

FETP/MPP8/Macroeconomics/Riedel

General Equilibrium in the Short Run

Introduction

Previous lectures focused on the linkage between the foreign exchange market and the domestic money market and derived the conditions for simultaneous equilibrium in the two markets. In this lecture we extend the model to encompass the domestic output (goods and services) market and show how it is linked asset markets and how simultaneous (i.e. general) equilibrium is established and maintained. We take up in turn:

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

Introduction

Since our focus is the short-run, prices and wages are taken to be fixed (exogenous).

We begin by focusing on the determination of the equilibrium level of output. Since prices are assumed to be fixed in the short run, equilibrium output is determined by the level of aggregate demand for output (GDP).

Since we are considering an open economy, external demand plays a key role. As we have learned, external demand (net exports) depends on the real exchange rate. With prices fixed, the real and nominal exchange rates and the real and nominal interest rates are one and the same.

After developing a model of goods market equilibrium in an open economy, we integrate that model with the models of foreign exchange market equilibrium and financial market equilibrium to produce a general equilibrium model (known in the textbook as the AA-DD model).

Finally, we put this model to work analyzing the impact of monetary and fiscal policy responses. **It's fun!**

Aggregate Demand for Goods and Services

The National Income Accounting framework identifies four main sources of aggregate demand:

- 1. Household consumption (C):** In the short run, with prices fixed, aggregate consumption spending is assumed to be a positive function of the level of income (Y) minus taxes (T)—in other words “disposable income” ($Y-T$). Wealth (W), the accumulated stock of assets in the economy, may be another determinant—more wealth, more consumption demand.
- 2. Business investment (I):** What determines aggregate investment spending? Normally it is assumed that investment spending is a positive function of the real return on investment, for which the real interest rate is a reasonable proxy.
- 3. Government spending (G):** Here we assume that government spending (G) and taxes (T) are determined by policy and hence are treated as exogenous.
- 4. External demand (X-M):** Exports are assumed to be a positive function of the real exchange rate (EP^*/P) and foreign income (Y^*); imports are assumed to be a negative function of the real exchange and a positive function of domestic income (Y)

GOODS MARKET EQUILIBRIUM

1. Goods market equilibrium: aggregate supply (Y) equal to aggregate demand (D):

$$Y = D = C + I + G + (X - M)$$

2. Theories of aggregate demand:

$$C = C((Y - \bar{T}), \bar{W}, \dots) = \bar{c}_0 + c(Y - \bar{T}) \Rightarrow \Delta C / \Delta(Y - \bar{T}) = c = MPC \quad 0 < c < 1$$

$$I = I(\bar{R}, \dots) = \bar{I}$$

$$G = \bar{G} \text{ and } T = \bar{T}$$

$$X = X(\bar{E}\bar{P}^*/\bar{P}, \bar{Y}^*, \dots) = \bar{X}$$

$$M = X(\bar{E}\bar{P}^*/\bar{P}, Y) = \bar{m}_0 + m(Y - \bar{T}) \Rightarrow \Delta M / \Delta(Y - \bar{T}) = m = MPM \quad 0 < m < 1$$

3. Solving the model:

$$Y = \bar{c}_0 + c(Y - \bar{T}) + \bar{I} + \bar{G} + \bar{X} - \bar{m}_0 - m(Y - \bar{T})$$

$$Y(1 - c + m) = \bar{I} + \bar{G} + \bar{X} - (c - m)\bar{T} + (\bar{c}_0 - \bar{m}_0)$$

$$Y = \frac{1}{s + m} (\bar{I} + \bar{G} + \bar{X} - (c - m)\bar{T} + (\bar{c}_0 - \bar{m}_0)) \Rightarrow s = 1 - c = MPS$$

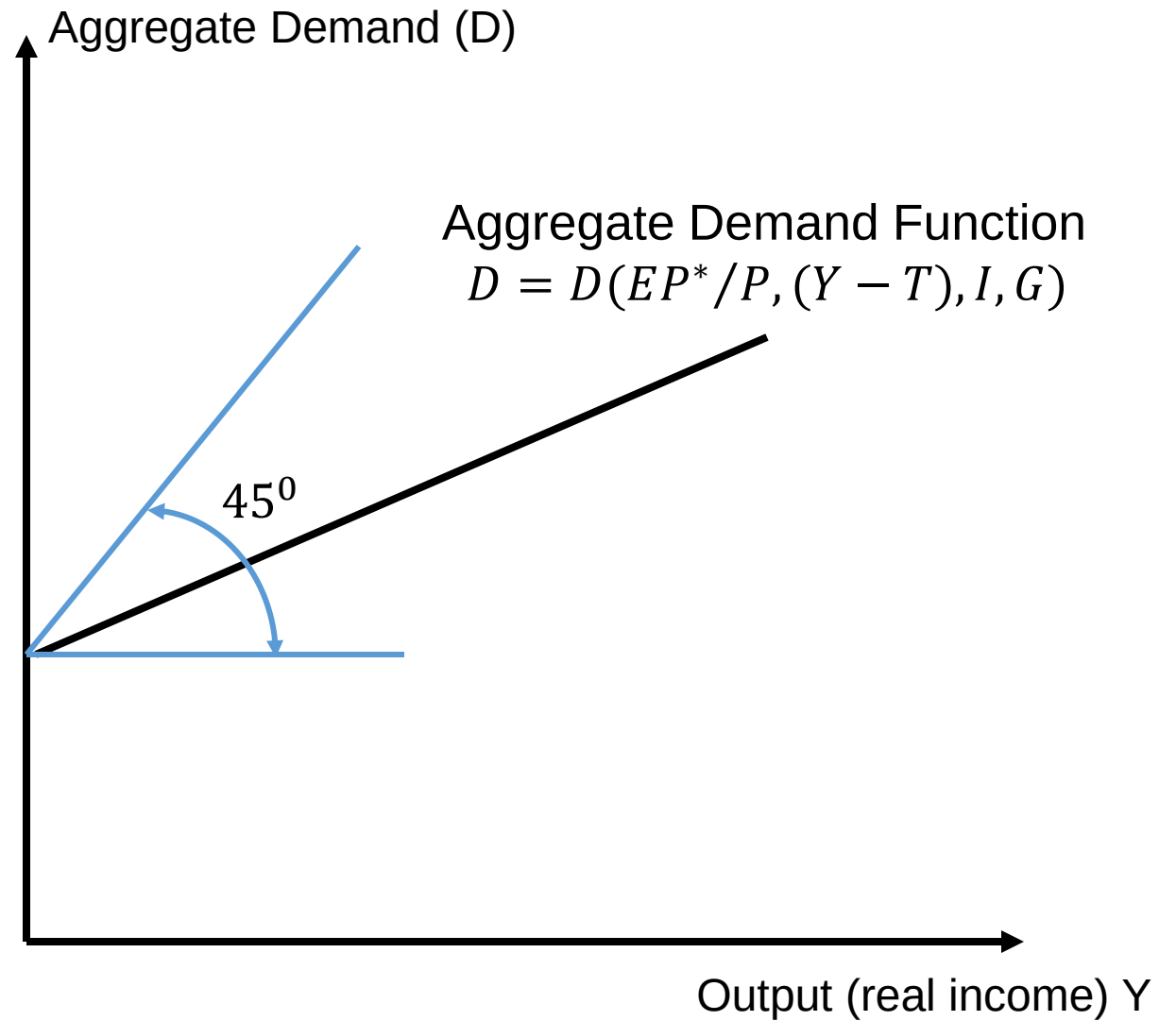
Aggregate Demand Function

In this model, as aggregate output (income= Y) rises, aggregate demand D rises, but the increase D arising from a rise in Y is less proportional to the rise in Y (i.e. the slope of the D curve is less than one. Why?

$$Y \uparrow \Rightarrow C \uparrow \Rightarrow D \uparrow$$
$$MPC < 1 \Rightarrow \Delta C < \Delta Y \Rightarrow \Delta D < \Delta Y.$$

$$Y \uparrow \Rightarrow M \uparrow \Rightarrow D \downarrow$$
$$MPM < MPC \Rightarrow \Delta M < \Delta C$$

