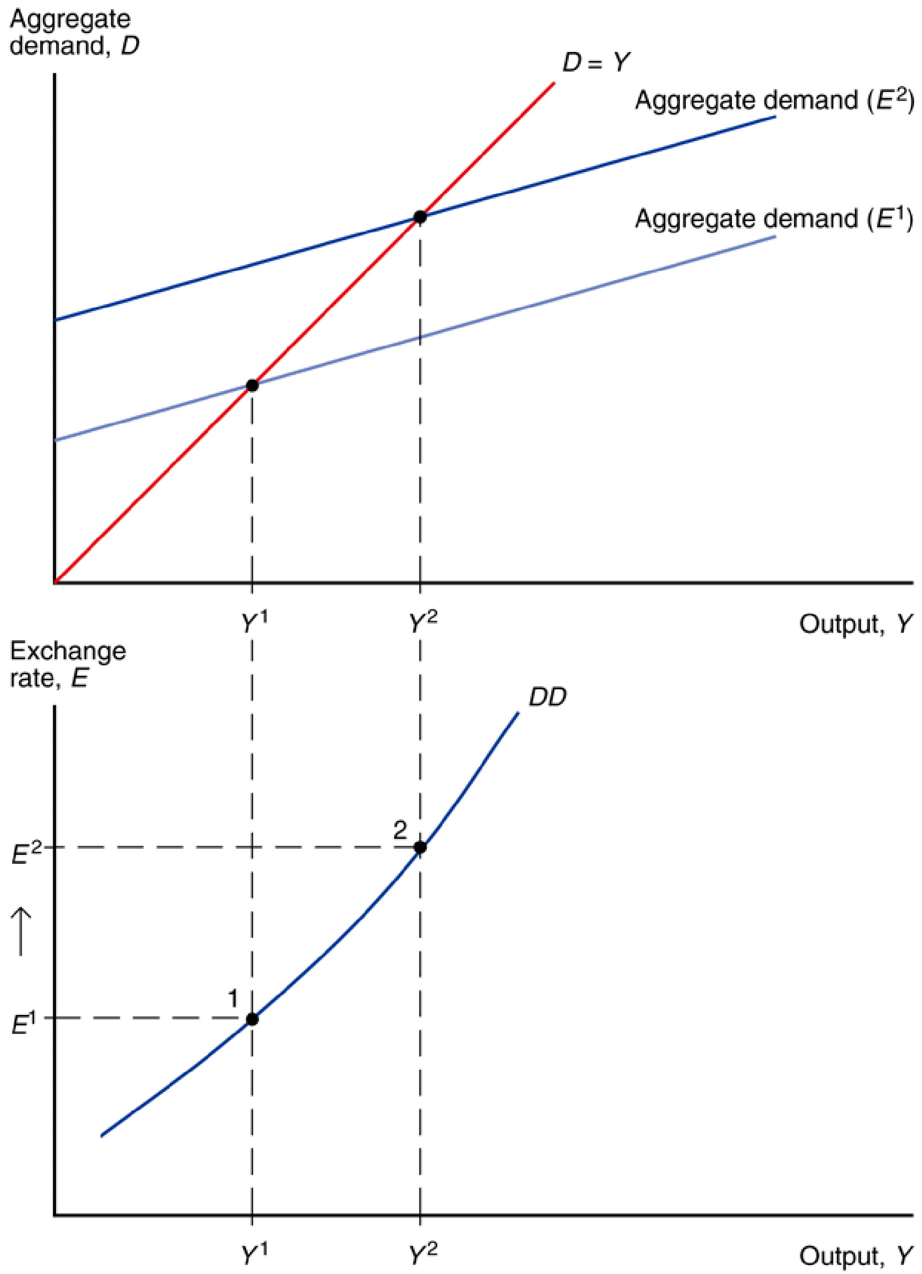
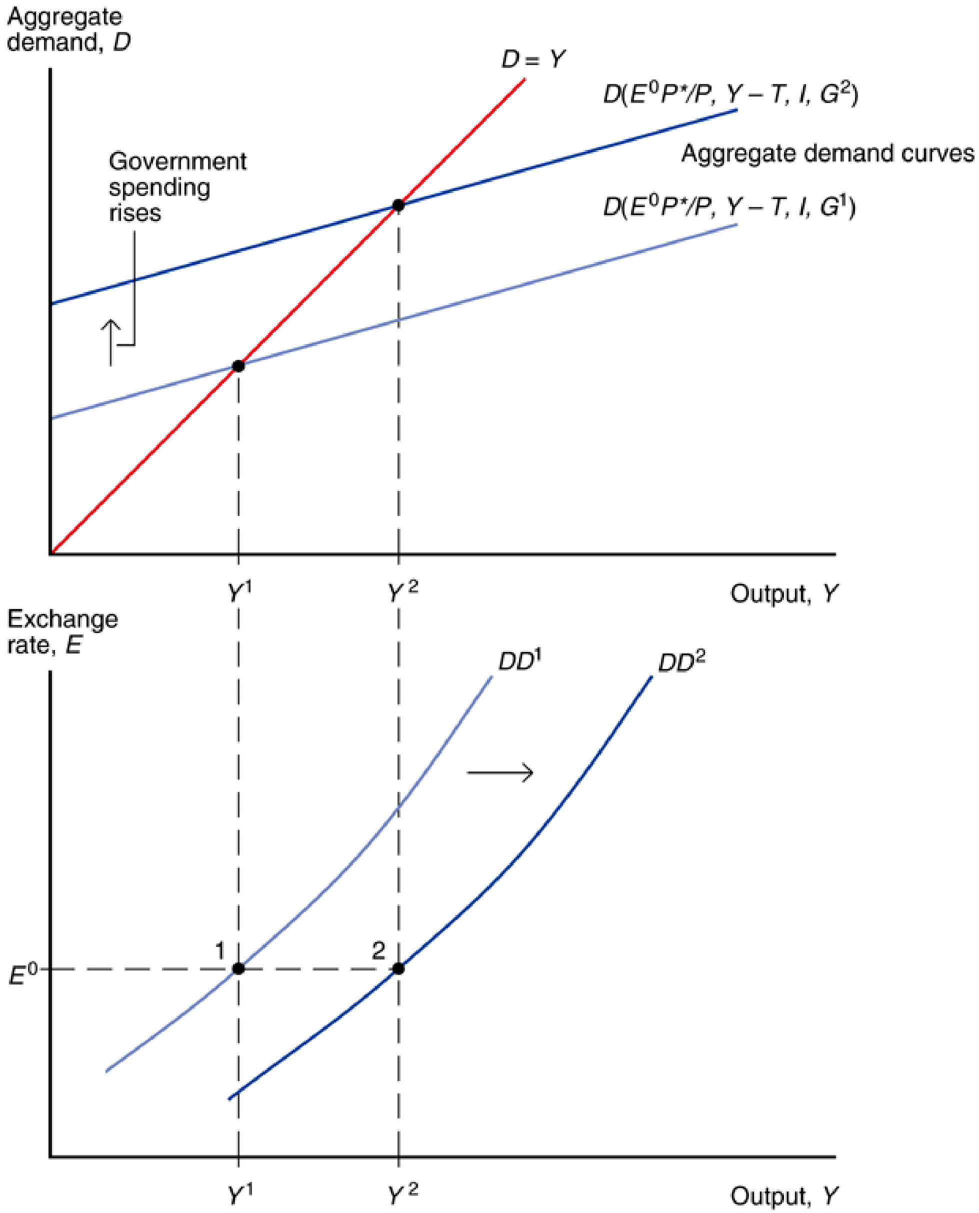


