Outline

Chapter 7: Putting all markets together: The AS-AD model

7.1 Aggregate supply
7.2 Aggregate demand
7.3 Equilibrium in the short run and the medium run
7.4 The effects of a monetary expansion
7.5 A decrease in the budget deficit
7.6 Changes in the price of oil

Learning objectives chapter 7

After you worked through this chapter, you should know

a) how to derive the aggregated demand and supply curves

b) the factors determining their slope

c) changes in variables that will cause a shift of these curves (shift parameters)

d) the comparative static effects in the short and medium run.

e) the forces which trigger the dynamic adjustment process.

7.1 Aggregate Supply (AS)

- The aggregate supply relation captures the effect of output (Y) on the price level (P)
- Important: the relationship between wages, prices, and price expectations over time.

Chapter 6:

$$W = P^e F(u, z)$$

$$P = (1 + \mu) W$$

- Assumption in chapter 6: $P = P^e$

Chapter 7:

- Assumption does only hold in the medium run but not in the short run.

- In the short run: P can deviate from P^e !

$$(7.1) \qquad P = P^e (1 + \mu) F(u, z)$$

7.1 Aggregate supply (AS)

$$(7.1) \qquad P = P^e(1+\mu)F(u,z)$$

Price level (P) depends on

- The expected price level P^e
- Unemployment rate u
- Mark up μ
- All other variables z

μ and z are exogenous and constant

$$u = \frac{U}{L} = \frac{L-N}{L} = 1 - \frac{N}{L} = 1 - \frac{Y}{L} \qquad\qquad u = 1 - \frac{Y}{L}$$

If the labor force (L) is constant the **unemployment rate (u)** is the lower, the higher the output (Y).

$$(7.2) \qquad P = P^e(1+\mu)F\left(1 - \frac{Y}{L}, z\right)$$

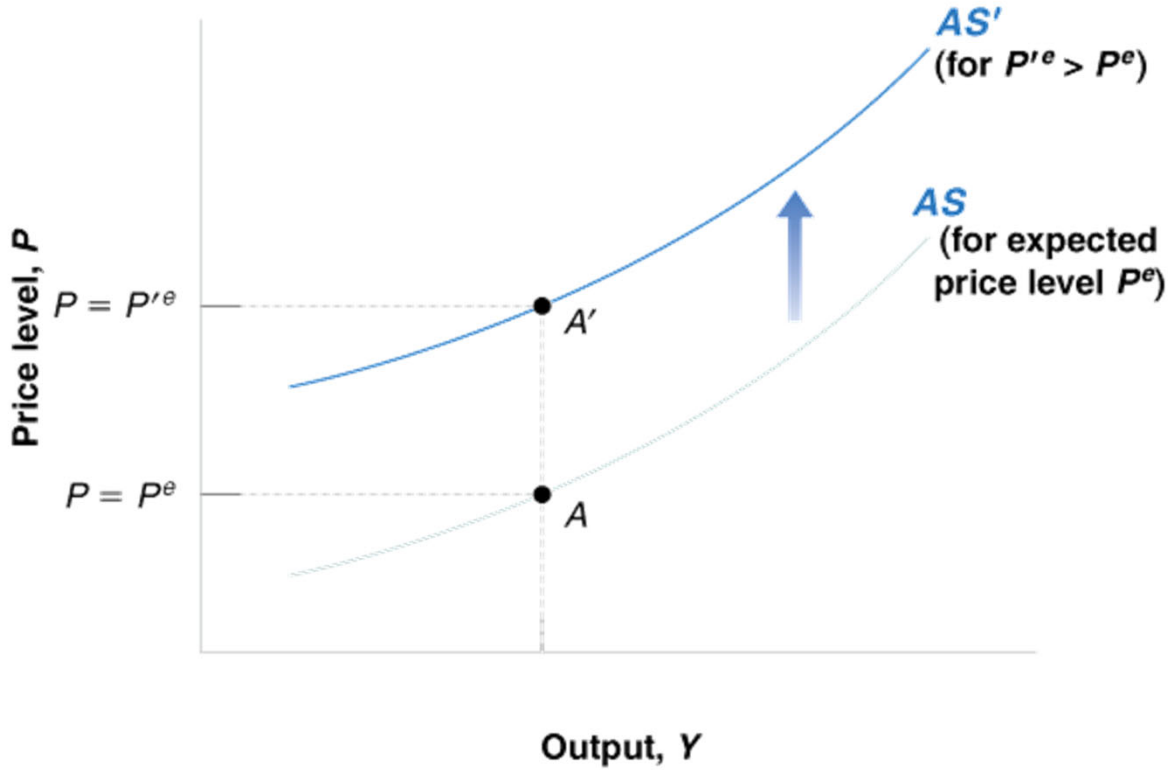
7.1 Aggregate supply (AS)

$$(7.2) \qquad P = P^e(1+\mu)F\left(1-\frac{Y}{L}, z\right)$$

Price level P varies positively with

- the price expectations
- and the income level.

Three properties of the AS-curve



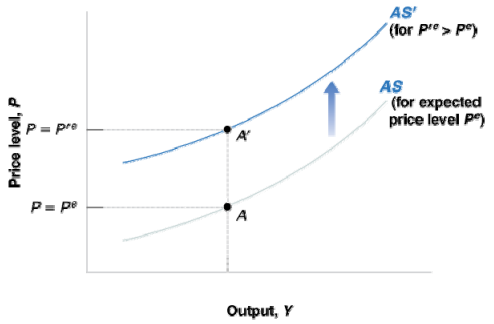
1. AS-curve has a positive slope.
2. Aggregated supply curve runs through point A.
3. An increase in the expected price level shifts the AS-curve upwards.

1. AS-curve has a positive slope

An increase in output increases the price level.

➔ **AS-curve has a positive slope**

1. $Y \uparrow \Rightarrow N \uparrow$
2. $N \uparrow \Rightarrow u \downarrow$
3. $u \downarrow \Rightarrow W \uparrow$
4. $W \uparrow \Rightarrow P \uparrow$



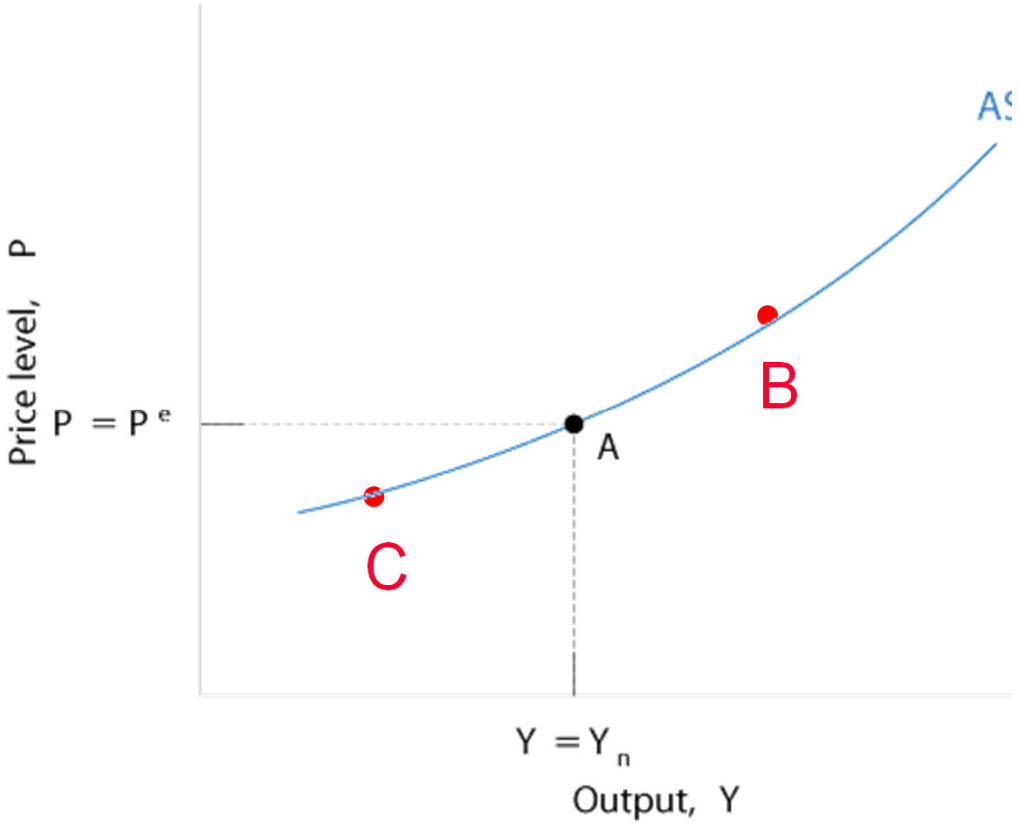
2. Aggregated supply curve runs through point A