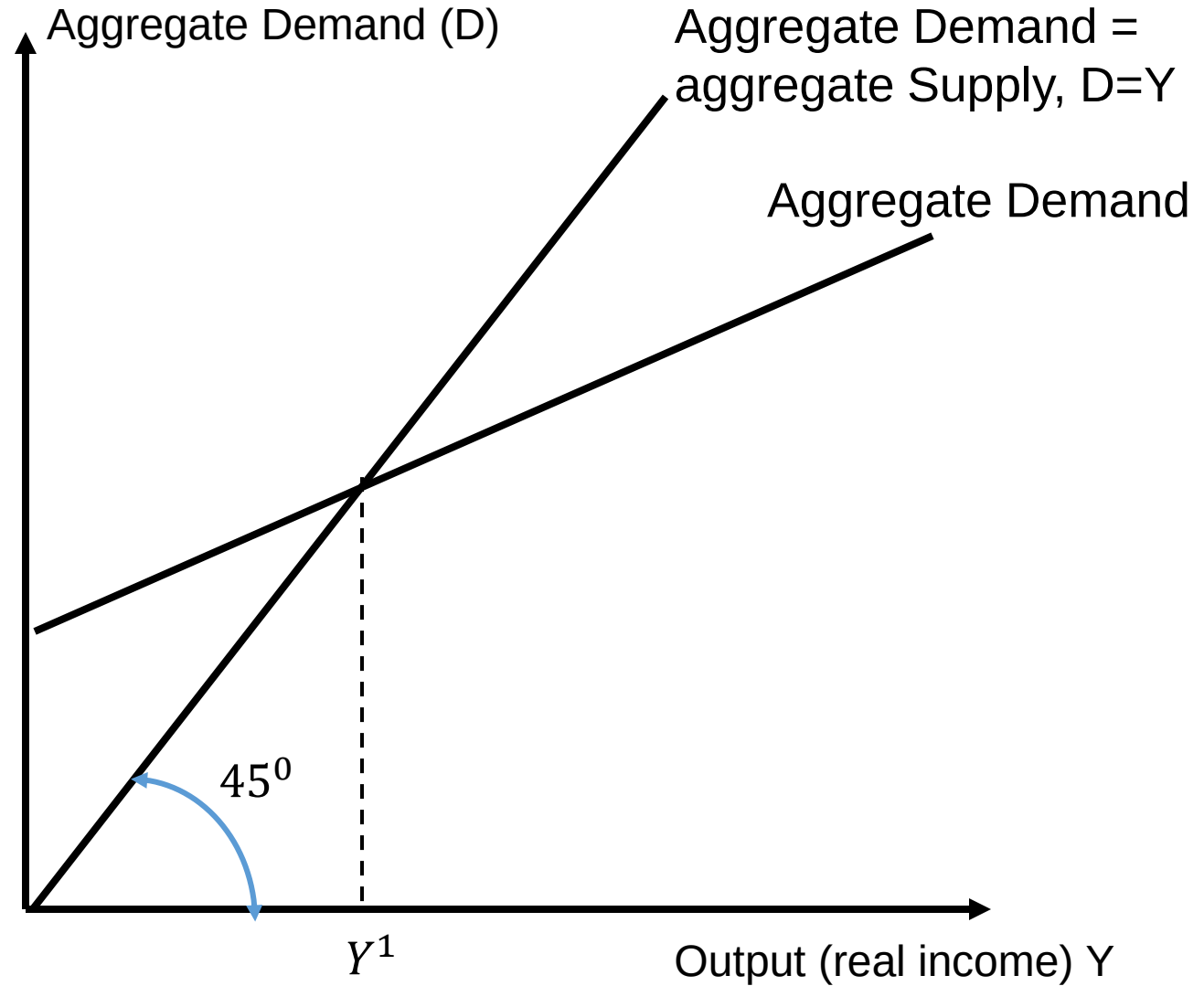
It follows that the aggregate demand has a positive slope < 1 .



Goods market equilibrium

Short run equilibrium in the goods market is at Y^1 , where the aggregate demand function and equilibrium income line ($Y=D$) intersect.

Below Y^1 aggregate demand $>$ aggregate supply; above Y^1 aggregate supply is greater than aggregate demand.



The effect of changes in aggregate demand

It is easily demonstrated that an exogenous increase in aggregate demand, which may result from:

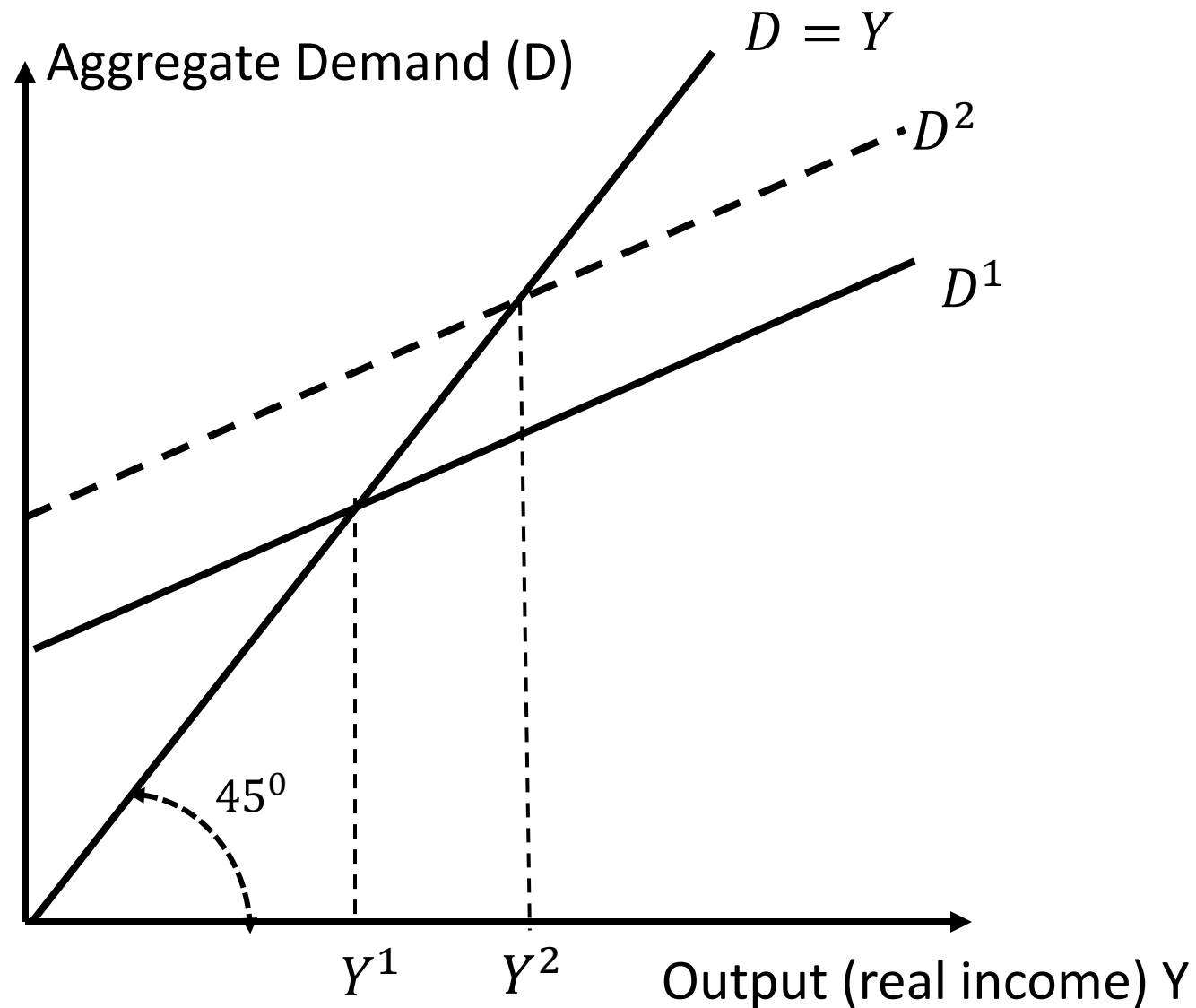
1. $G \uparrow$
2. $I \uparrow$
3. $X \uparrow$

Leads to an increase in real output (income) that proportionally greater than the increase in aggregate demand that causes real output (income) to rise.

This is known as the multiplier effect.

$$Y = \frac{1}{s + m} (I + G + X)$$

$$\text{If } s + m < 1 \Rightarrow \Delta Y > \Delta G$$



The effect of changes in aggregate demand

It is easily demonstrated that an exogenous increase in aggregate demand, which may result from:

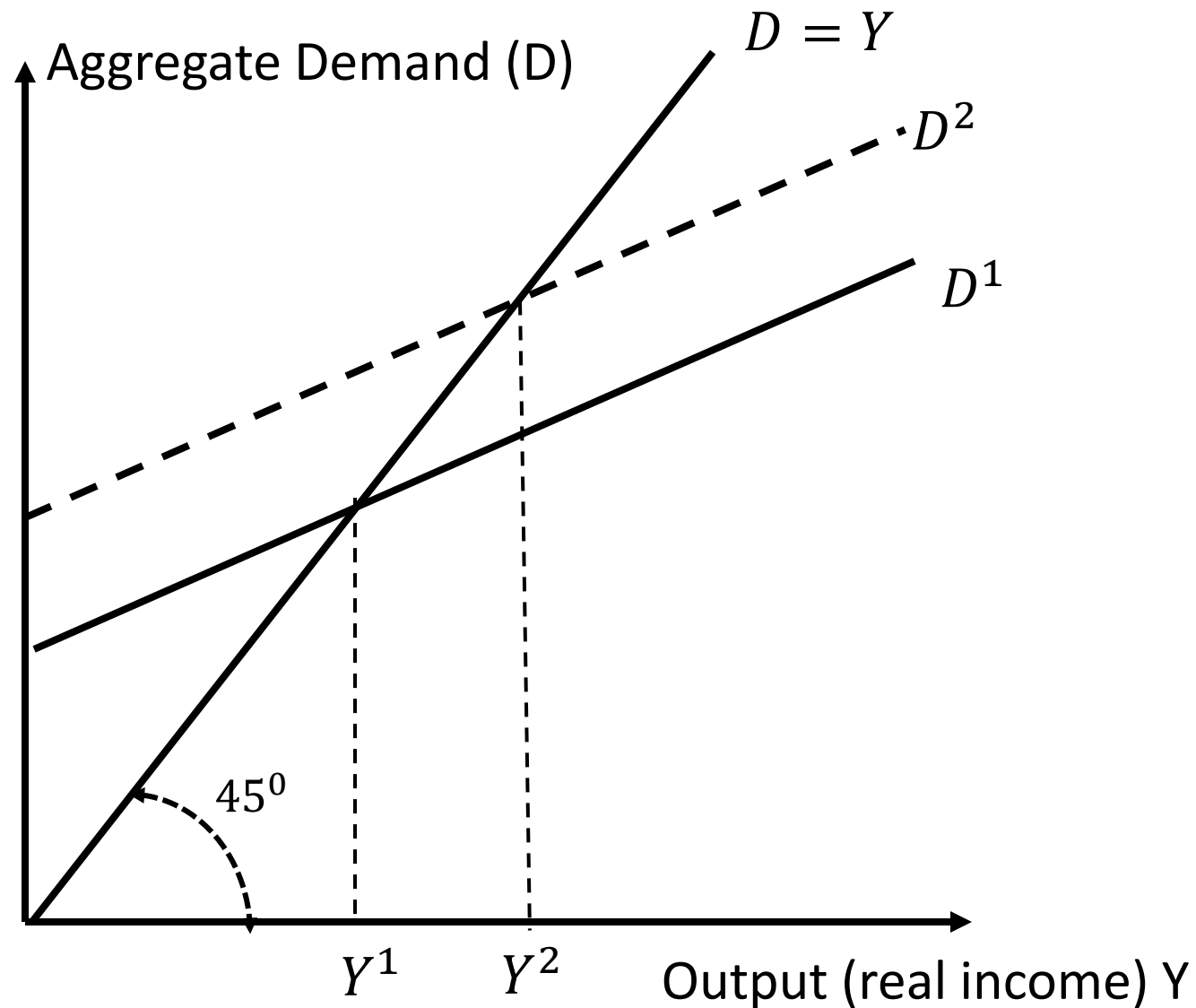
1. $G \uparrow$
2. $I \uparrow$
3. $(X - M) \uparrow$