Fig. 17-5: Government Demand and the Position of the *DD* Schedule



Changes shifting the DD-curve to the right

1. **An increase in government expenditure (*G*↑)**
2. **A reduction in the tax (*T*↓)**
3. **An increase in investment (*I*↑)**
4. **A reduction in the domestic price level (*P*↓)**
5. **An increase in the foreign price level (*P**↑)**
6. **An increase in foreign income (*Y**↑)**
7. **A reduction in the savings rate (*s*↓)**
8. **A shift in expenditure from foreign to domestic goods (increased relative demand for domestic goods)**

Equilibrium in asset markets

1. Foreign currency market (interest rate parity)

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

2. Money market

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

Fig. 17-6: Output and the Exchange Rate in Asset Market Equilibrium

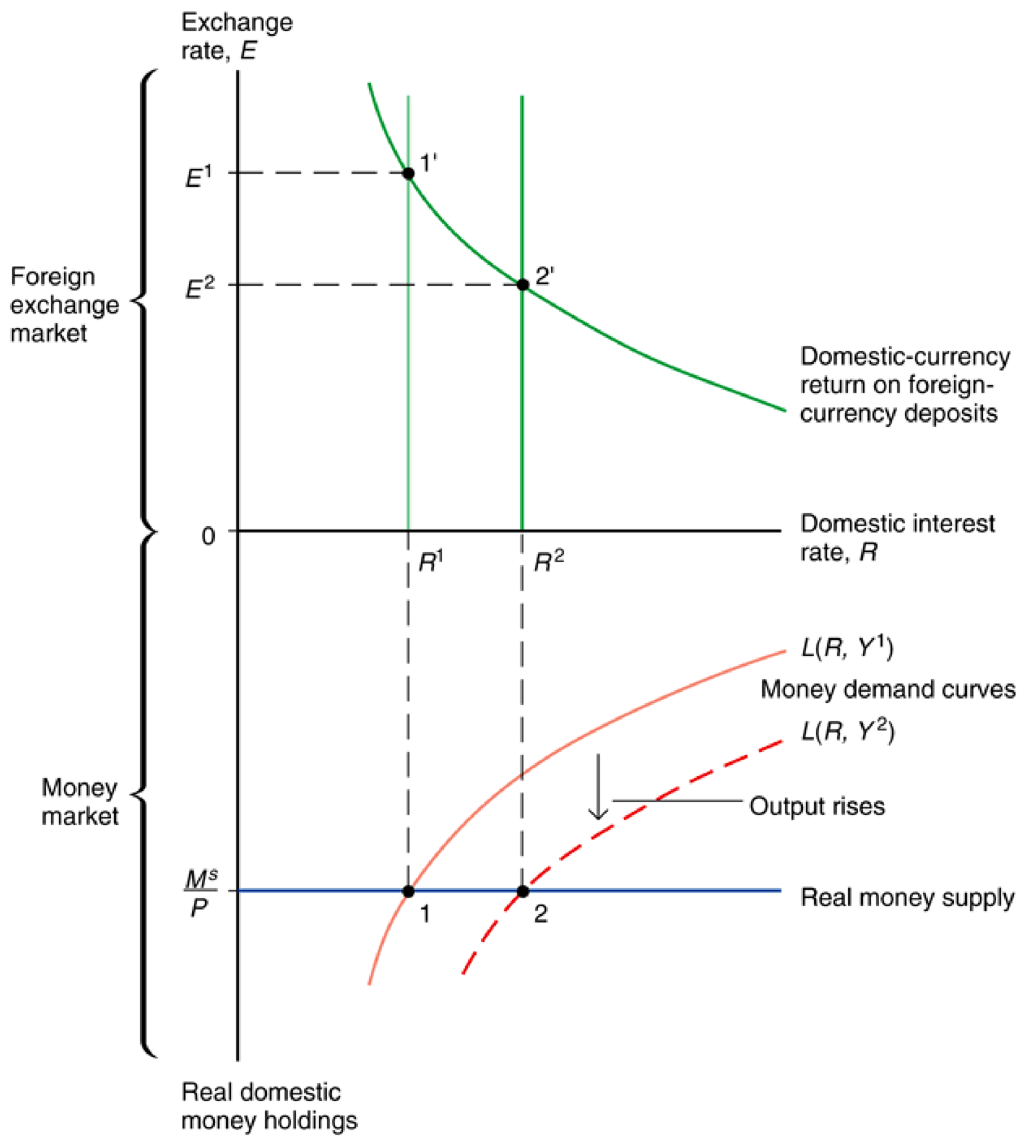
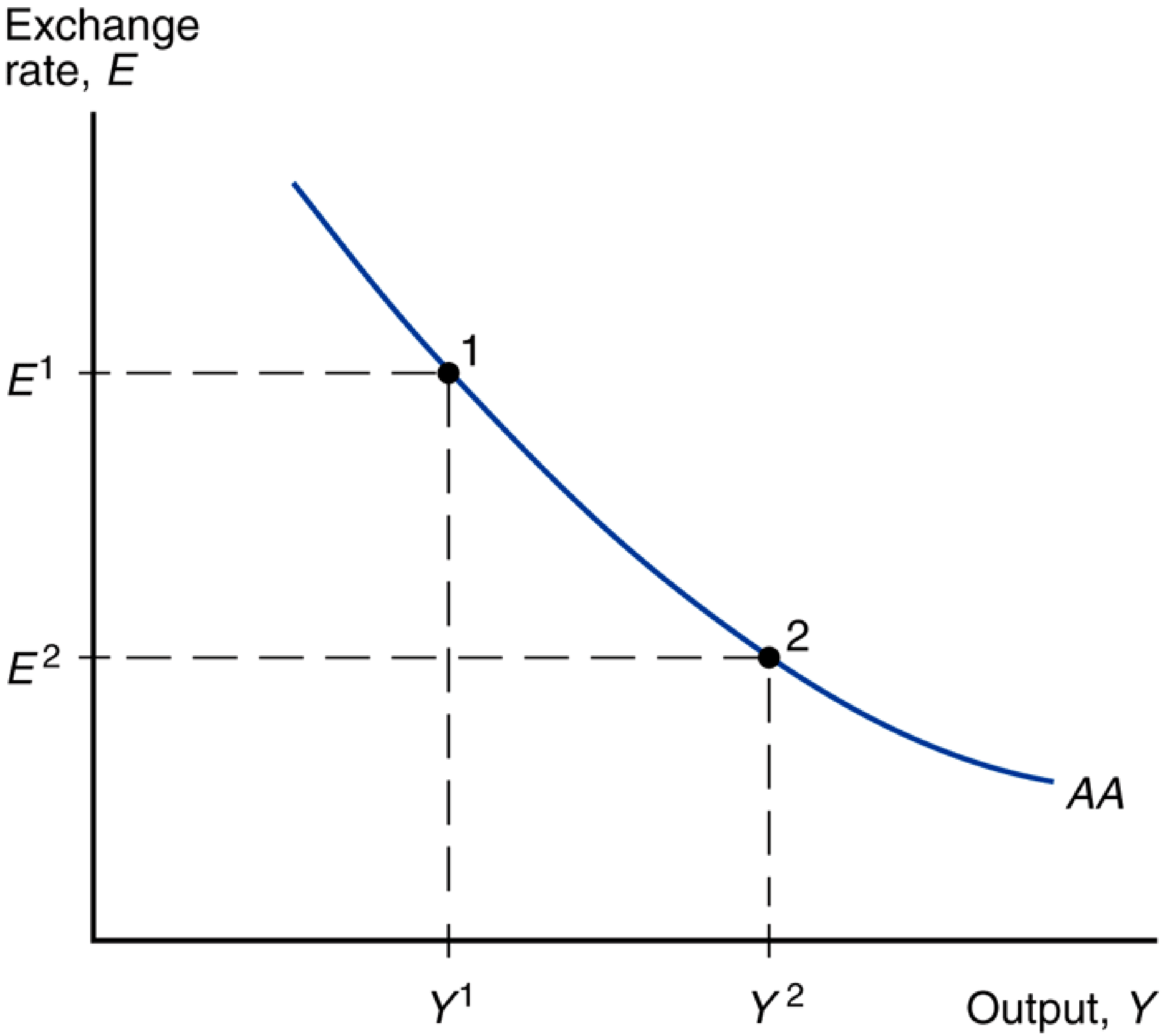