- **In A:** $Y = Y_n \rightarrow P = P^e$

Implications:

$$\text{in B: If } \quad Y > Y_n \quad \Rightarrow \quad P > P^e$$

$$\text{in C: If } \quad Y < Y_n \quad \Rightarrow \quad P < P^e$$

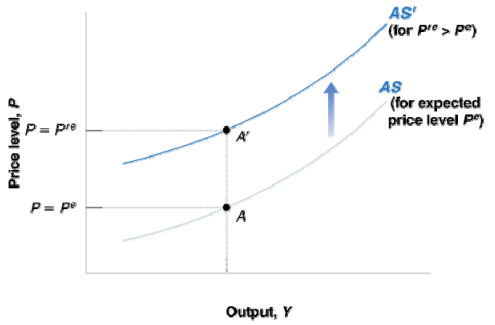


3. A change in P^e shifts the AS-curve

- If P^e changes, the AS-curve will shift.
- An increase in the price expectations will shift the AS-curve upwards.
- A reduction of P^e shifts the AS-curve downwards.

Argumentation:

1. $P^e \uparrow \Rightarrow W \uparrow$
2. $W \uparrow \Rightarrow P \uparrow$



AS-curve: Numerical example

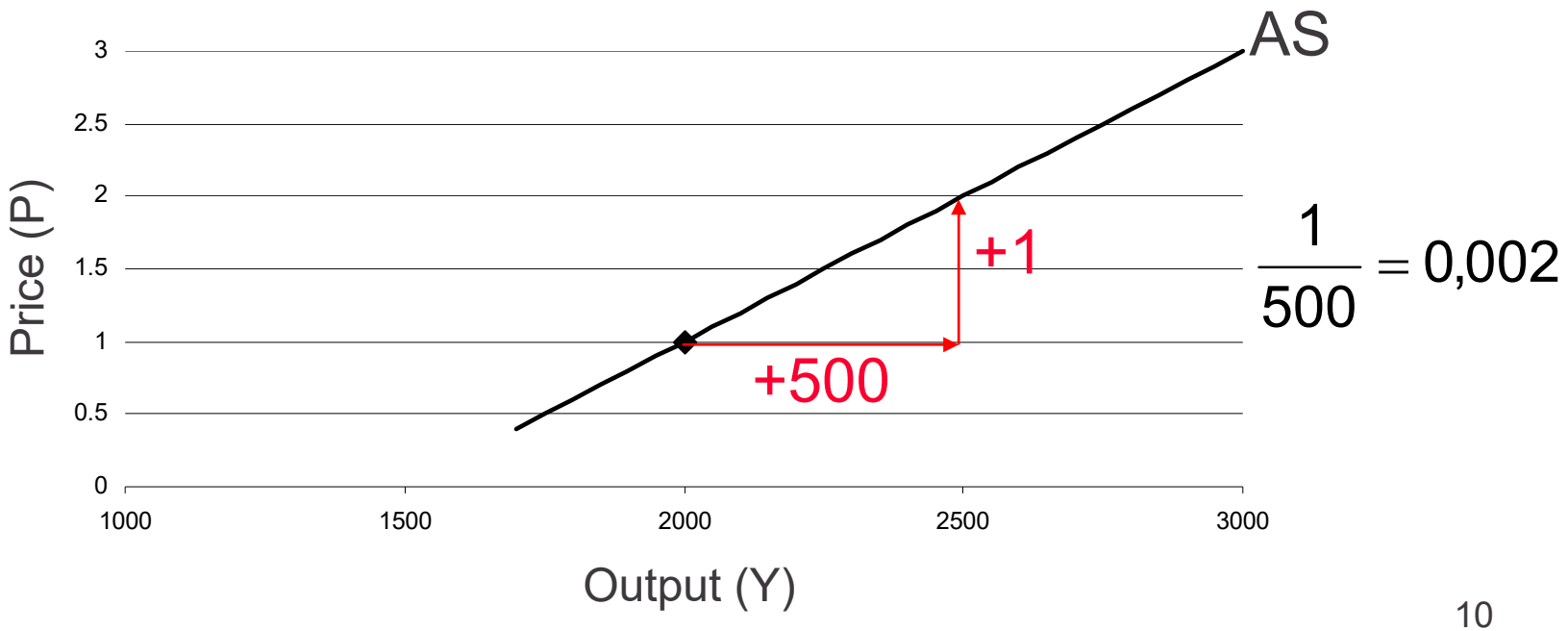
Assumption

AS-curve is linear

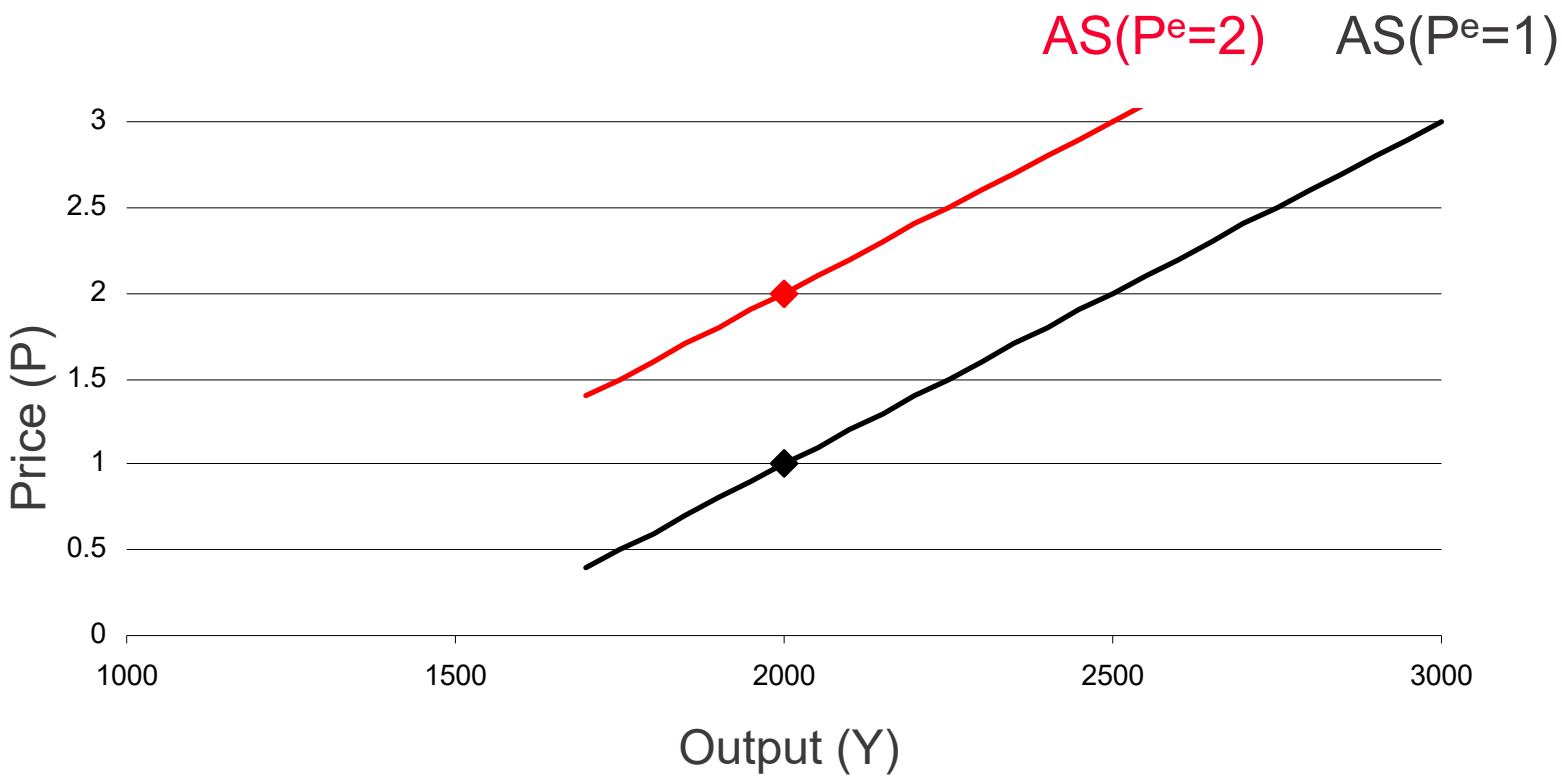