Leads to an increase in real output (income) that proportionally greater than the increase in aggregate demand that causes real output (income) to rise.

This is known as the multiplier effect.

$$Y = \frac{1}{s + m} (I + G + X - M)$$

$$\text{If } s + m < 1 \Rightarrow \Delta Y > \Delta G$$

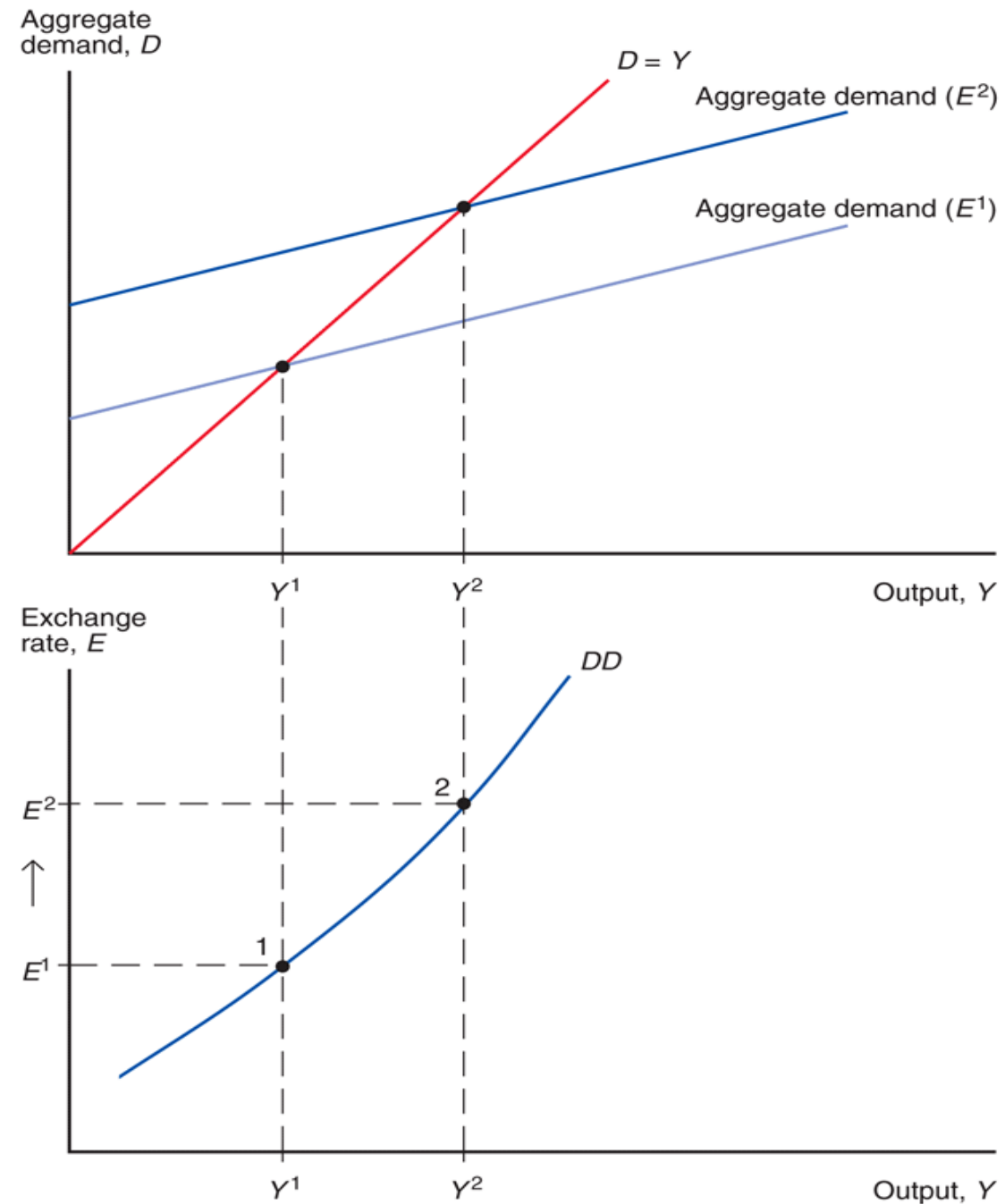


The exchange rate and the equilibrium level of output: the DD Schedule

A devaluation of the currency ($E \uparrow$) lead to higher exports and lower imports ($X - M$) $\uparrow$ which in turn leads the a proportionally greater increase in the equilibrium level of output and income (the multiplier effect) as illustrated in the *figure above*.

The relationship between the exchange rate and the equilibrium level of output and income is illustrate in the *figure below*. The DD schedule shows all the combinations of output and the exchange rate for which the output market is in a short-run equilibrium

Note: subsequently we will derive the relationship between the exchange rate of equilibrium income for which asset markets are in equilibrium.



Factors that affect the DD Schedule

1. Change in Government Spending (G)

$$G \uparrow \Rightarrow Y \uparrow = DD \rightarrow$$

$$G \downarrow \Rightarrow Y \downarrow = DD \leftarrow$$

2. Change in Taxes (T)

$$T \uparrow \Rightarrow Y \downarrow = DD \leftarrow$$

$$T \downarrow \Rightarrow Y \uparrow = DD \rightarrow$$

3. Change in P

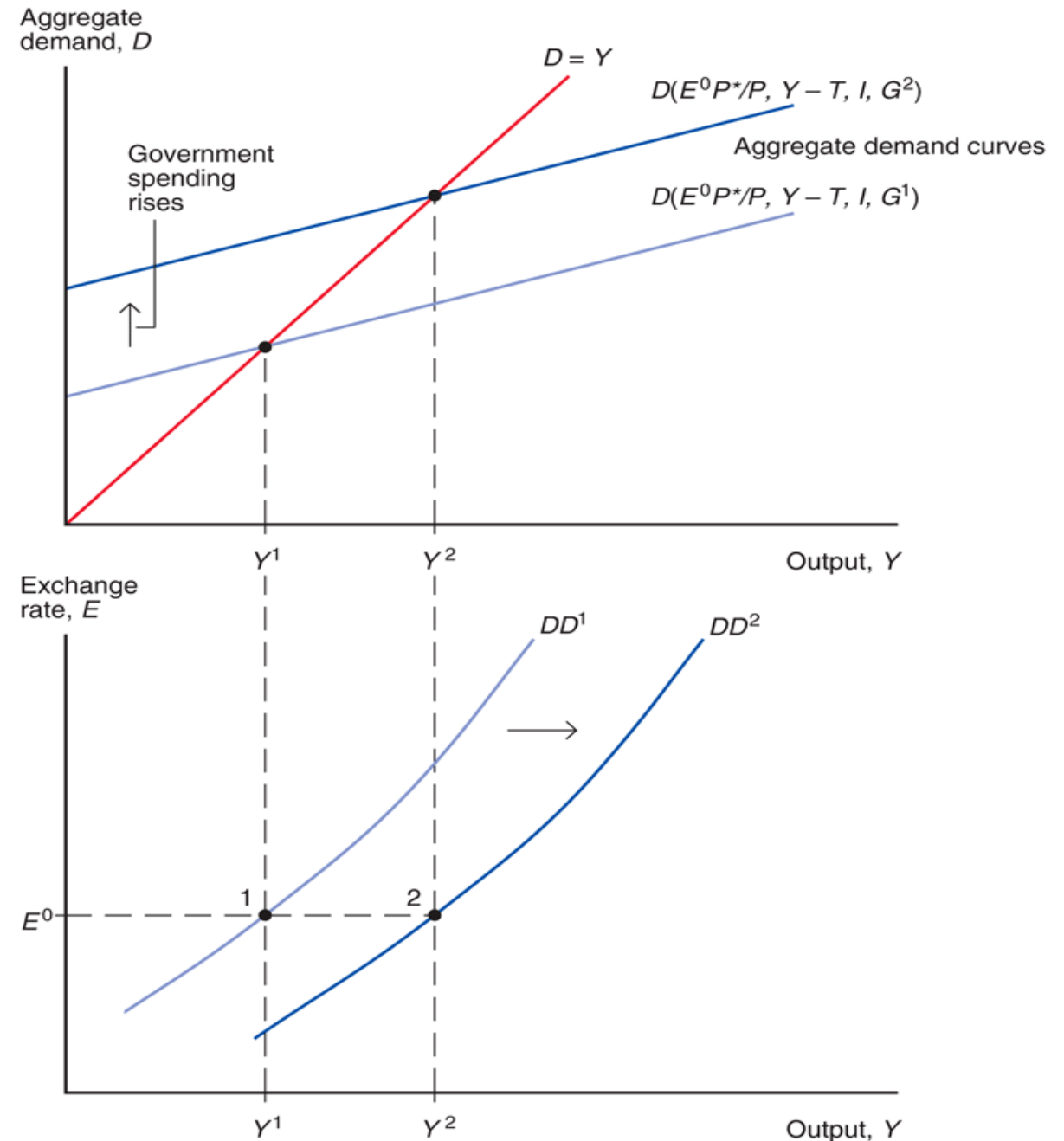
$$P \uparrow \Rightarrow EP^*/P \downarrow = (X - M) \downarrow = Y \downarrow = DD \leftarrow$$