Fig. 17-7: The *AA* Schedule



<u>Factors shifting the AA-curve upwards</u>

1. **An increase in money supply ($M^s\uparrow$)**
2. **A reduction in the price level ($P\downarrow$)**
3. **An expected future depreciation ($E^e\uparrow$)**
4. **A higher foreign interest rate ($R^*\downarrow$)**
5. **A reduction in domestic money demand**

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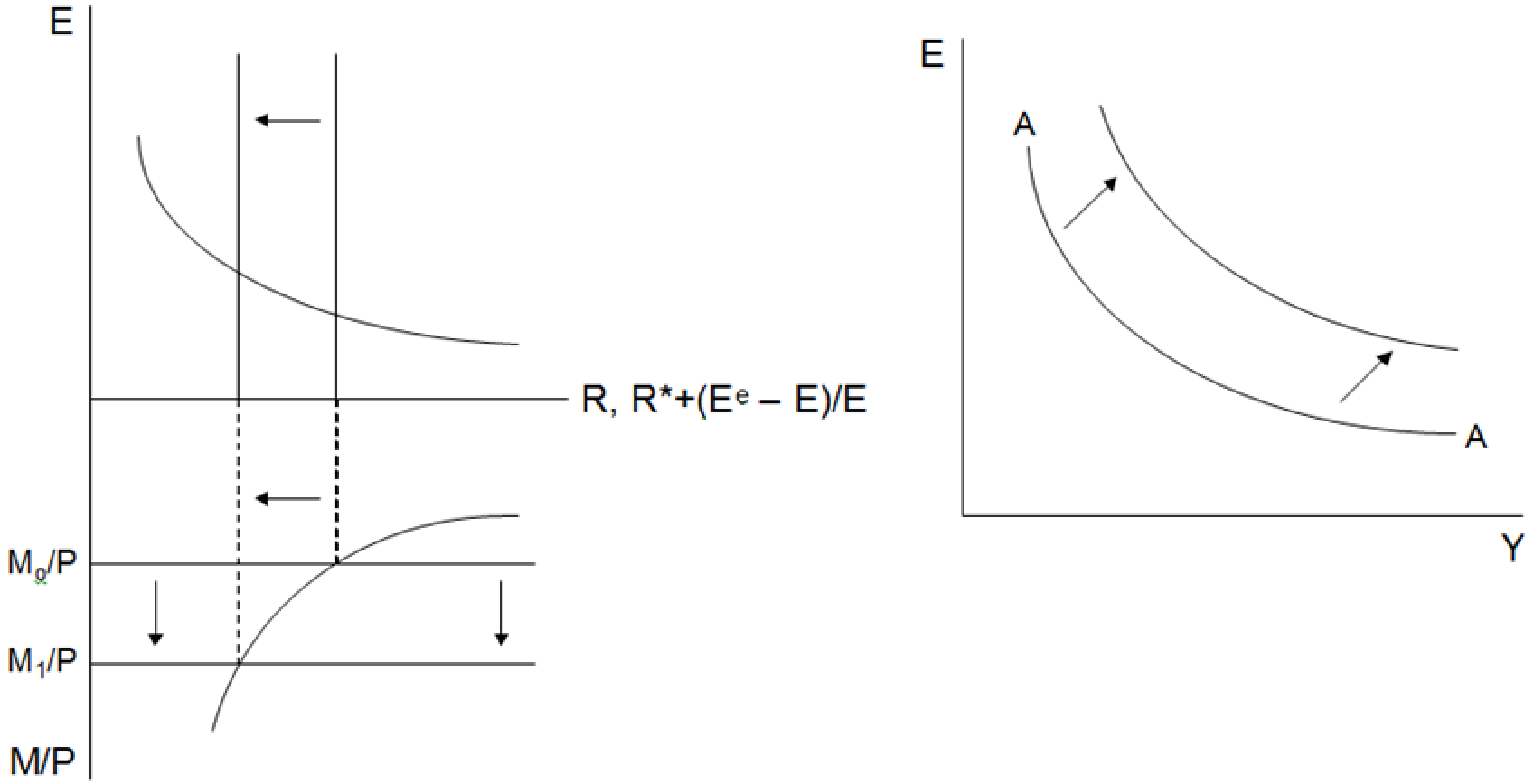
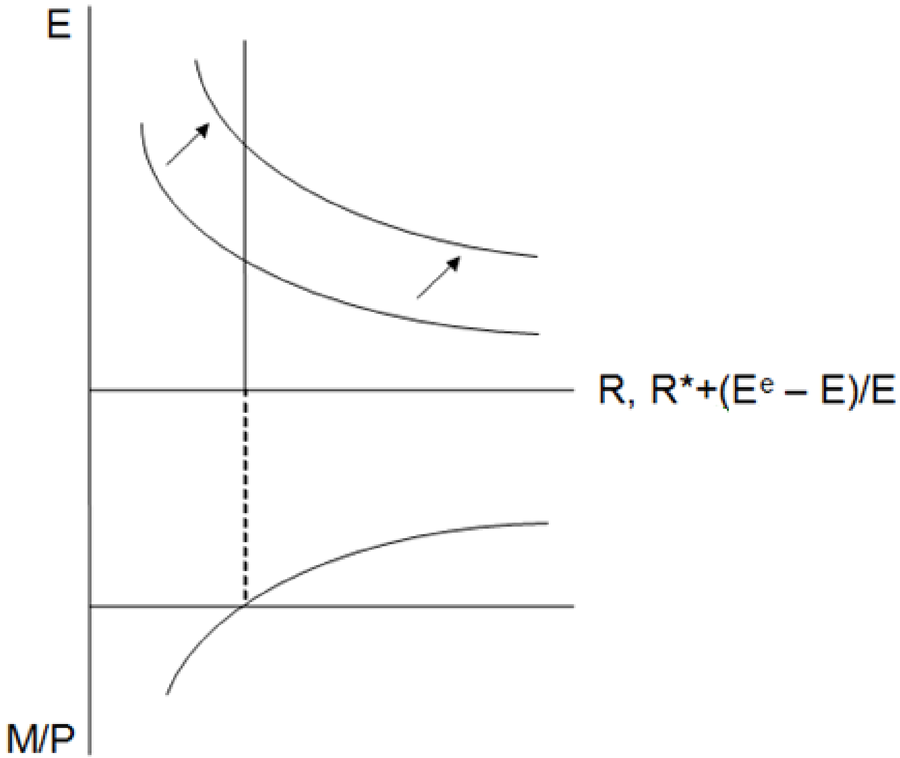
AN INCREASE IN MONEY SUPPLY, A REDUCTION OF THE PRICE LEVEL