$$P = P^e + f(Y - Y_n)$$

$$P = 1 + 0{,}002(Y - 2000)$$

P^e	1
f	0,002
Y_n	2000



AS-curve: Numerical example: $P^e = 2$



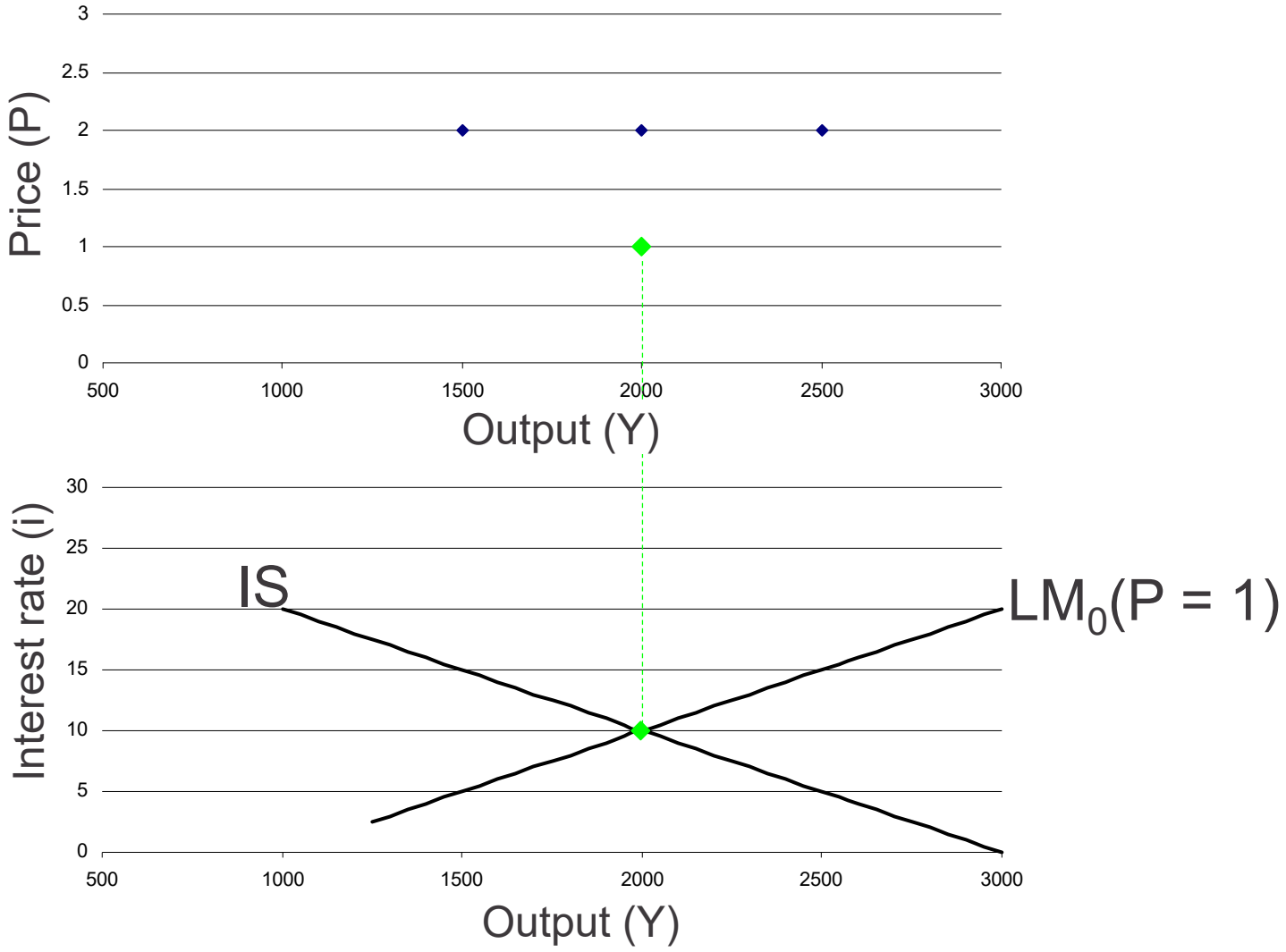
7.2 Aggregate demand (AD)

- **Aggregated demand** captures the effect of the price level on the demand side of an economy.
- AD depends on the equilibrium conditions for the goods and financial market.

$$\text{Goods market } (\text{IS}): \quad Y = c_0 + c_1(Y - T) + b_0 + b_1 Y - b_2 i + G$$

$$\text{Financial market } (\text{LM}): \quad \frac{M}{P} = d_0 + d_1 Y - d_2 i$$

7.2 Aggregated demand curve: Graphical derivation



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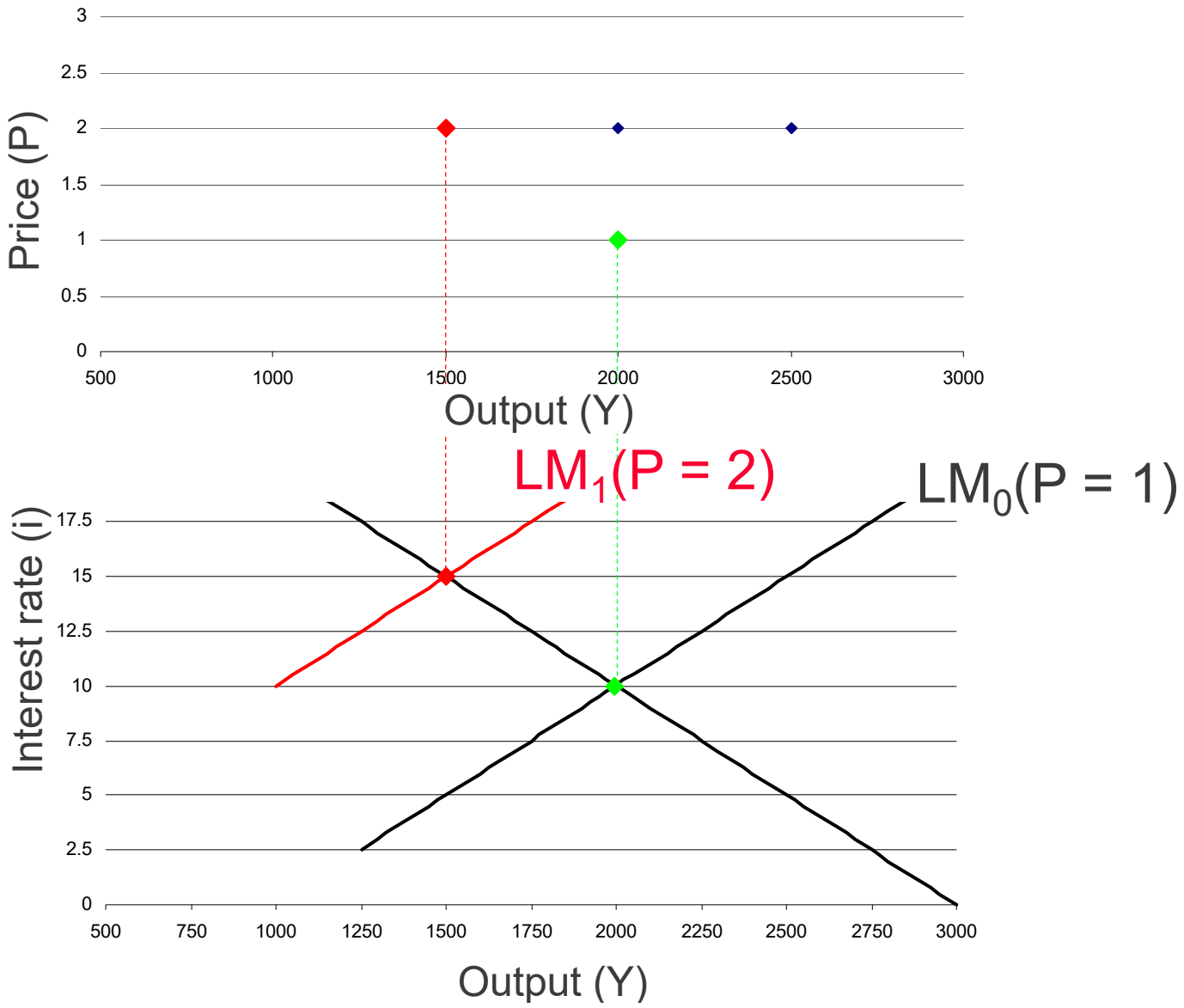