$$P \downarrow \Rightarrow EP^*/P \uparrow = (X - M) \uparrow = Y \uparrow = DD \rightarrow$$

4. Change in Investment (I)

$$I \uparrow \Rightarrow Y \uparrow = DD \rightarrow$$

$$I \downarrow \Rightarrow Y \downarrow = DD \leftarrow$$



Asset Market Equilibrium

In the **foreign exchange market** the condition for equilibrium is uncovered interest parity (UIP):

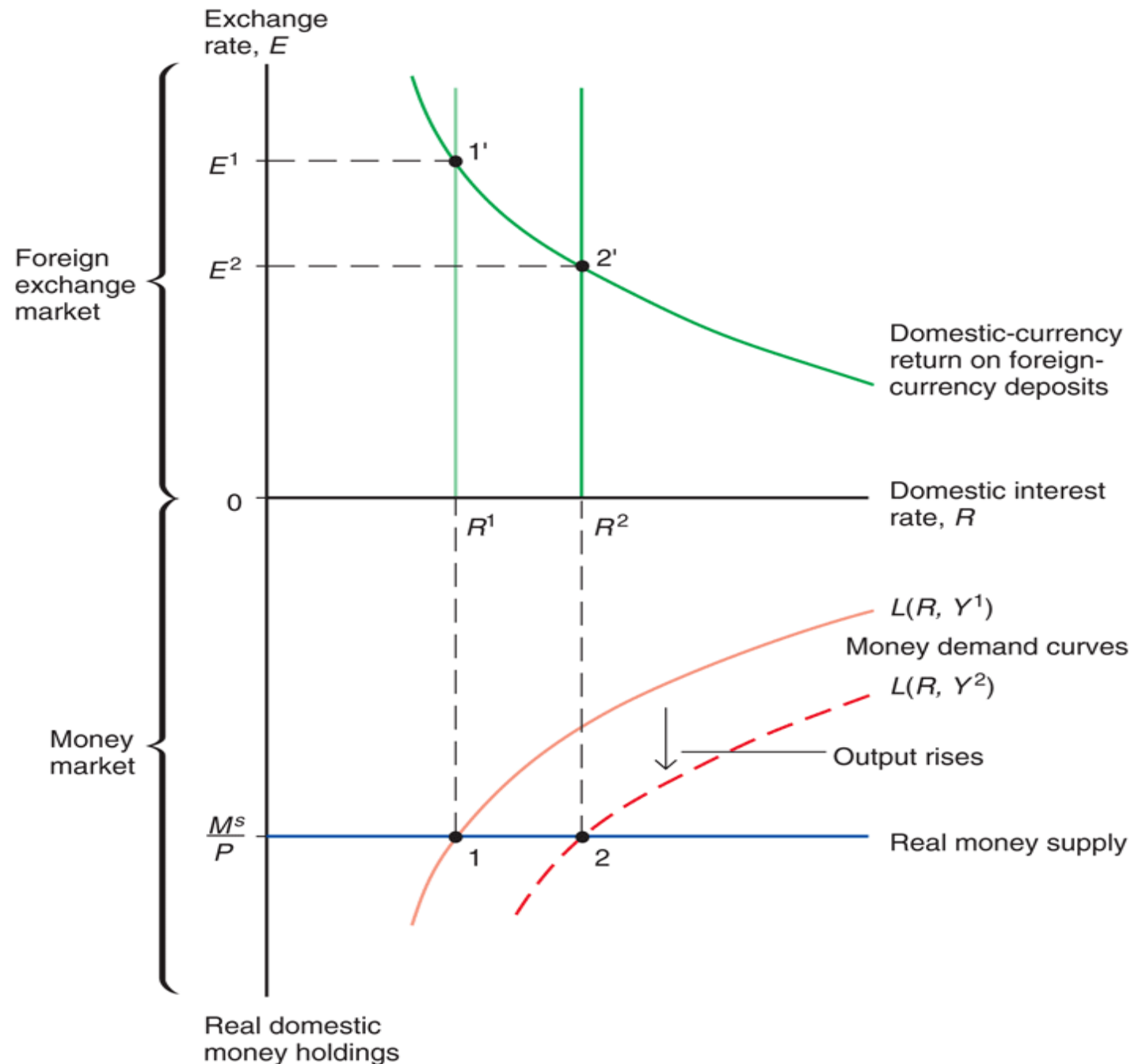
$$R = R^* + (E' - E)/E$$

In the **domestic money market** the condition for equilibrium is real money supply = real money demand:

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

As illustrated, the effect of an increase in real income is an appreciation ($E \downarrow$) of the real exchange rate. Why?

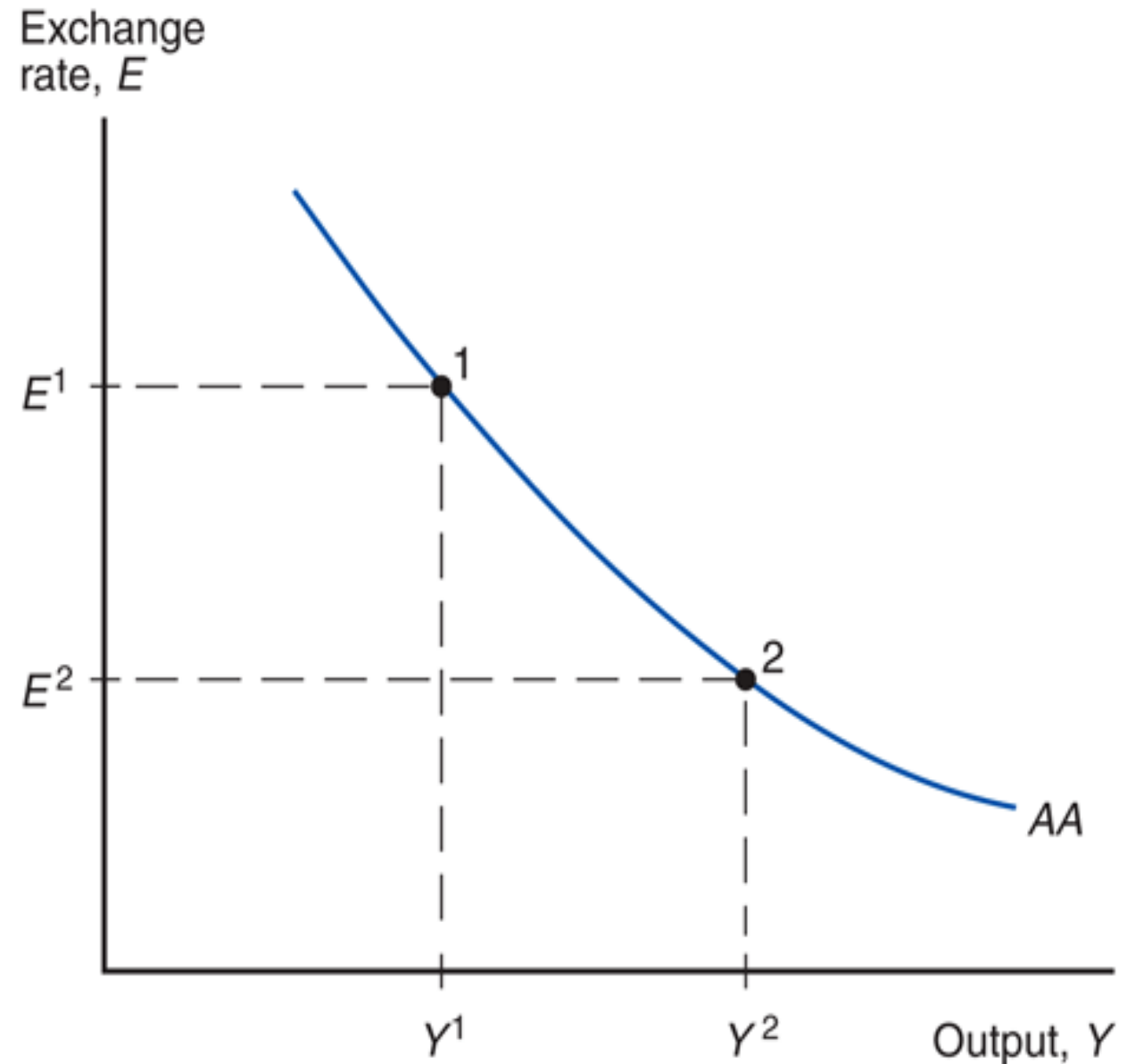
$$Y \uparrow \Rightarrow L \uparrow \Rightarrow R \uparrow \Rightarrow E \downarrow$$



Deriving the AA Schedule

While the **DD Schedule** show all the combinations of exchange rate and real income for which the goods market is in equilibrium, the **AA Schedule** shows all the combinations of exchange rate and real income for which asset markets (foreign exchange and domestic money markets) are in equilibrium, other things equal.