AN EXPECTED DEPRECIATION, AN INCREASE IN THE FOREIGN INTEREST RATE



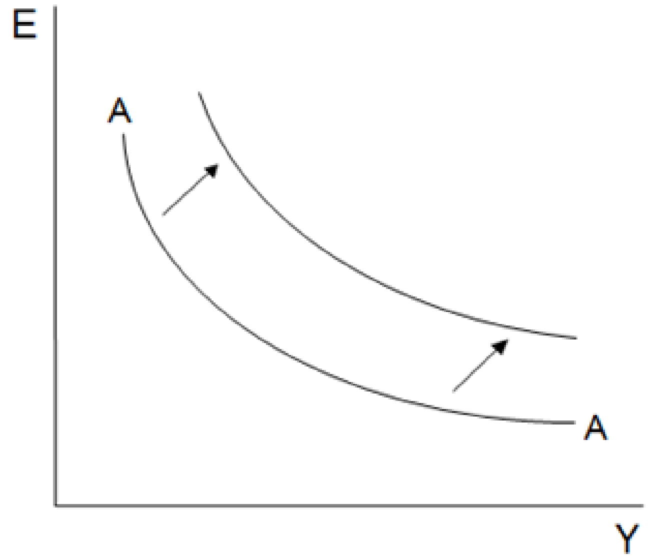


Fig. 17-8: Short-Run Equilibrium: The Intersection of *DD* and *AA*

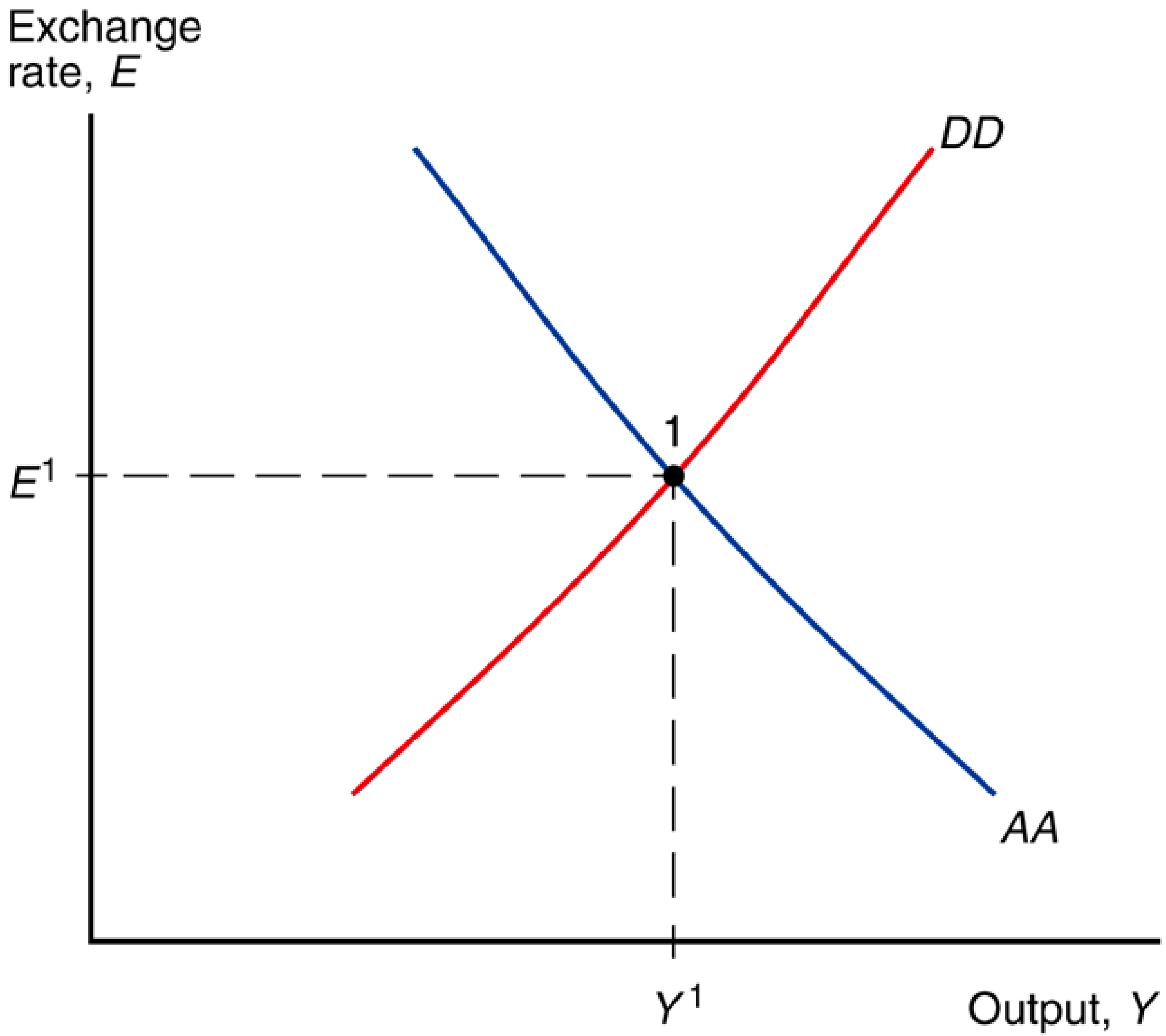
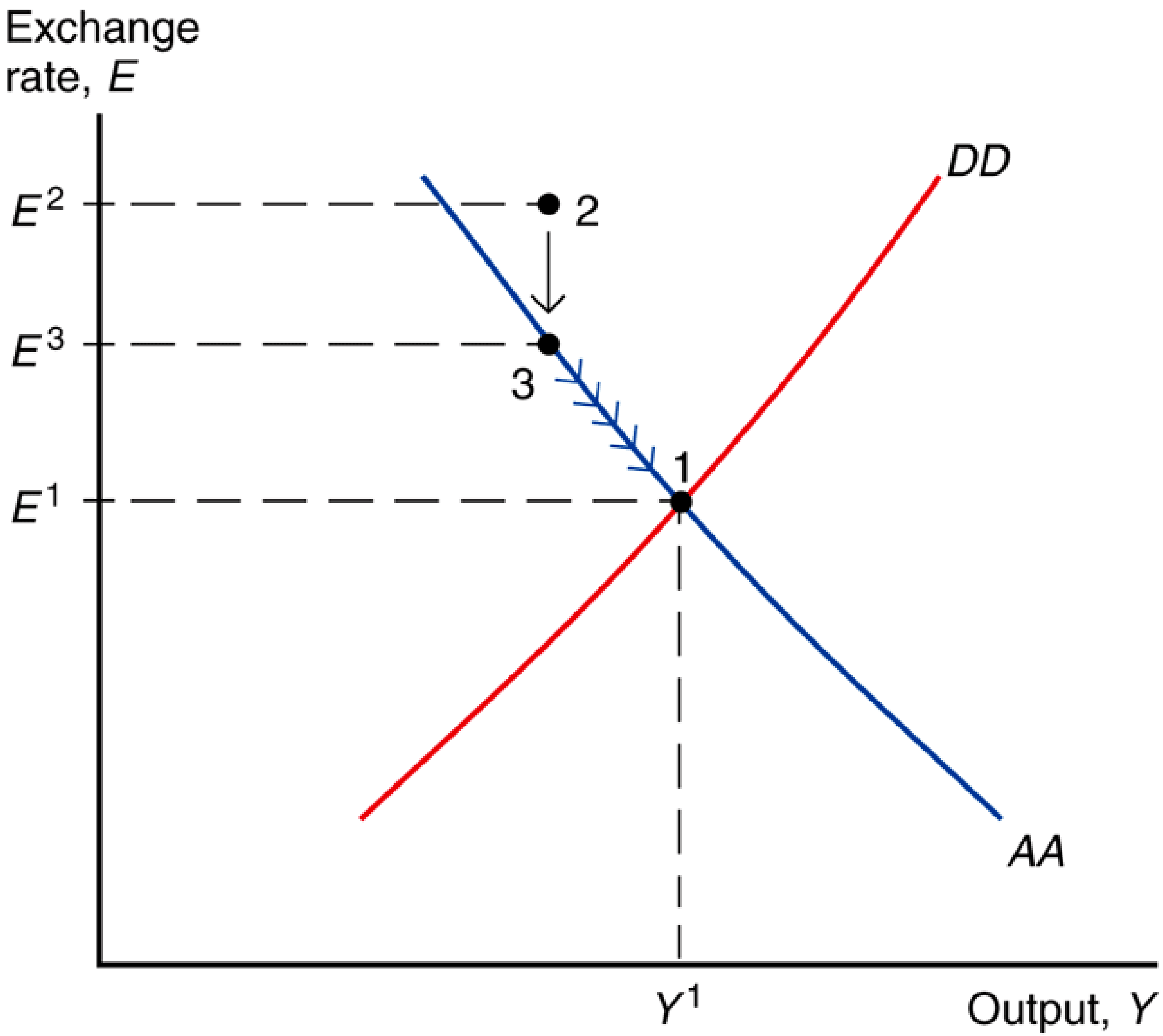