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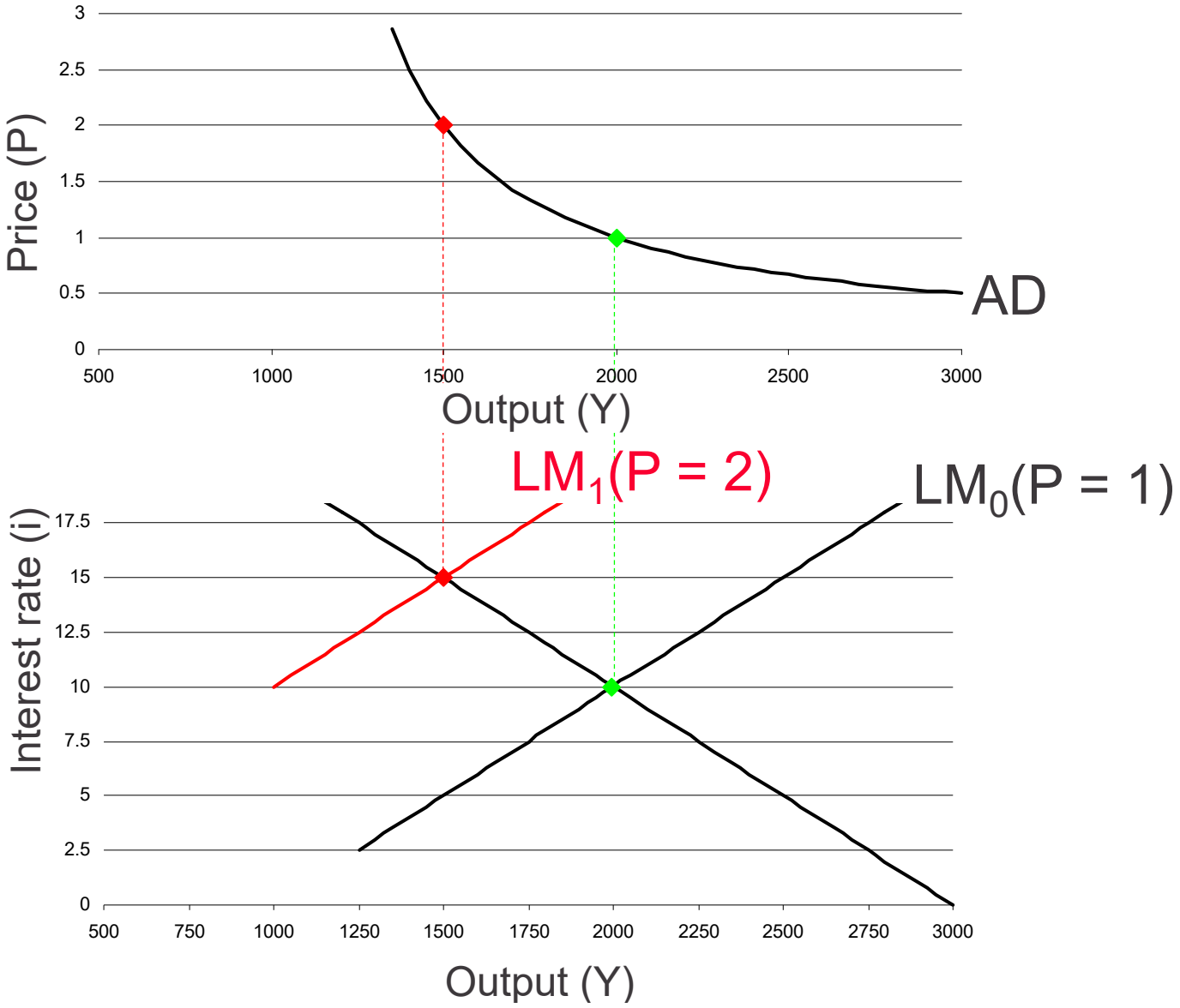


Shift of the AD-curve

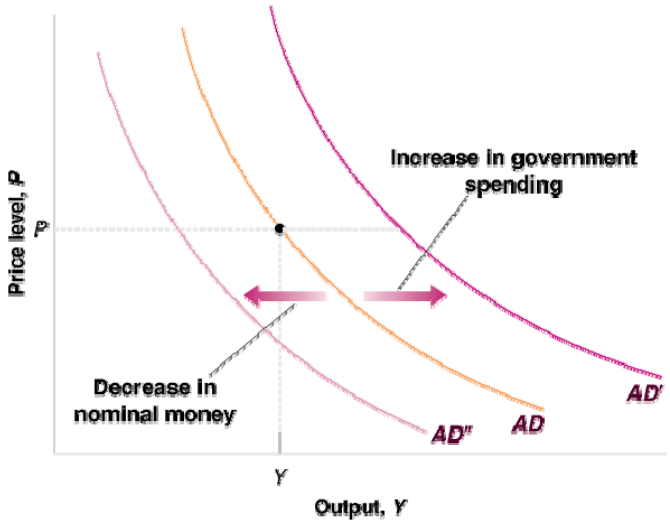
$$\text{IS}: \quad Y = c_0 + c_1(Y - T) + b_0 + b_1 Y - b_2 i + G$$

$$\text{LM}: \quad \frac{M}{P} = d_0 + d_1 Y - d_2 i$$

AD-curve to the right:

$$\text{IS}: \quad c_0 \uparrow \quad T \downarrow \quad b_0 \uparrow \quad G \uparrow$$

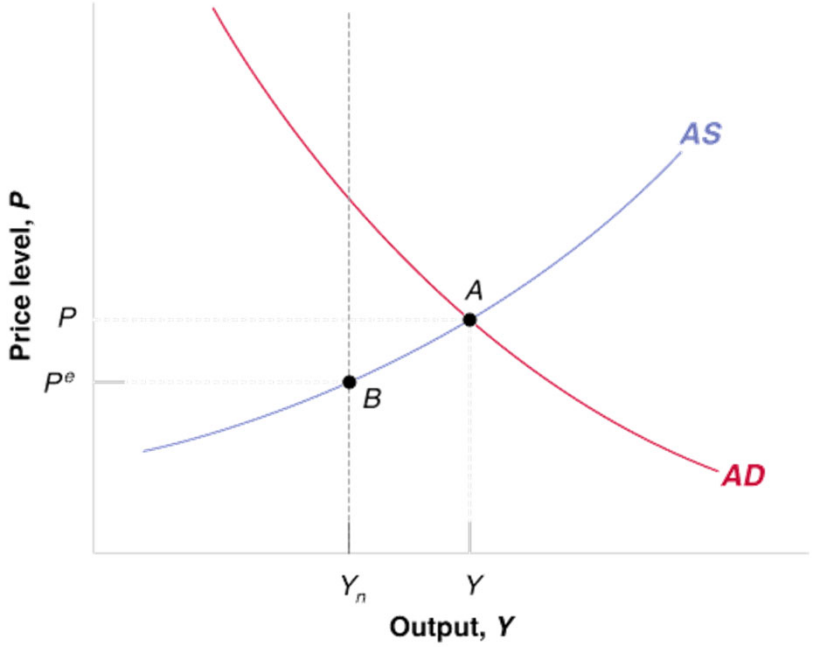
$$\text{LM}: \quad M \uparrow \quad d_0 \downarrow$$



7.3 Equilibrium in the short and medium run

Equilibrium in the short run

- Short run equilibrium is determined by the intersection of the AD- and AS-curve.
- In this short run equilibrium, all markets are in equilibrium.