Other things equal, the higher the level of income, the higher the demand for money, the higher the domestic interest rate and hence the lower the exchange rate.



Factors that shift the AA Schedule

1. Change in the money supply (M^S)

$$M^S \uparrow \Rightarrow AA \rightarrow$$

2. A change in the domestic price level (P)

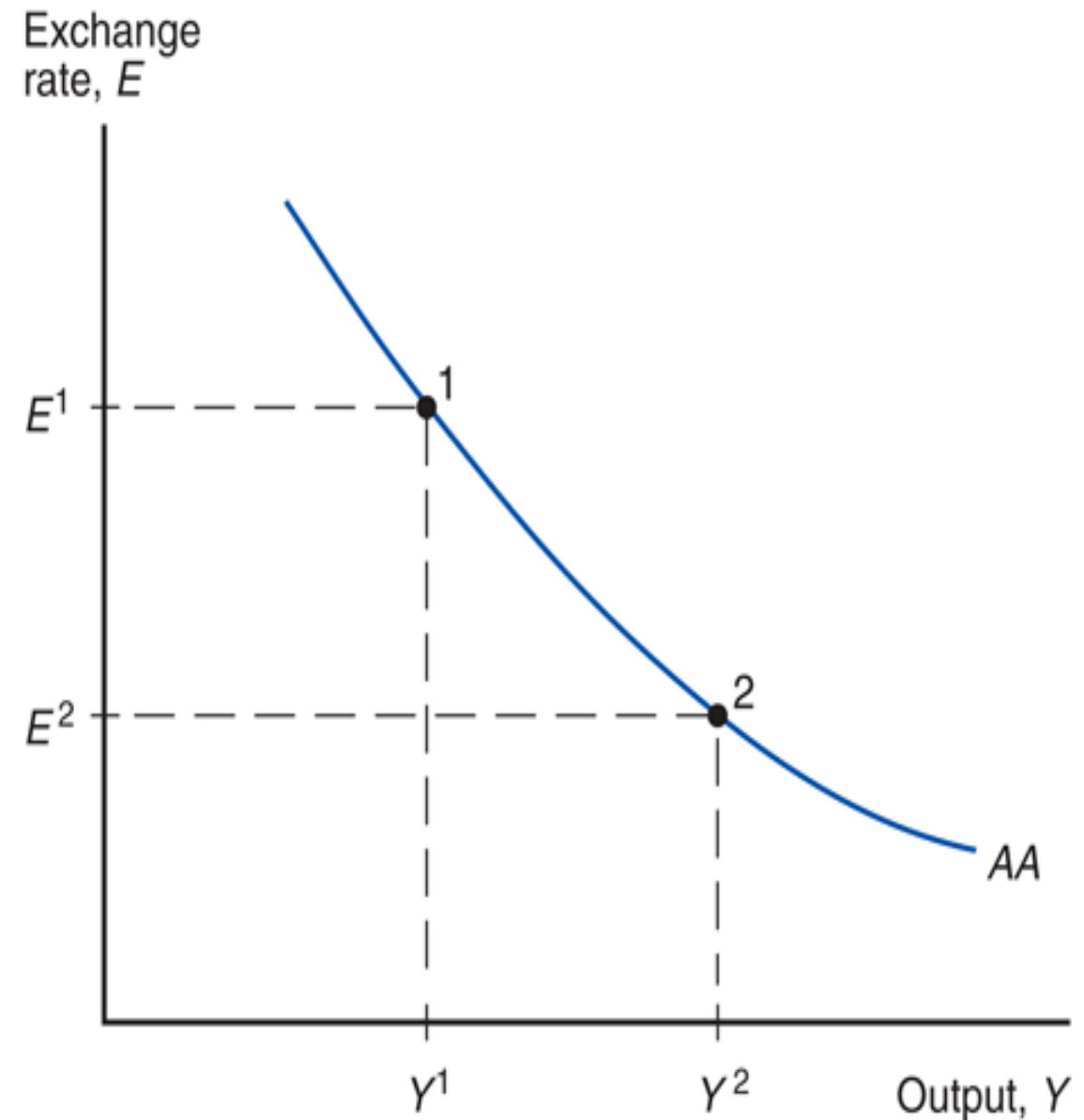
$$P \uparrow \Rightarrow AA \leftarrow$$

3. A change in the expected exchange rate (E')

$$E' \uparrow \Rightarrow AA \rightarrow$$

4. A change in the foreign interest rate (R^*)

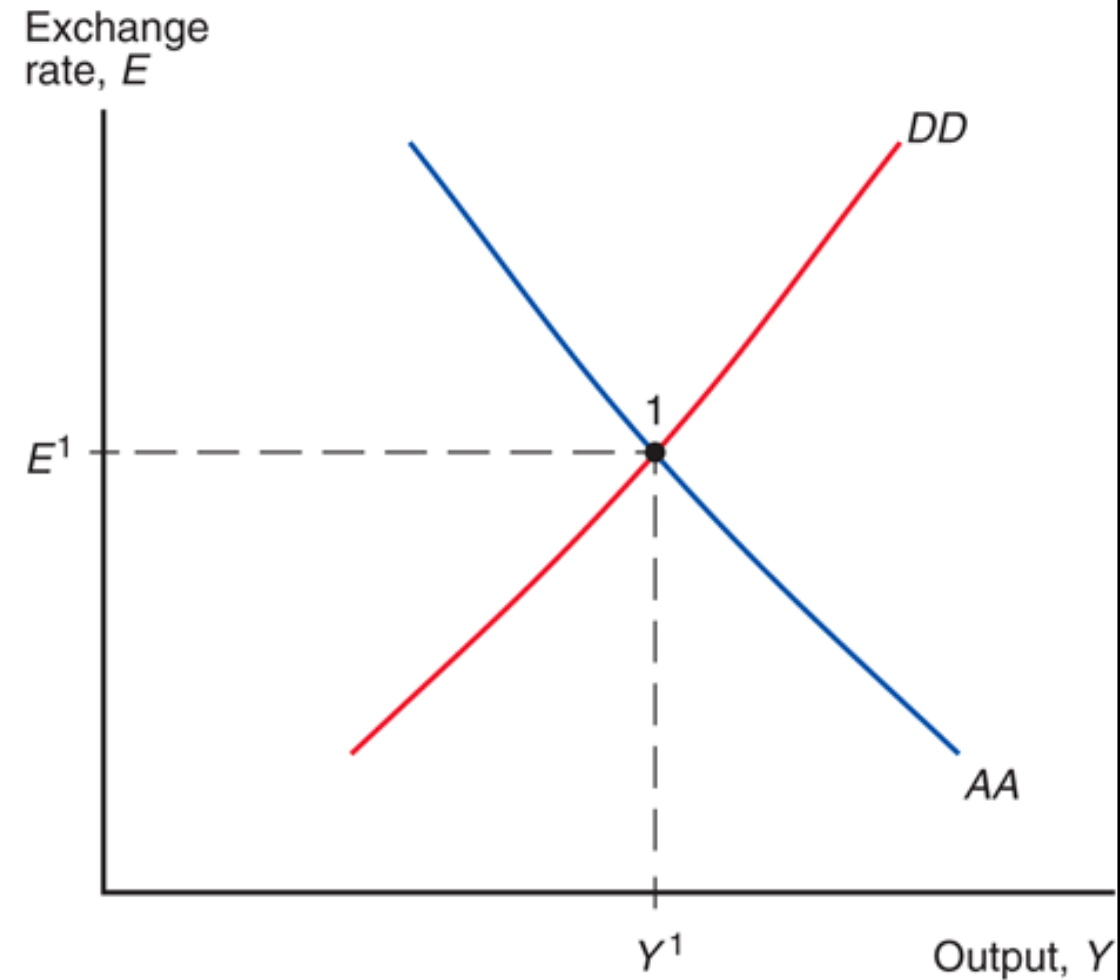
$$R^* \uparrow \Rightarrow AA \rightarrow$$



A General Equilibrium

Definition: The value of the exchange rate (E) and income (Y) at which equilibrium holds in three markets:

1. **Goods markets:** Aggregates supply equals aggregate demand ex ante.
2. **Foreign exchange market:** uncovered interest parity holds.
3. **Domestic money market:** the quantity of real monetary assets supplied equals the quantity of real monetary assets demanded.