Fig. 17-9: How the Economy Reaches Its Short-Run Equilibrium



A temporary change in the money supply

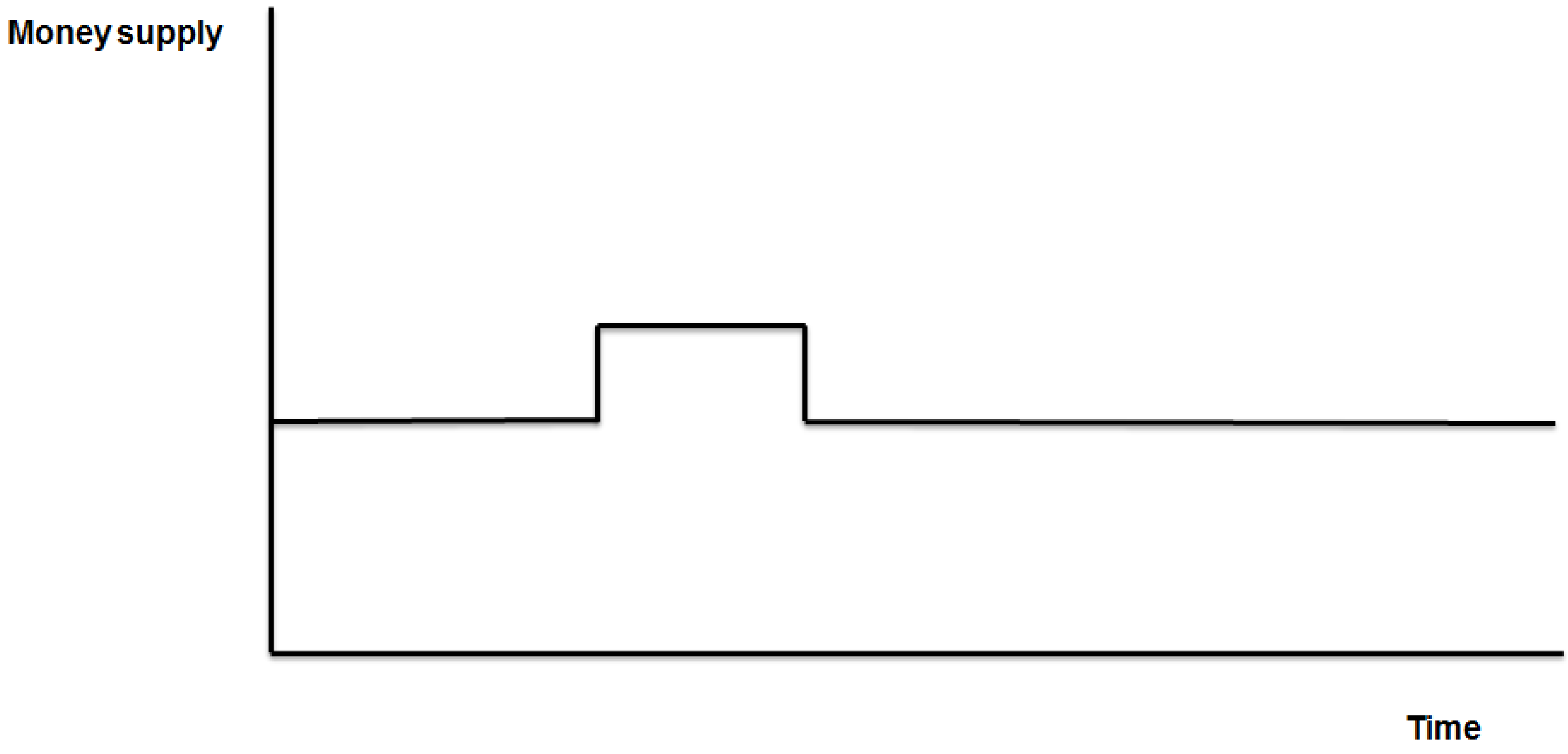


Fig. 17-10: Effects of a Temporary Increase in the Money Supply

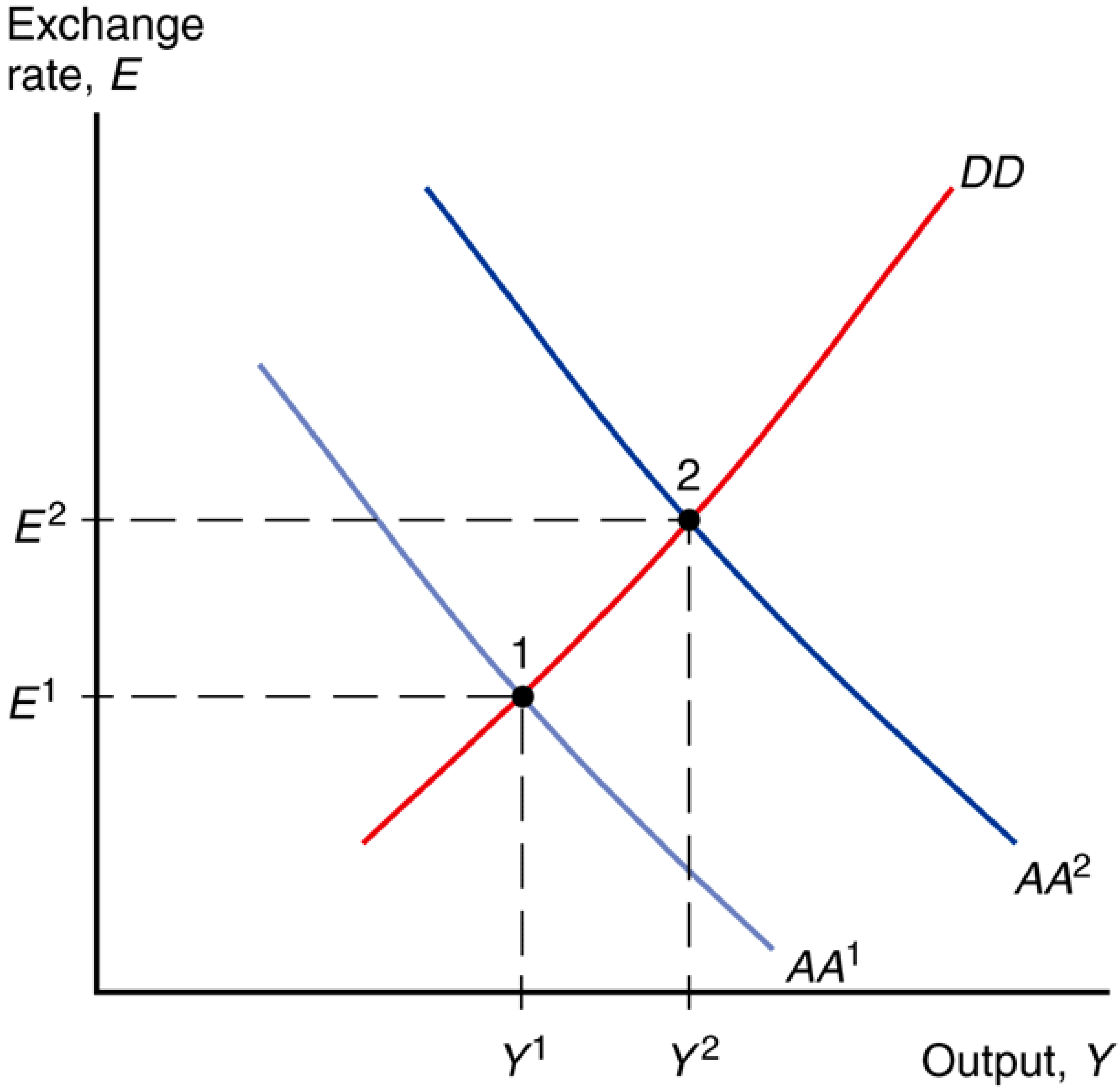


Fig. 17-11: Effects of a Temporary Fiscal Expansion