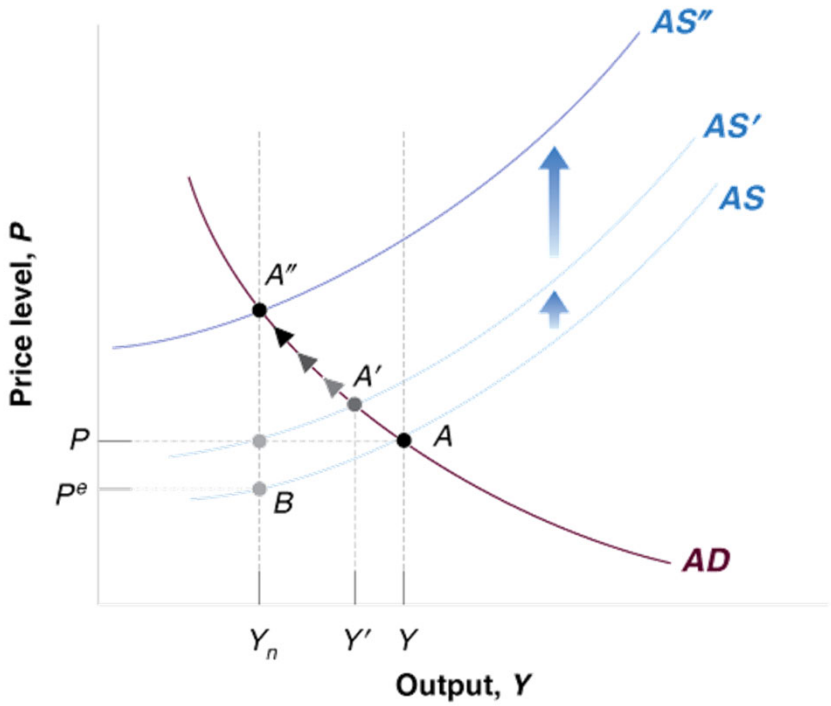


Difference between the short and the medium run

In short run equilibrium A: $Y > Y_n \Rightarrow P > P^e$

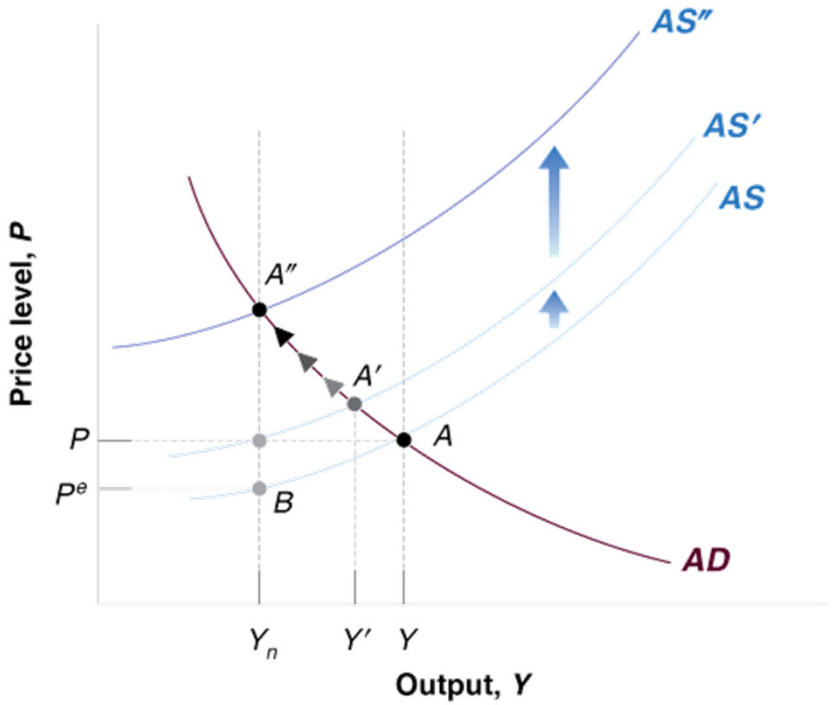
- Over time: Employees/employers adjust their price expectations $P^e\uparrow$
  ➔ AS-curve shift upwards ➔ AS‘

- $P^e\uparrow$ increases the nominal wage level (w↑), cost increase, prices increase (from P^A to $P^{A‘}$)



Difference between the short and the medium run

- Adjustment process stops, if: $Y = Y_n \Rightarrow P = P^e$
- Employee/employer do not have a reason to change their expectations.
- In the medium run the output will adjust towards its natural level.