How the economy adjusts to equilibrium

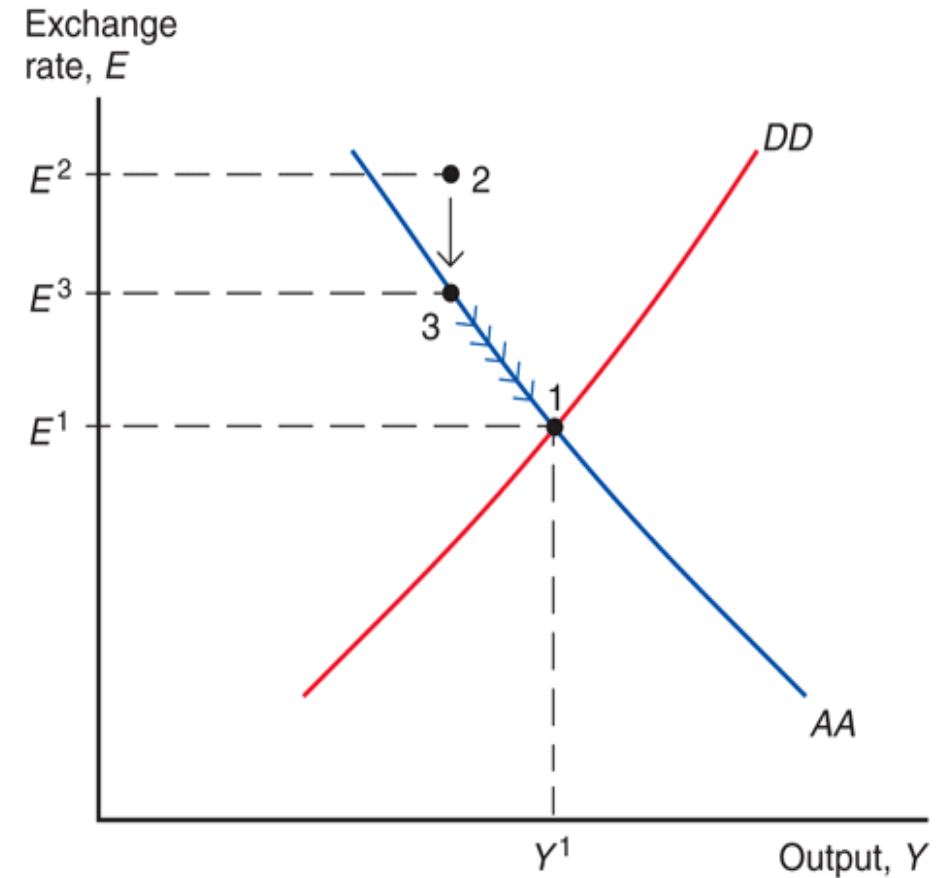
How does the economy reach equilibrium?

Suppose the economy is at point 2, above AA and DD—both the output market and financial markets are out of equilibrium.

Because E is above AA, the expected rate of appreciation of the domestic currency is above the equilibrium level. The return on domestic deposits is above the expected rate of return on foreign deposits, so there is an excess demand for domestic currency.

Also because E is high at 2, domestic goods are cheap, causing an excess demand for domestic output.

There is an immediate appreciation ($E^2 \rightarrow E^3$), which equalizes expected return on domestic and foreign assets (we are on AA at 3), the excess demand for domestic output persists. Firms respond to the excess demand by increasing output and the economy moves down the AA curve to 1, where aggregate demand and supply are equal.



Analyzing Monetary and Fiscal Policy

Here we analyze how shifts in monetary and fiscal policy affect output and the exchange rate.

Monetary policy works through changes in money supply (M^S)

Fiscal policy works through changes in government spending (G) and taxes (T)

Policy changes may be temporary (i.e. the public does not adjust its expectation about the long run exchange rate) or permanent (the public adjusts its expectation about the long-run exchange rate).

We consider policy shifts from both a short run perspective (prices do not adjust) and a long run perspective (the price level adjusts).

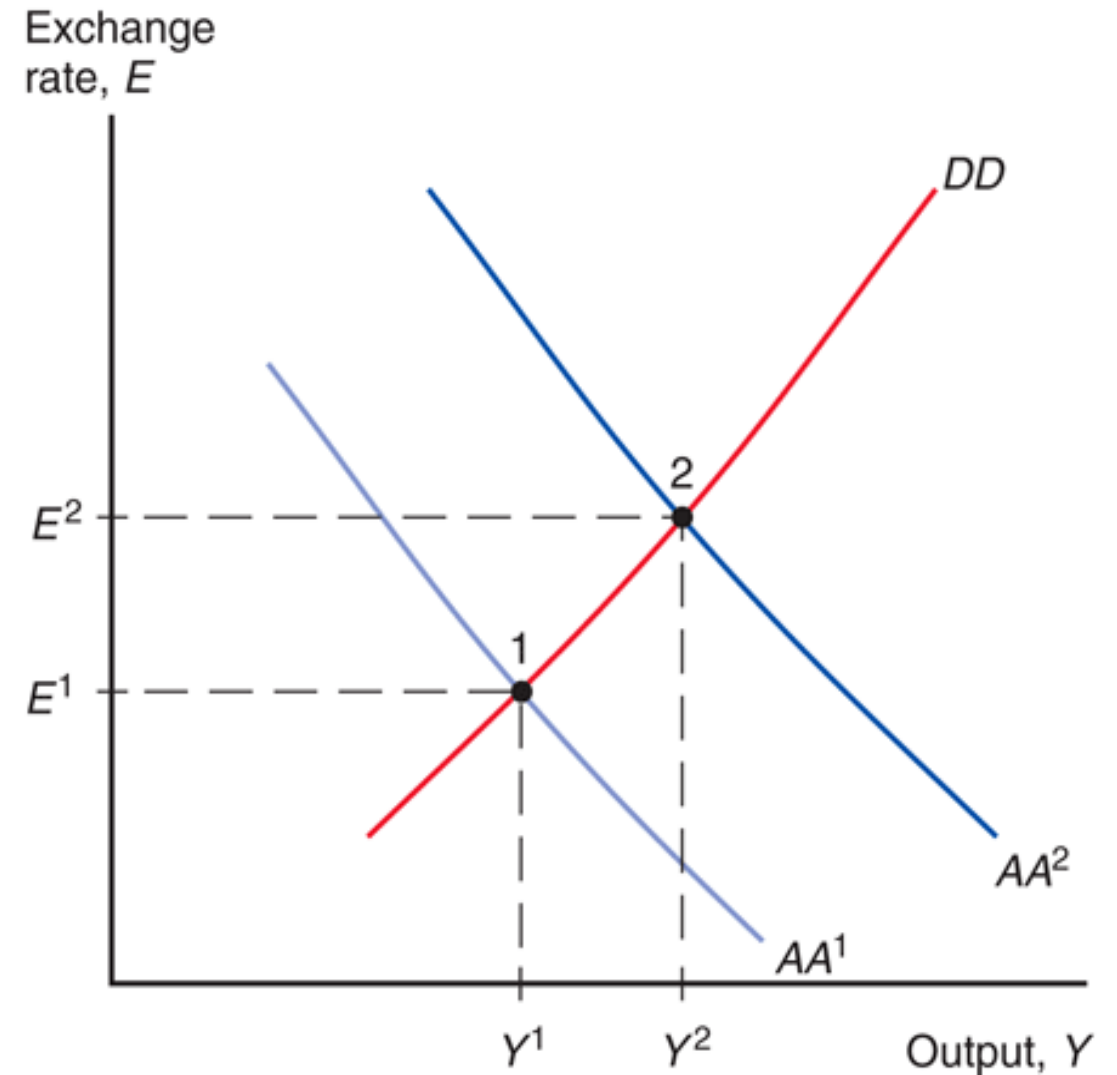
	Short Run	Long Run
Temporary Δ in Policy	Prices fixed Expectation fixed	Prices adjust Expectations fixed
Permanent Δ in Policy	Prices fixed Expectations adjust	Prices adjust Expectation adjust

Effects of a **Temporary** Increase in the Money Supply

An increase in $M^S \uparrow$ causes AA to shift to the right, leading to a depreciation ($E \uparrow$) and a rise in output ($Y \uparrow$).

Why the currency depreciates: when money supply increases the interest rate falls, so the exchange rate must rise immediately to maintain UIP.

The currency depreciation increases demand for domestic goods and we move along the DD schedule to a higher level of income.