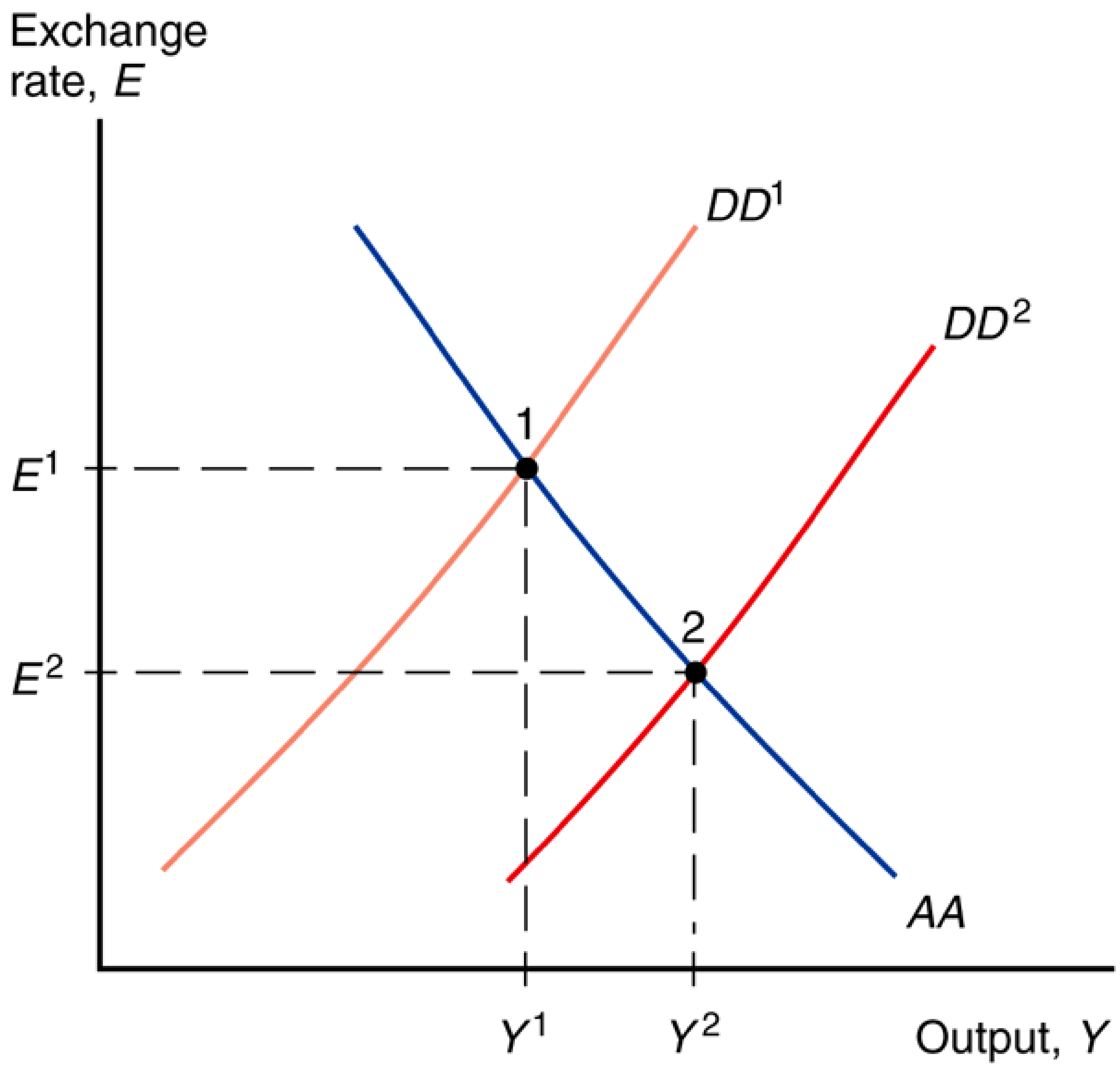
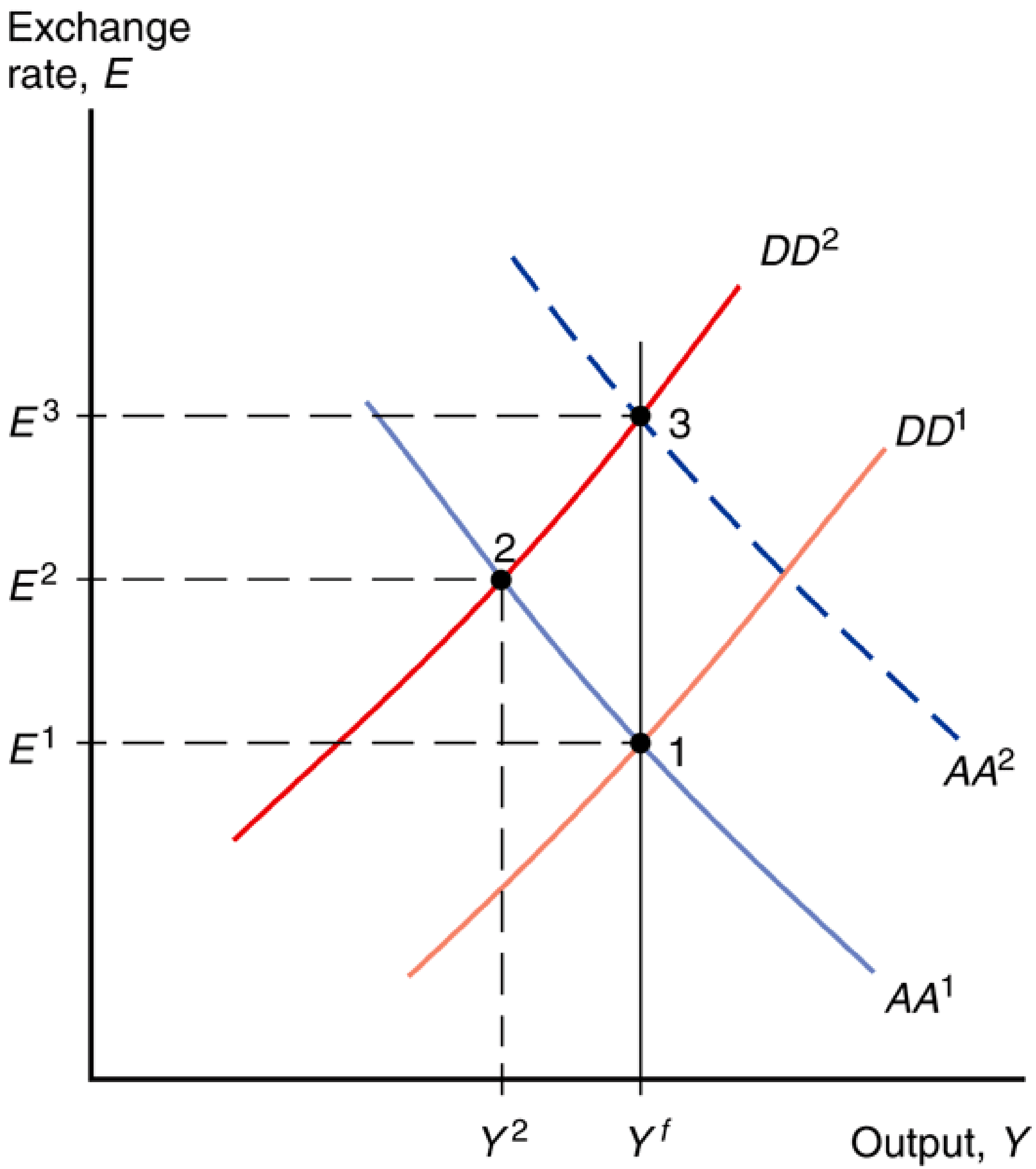


Fig. 17-12: Maintaining Full Employment After a Temporary Fall in World Demand for Domestic Products

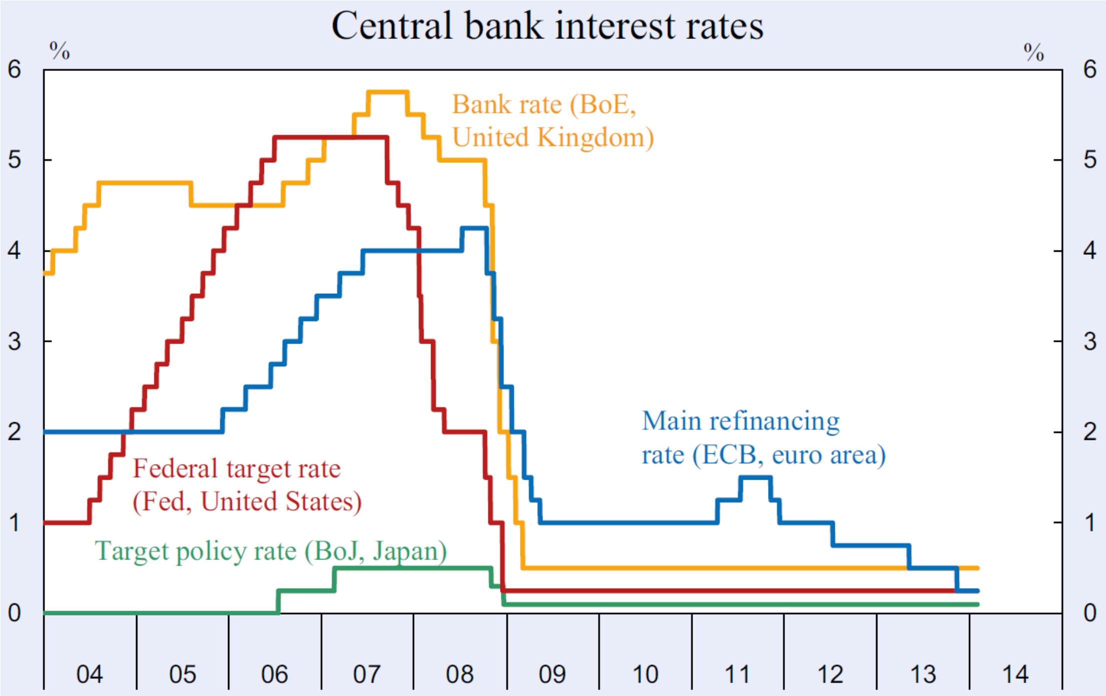


Problems with stabilisation policy

- **Policies can easily become too expansionary on average (”inflation bias”)**
- **It is difficult *ex ante* to identify disturbances and how strong they are**
- **An expansionary fiscal policy can contribute to permanent budget deficits: US and the euro zone in the recent recession**
- **Policy lags**