Chapter 7: Putting all markets together: The AS-AD model

- Learning objectives

1. 7.1 Aggregate supply
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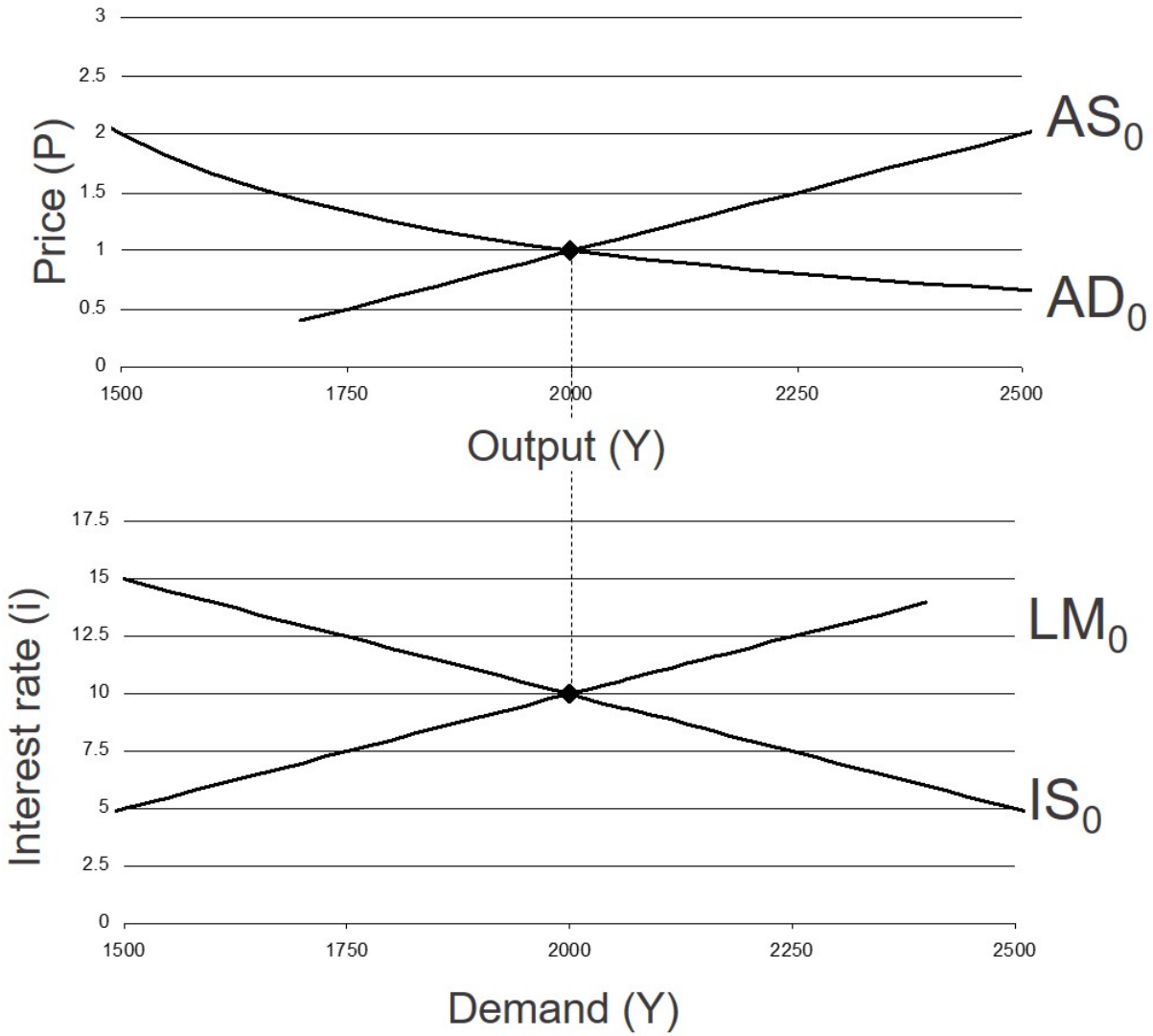
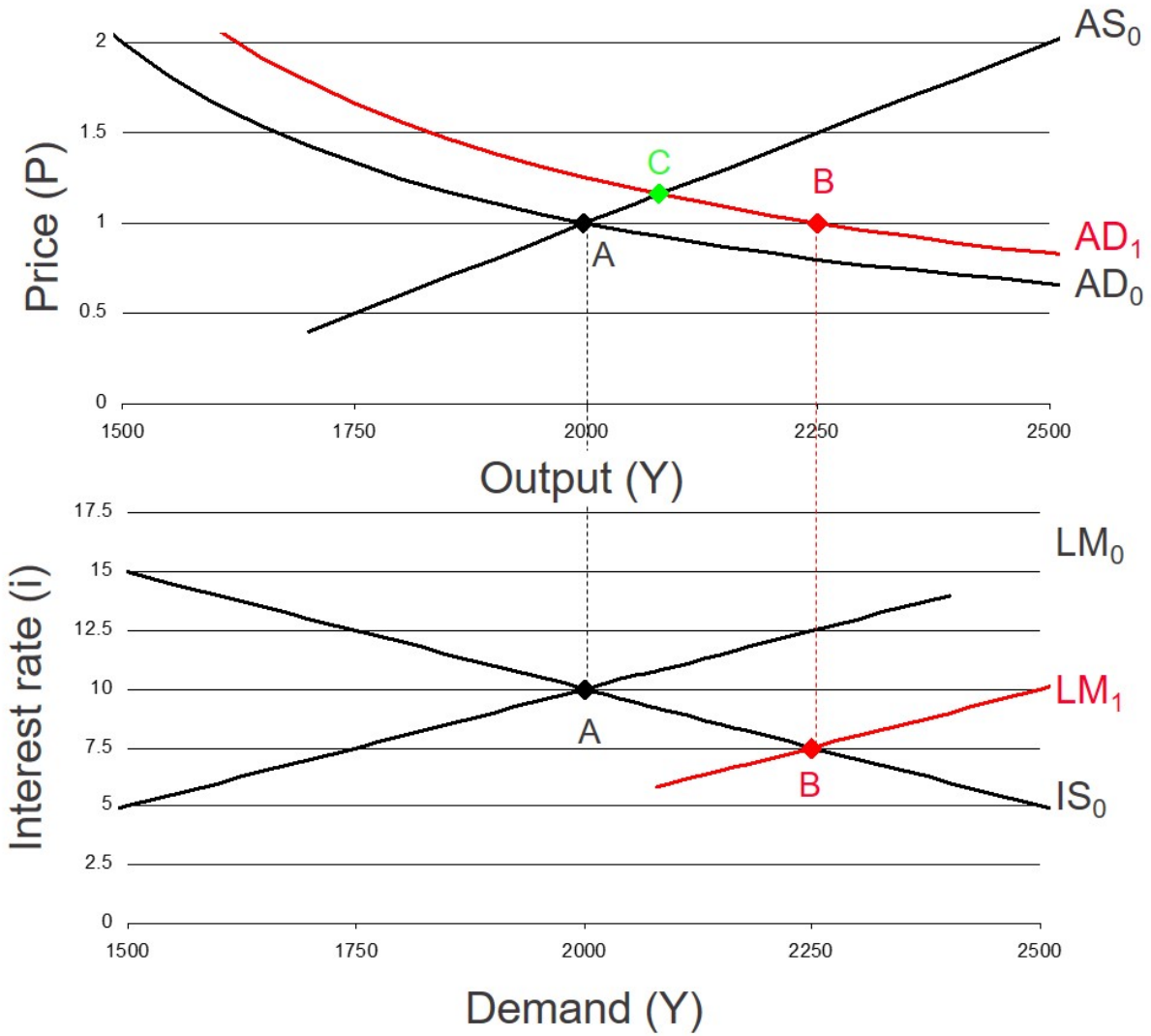
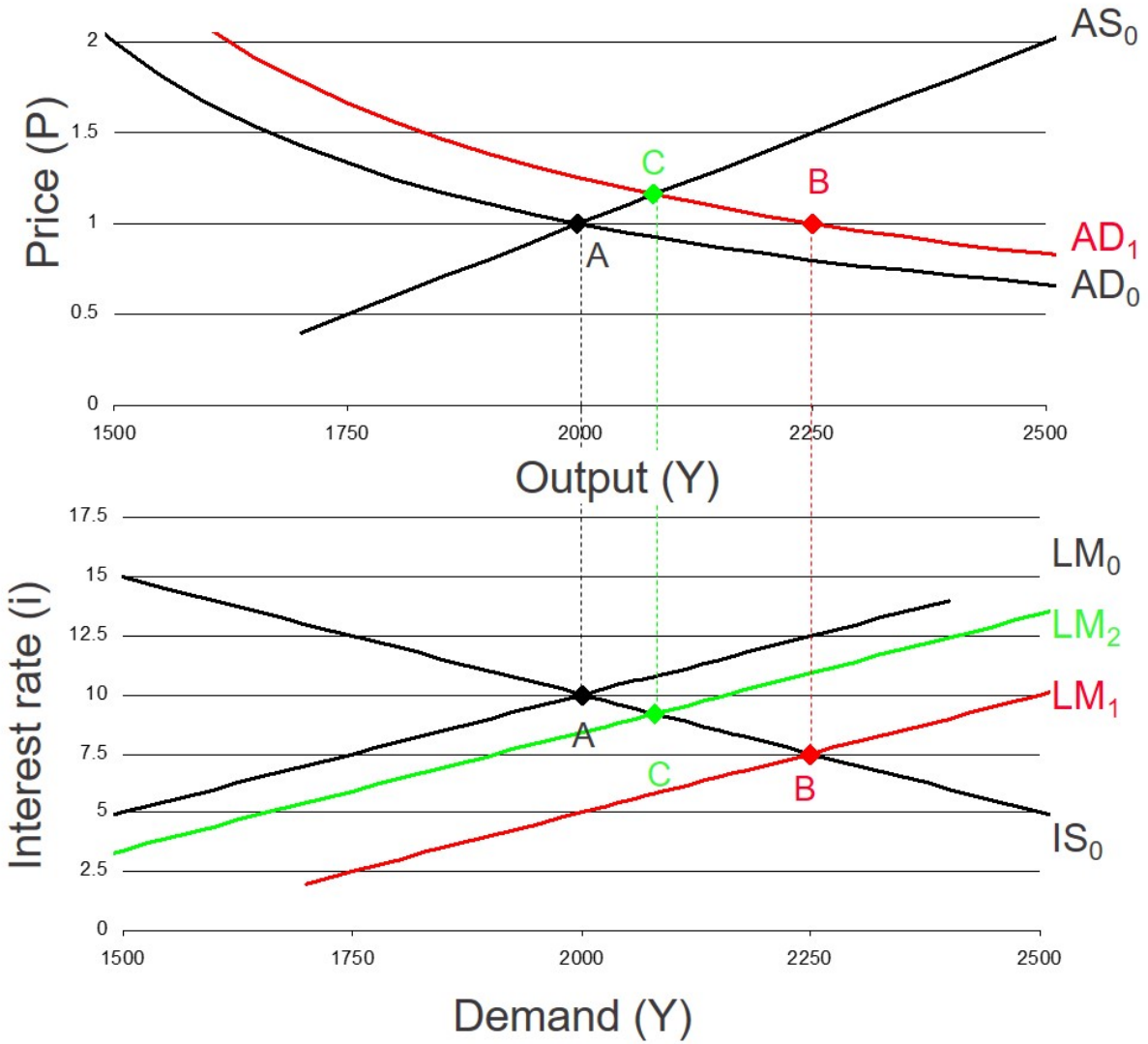
Expansionary monetary policy in the AS-AD-model