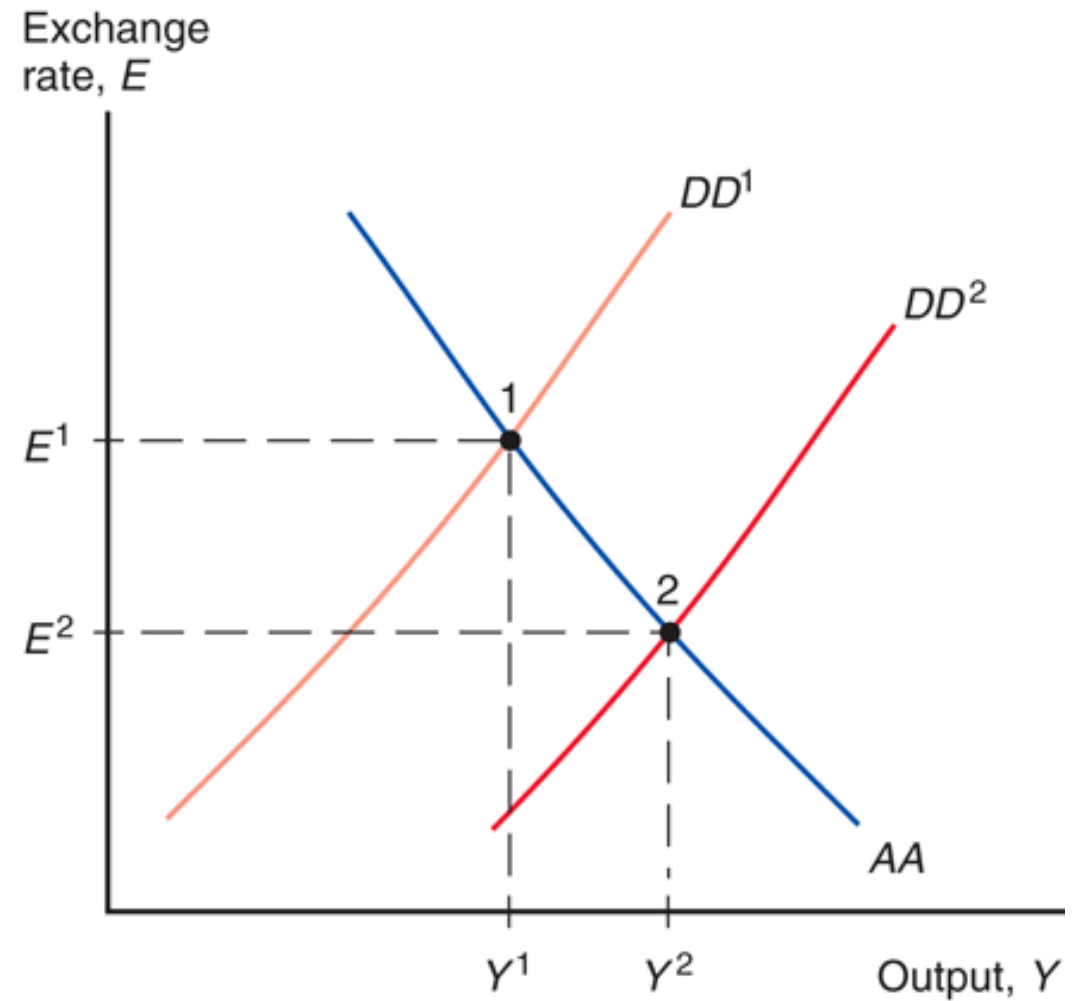


Effects of a **Temporary** Fiscal Expansion

An increase in G or a fall in T shifts the DD schedule to the right, leading to a currency appreciation and a higher level of output

The increase in G leads to a rise in Y and an increase demand for money. Since the money supply does not change, the interest rate is pushed up.

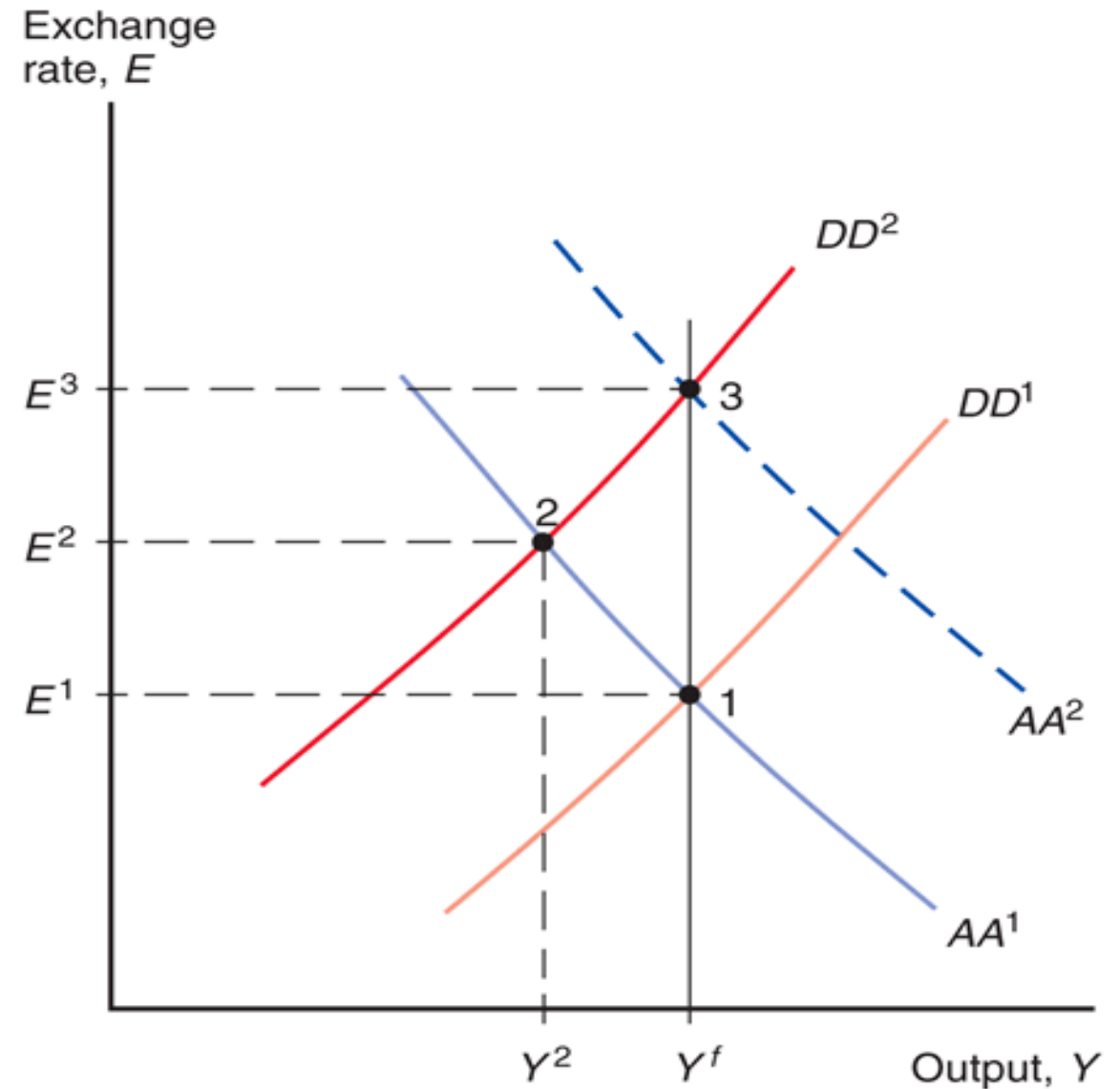
Since E' does not change, E must fall to restore UIP in the foreign exchange market.



Maintaining full employment after a **Temporary** Fall in World Demand for Domestic Output

A temporary fall in demand for domestic output causes the currency to depreciate and output to fall below the full-employment level (E^2, Y^2).