  - It takes time to change policy and before it affects the economy

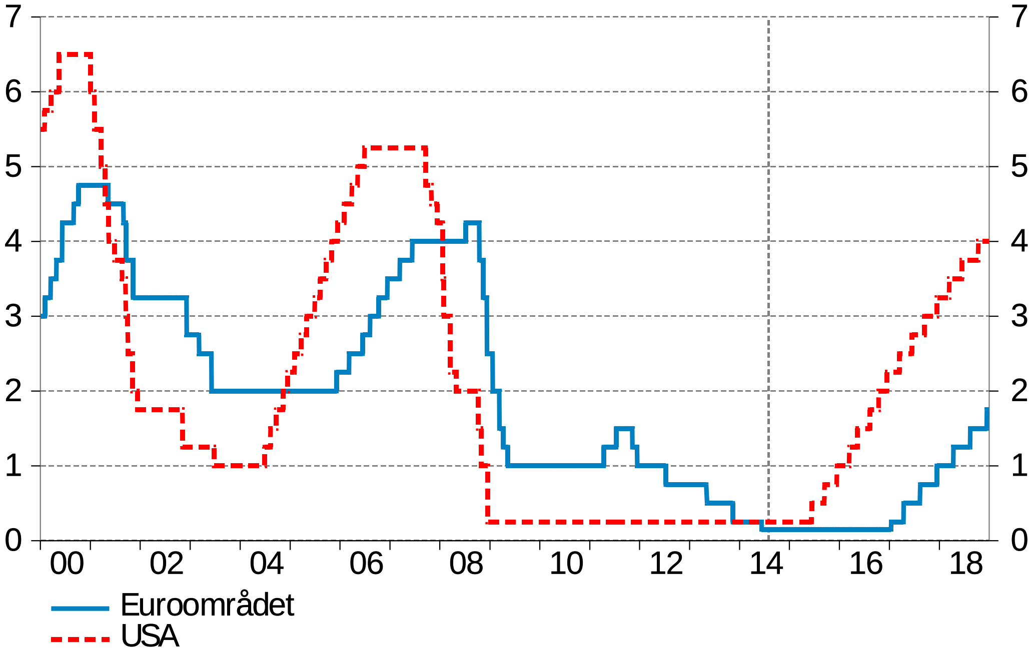
Figure 1.17 EEAG report 2014



Source: European Central Bank, Federal Reserve Bank of St. Louis, Bank of England, Bank of Japan, last accessed on 31 January 2014.

Central bank interest rates

Percent



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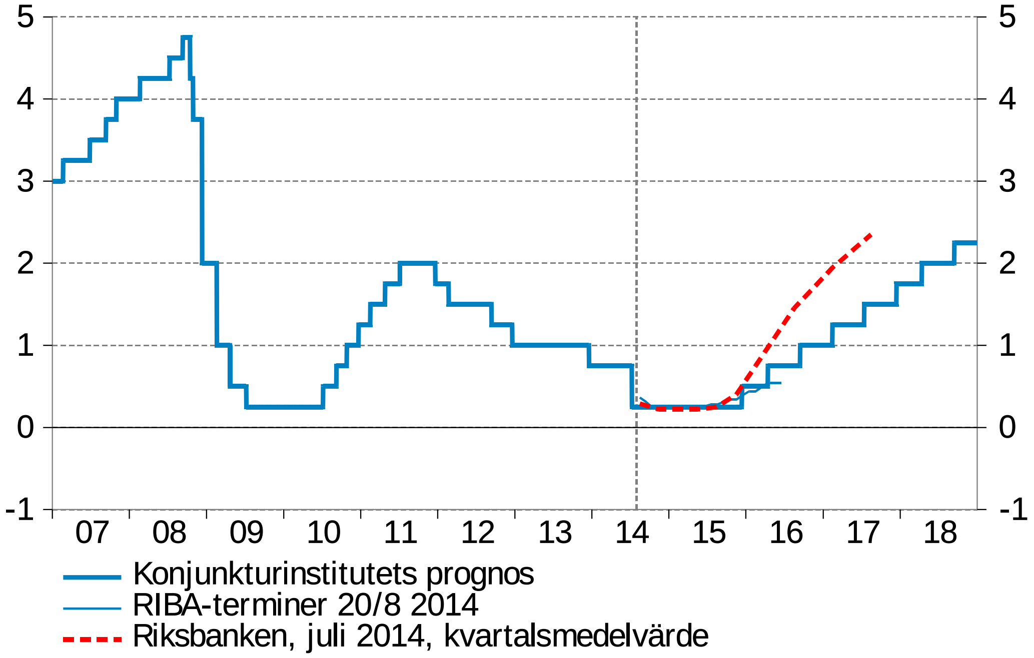
Repo rate in Sweden

Percent



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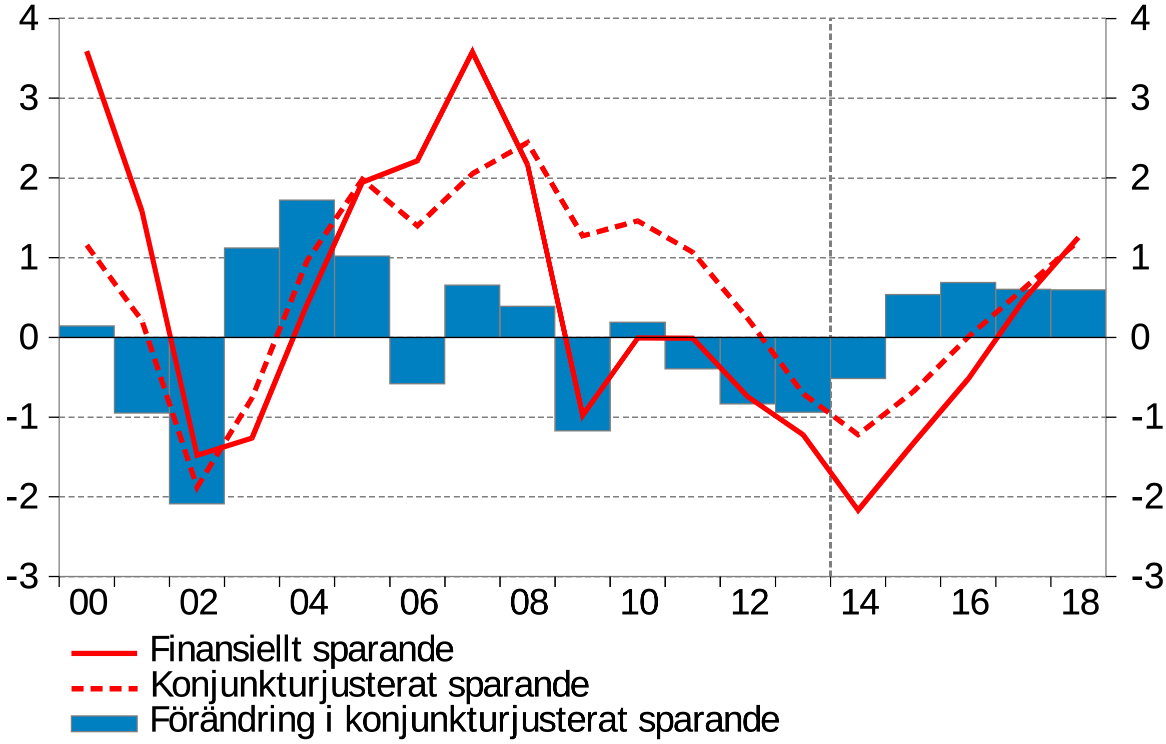
<u>General government net lending and cyclically adjusted general government net lending</u>

Percentage of GDP and potential GDP, respectively



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<u>GDP gap and fiscal policy</u>

Percentage of potential GDP