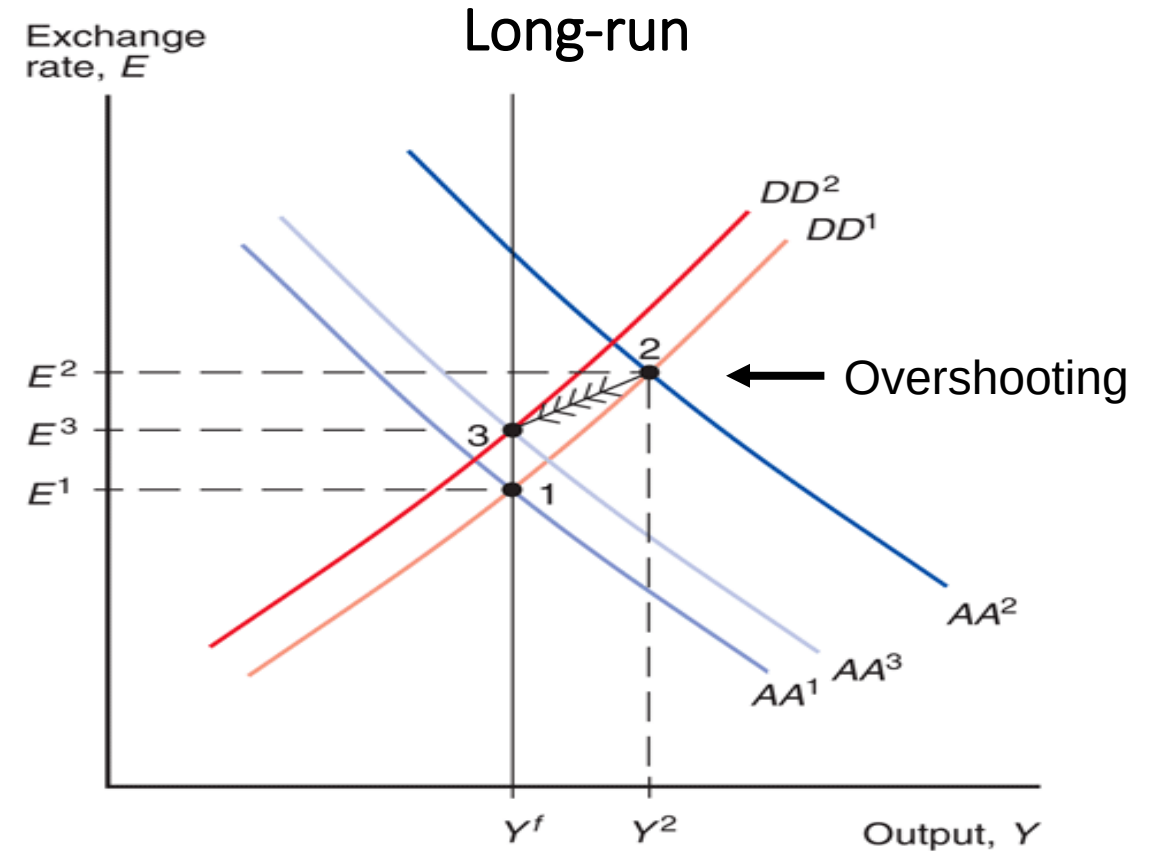
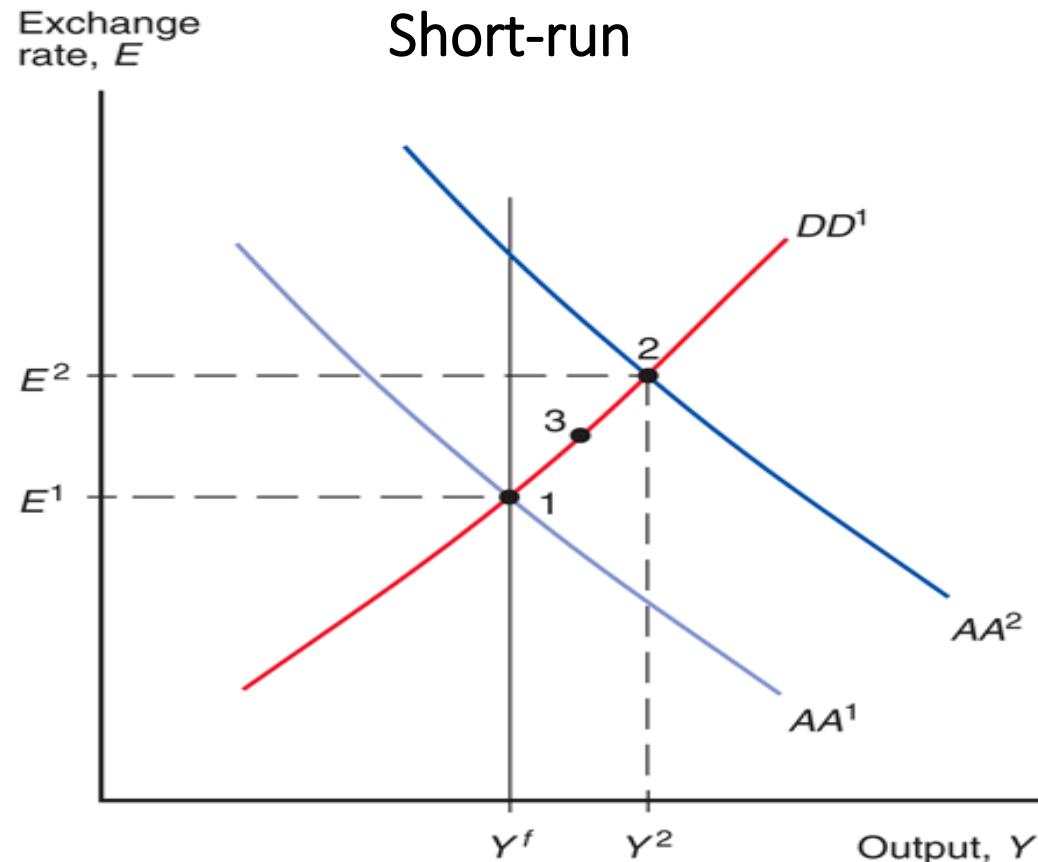
The government can restore full employment by a temporary fiscal expansion ($DD^2 \rightarrow DD^1$) or by a temporary monetary expansion ($AA^1 \rightarrow AA^2$)



Effects of a Permanent Increase in the Money Supply

Assume the economy starts from a position of full employment. **In the short run**, the permanent increase in M^S leads to a large devaluation and pushing income above the full employment level ($1 \rightarrow 2$).

Because the economy is operating above full employment, wages and prices rise in **the long run**. As prices rise the real exchange rate falls (shifting DD to the left) and real money supply falls shifting AA to the left.

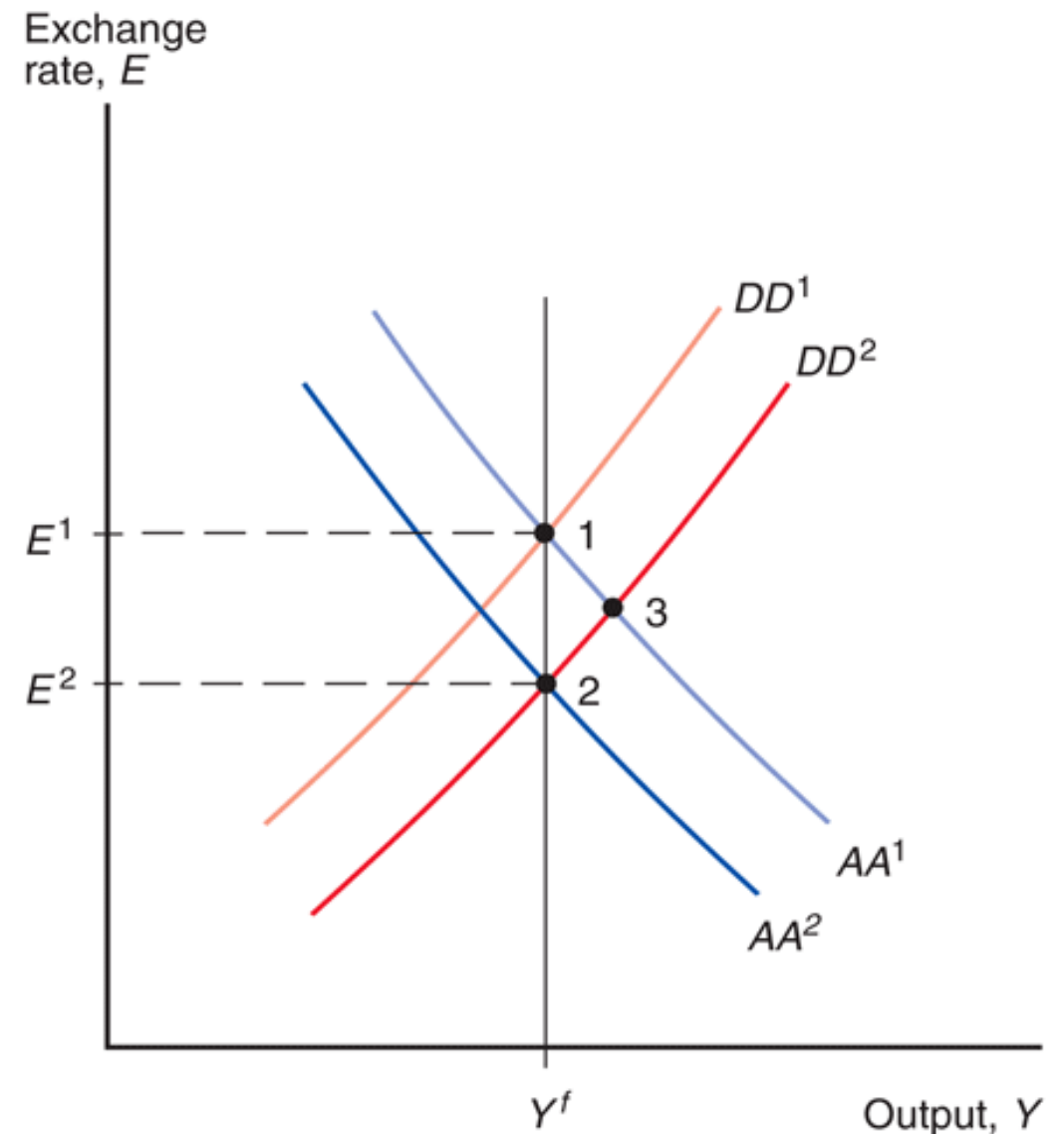


Effects of a Permanent Fiscal Expansion

A permanent fiscal expansion shifts DD to the right. Since the fiscal expansion is permanent the expected long-run exchange rate falls, causing the AA schedule to shift to the left.

The strong appreciate of the currency offsets the expansionary effect of increased government spending.

In the end, the only lasting effect is the crowding out of the external sector by the government sector.



THE MULTIPLIER REVISITED: U.S. Stimulus Package

The stimulus package might be considered a good deal in the short-run, since we “buy” 600 in government outlays by giving up 240 in private spending, but that depends on how one values the additional outlays (cash for clunkers?)

In the long-run, when it has to be paid for by raising taxes, it is a decidedly bad deal. The government ends up spending 600 to reduce GDP by 300.

	2009	2010	2011	2012	2013	Sum
Impact of Stimulus Package						
ΔG	300	300				600
ΔY	120	180	60			360
Impact of Paying for Stimulus Package						
ΔT			300	300		600
ΔY				-330	-330	-660
Net Impact of Tax Financed Stimulus Package						
Net ΔY	120	180	60	-330	-330	-300