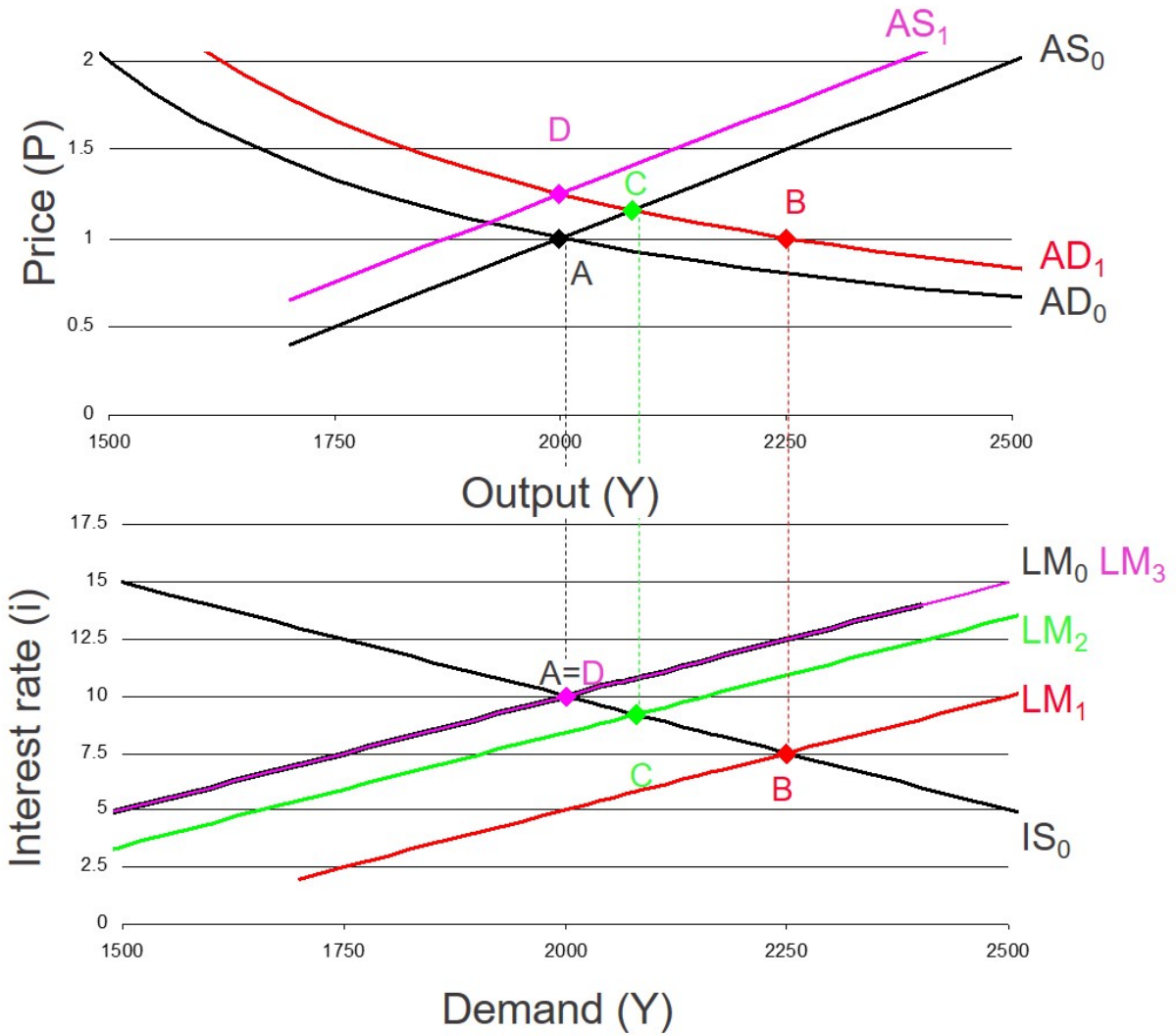
Expansionary monetary policy ($dM = +500$)



Equilibrium in the short run



Equilibrium in the medium run



Dynamics: From A to B

- $M^S \uparrow \Rightarrow M^S > M^D \Rightarrow B^D \uparrow \Rightarrow B^D > B^S \Rightarrow BP \uparrow \Rightarrow i \downarrow \Rightarrow M^D \uparrow$
- Due to the reduction in interest rates: Spillover effect from the money market to the goods market:
- $(-b_2 \cdot i \downarrow) \uparrow \Rightarrow Y^D \uparrow \Rightarrow Y^D > Y^S \Rightarrow Y \uparrow \& P \uparrow \Rightarrow C(Y) \uparrow \Rightarrow Y \uparrow\uparrow\uparrow$
- Due to income growth: Spillover effect from the goods market to the money market:
- $M^D \uparrow$

Dynamics: From B to C

- $P \uparrow \Rightarrow \frac{M}{P\uparrow} \downarrow \quad M^D > M^S \Rightarrow B^S \uparrow \Rightarrow B^S > B^D \Rightarrow BP \downarrow \Rightarrow i \uparrow \Rightarrow M^D \downarrow$
- Due to the increase in the interest rates: Spillover effect from the money market to the goods market:
- $(-b_2 \cdot i \uparrow) \downarrow \Rightarrow Y^D \downarrow \Rightarrow Y^S > Y^D \Rightarrow Y \downarrow$
- Effect on GDP is lower in the short run equilibrium of the AS AD model compared to the IS LM model.

Dynamics: From C to D

- In equilibrium A: $\frac{W_A}{P_A} = \frac{2000 \text{ EUR}}{2 \text{ EUR/choc}} = 1000$ chocolate bars
- In equilibrium C: $\frac{W_A}{P_C} = \frac{2000 \text{ EUR}}{3 \text{ EUR/choc}} \approx 667$ chocolate bars
- Idea: *Let's increase the wage to:* $W_C = 3000$ EUR
- Idea: $\frac{W_C}{P_C} = \frac{3000 \text{ EUR}}{3 \text{ EUR/choc}} = 1000$ chocolate bars
- Result: $\frac{W_C}{P'_C} = \frac{3000 \text{ EUR}}{3.50 \text{ EUR/choc}} \approx 857$ chocolate bars
- In equilibrium D: $\frac{W_D}{P_D} = \frac{4000 \text{ EUR}}{4 \text{ EUR/choc}} = 1000$ chocolate bars

Neutrality of money / Classical dichotomy

Neutrality implies:

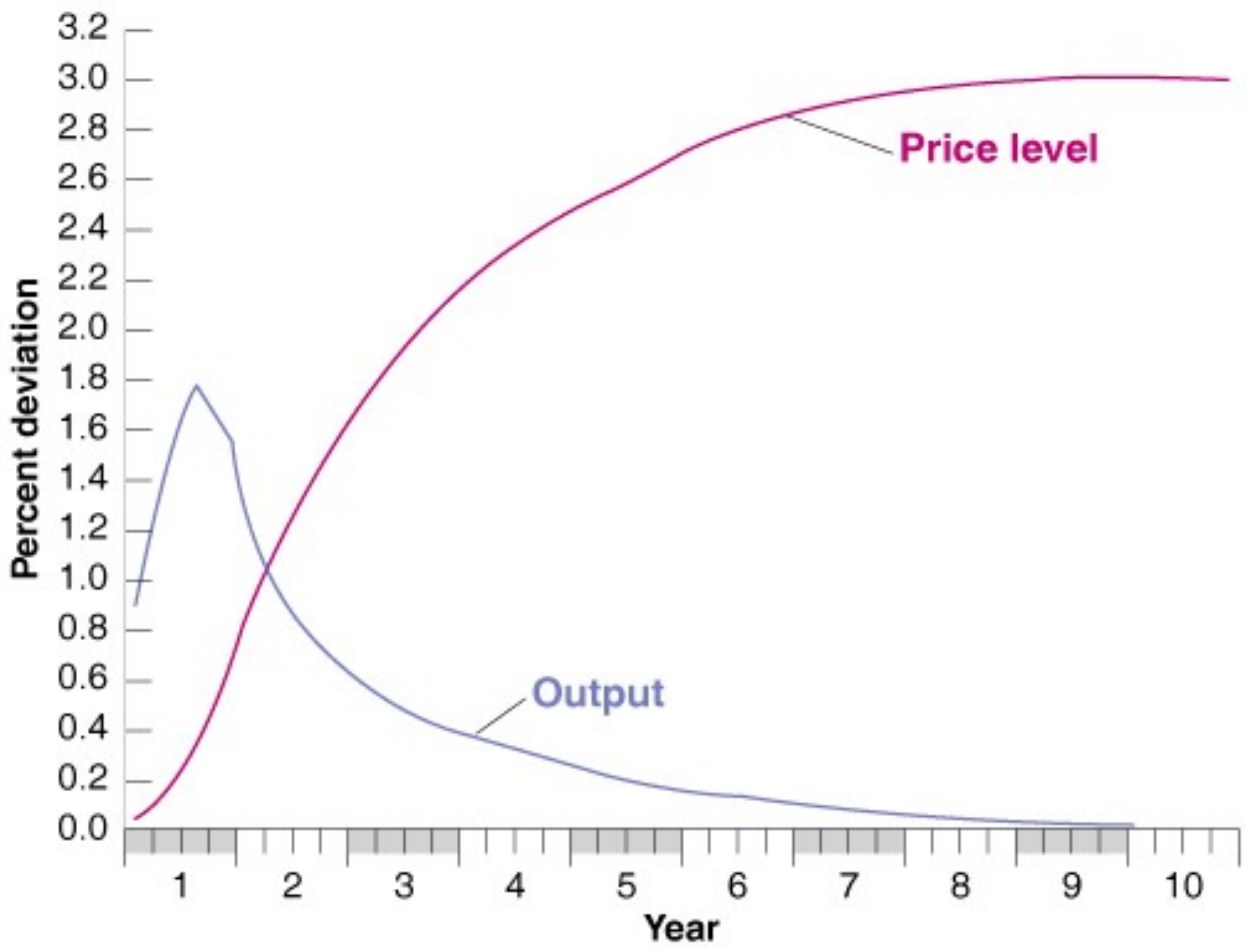
- An increase in money supply does not affect – in the medium run – the real output or the real interest rate.
- The increase in money supply is neutralized via an increase in the price level:

$$\frac{M \uparrow}{P \uparrow} = \bar{M}^S \tag{1}$$

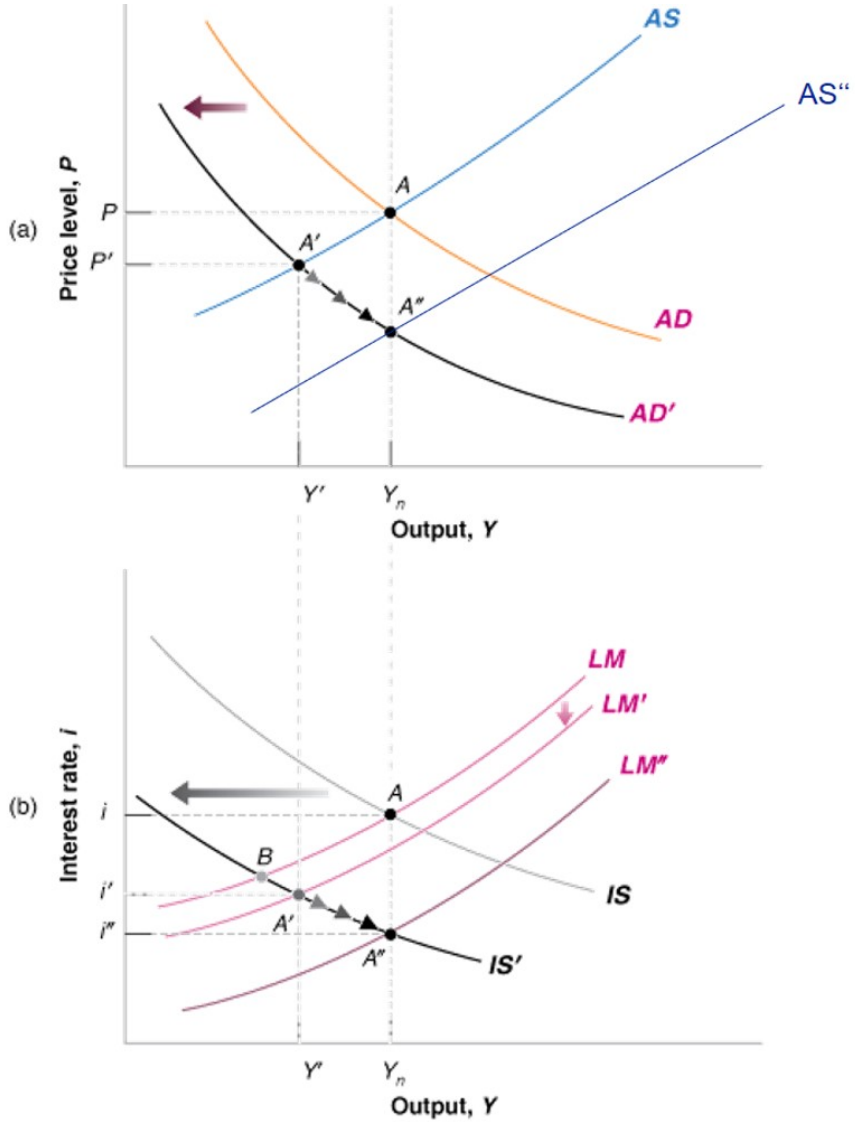
Classical Dichotomy:

- Supply side determines the level of real income.
- Demand side determines the size of the price level.

Empirical analysis



Restrictive fiscal policy: AS-AD-model



Dynamics: From C to D

A' = C and A'' = D

- In equilibrium A: $\frac{W_A}{P_A} = \frac{4000 \text{ EUR}}{4 \text{ EUR/choc}} = 1000$ chocolate bars
- In equilibrium C: $\frac{W_A}{P_C} = \frac{4000 \text{ EUR}}{3 \text{ EUR/choc}} \approx 1333$ chocolate bars
- Idea: *Let's decrease the wage to:* $W_C = 3000$ EUR
- Idea: $\frac{W_C}{P_C} = \frac{3000 \text{ EUR}}{3 \text{ EUR/choc}} = 1000$ chocolate bars
- Result: $\frac{W_C}{P'_C} = \frac{3000 \text{ EUR}}{2.50 \text{ EUR/choc}} \approx 1200$ chocolate bars
- In equilibrium D: $\frac{W_D}{P_D} = \frac{2000 \text{ EUR}}{2 \text{ EUR/choc}} = 1000$ chocolate bars

GDP level constant but structure has changed

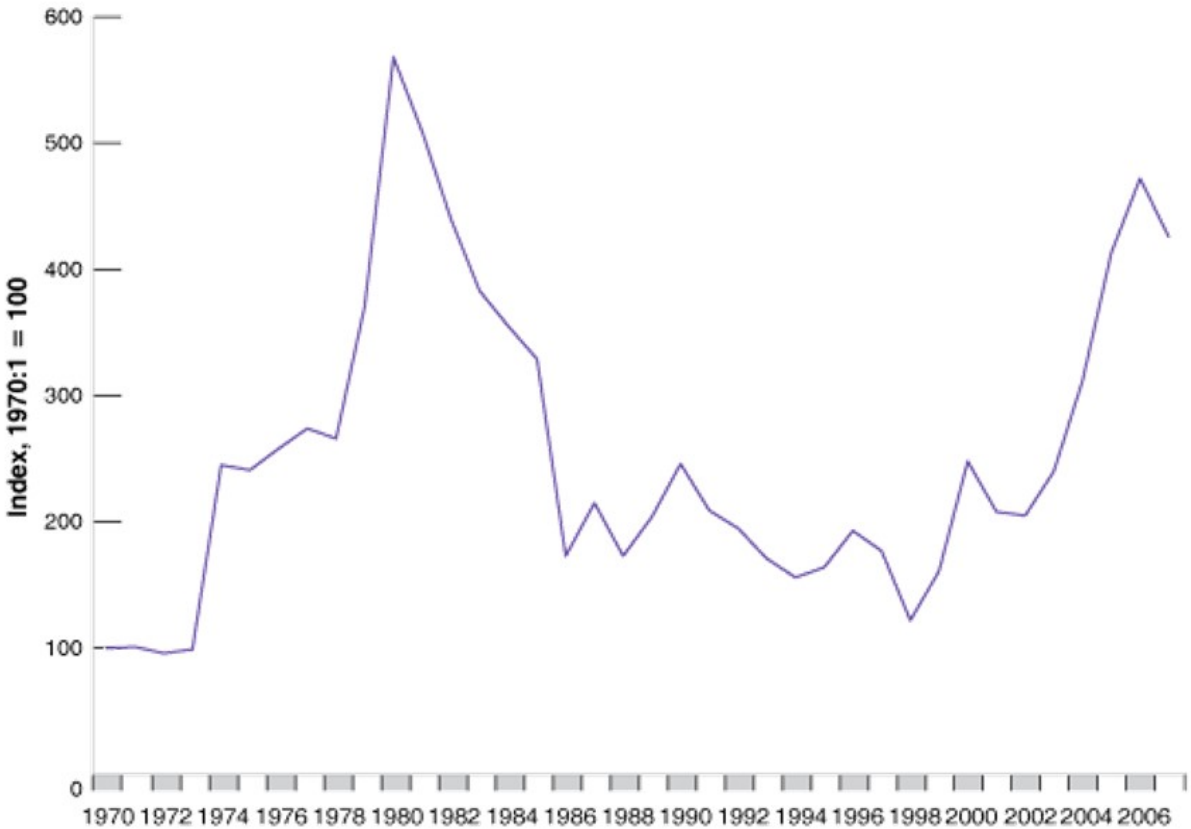
- Demand structure has changed due to the consolidation of the government budget deficit.

$$Y = c_0 + c_1(Y - T) + b_0 + b_1 Y - b_2 i + G \tag{2}$$

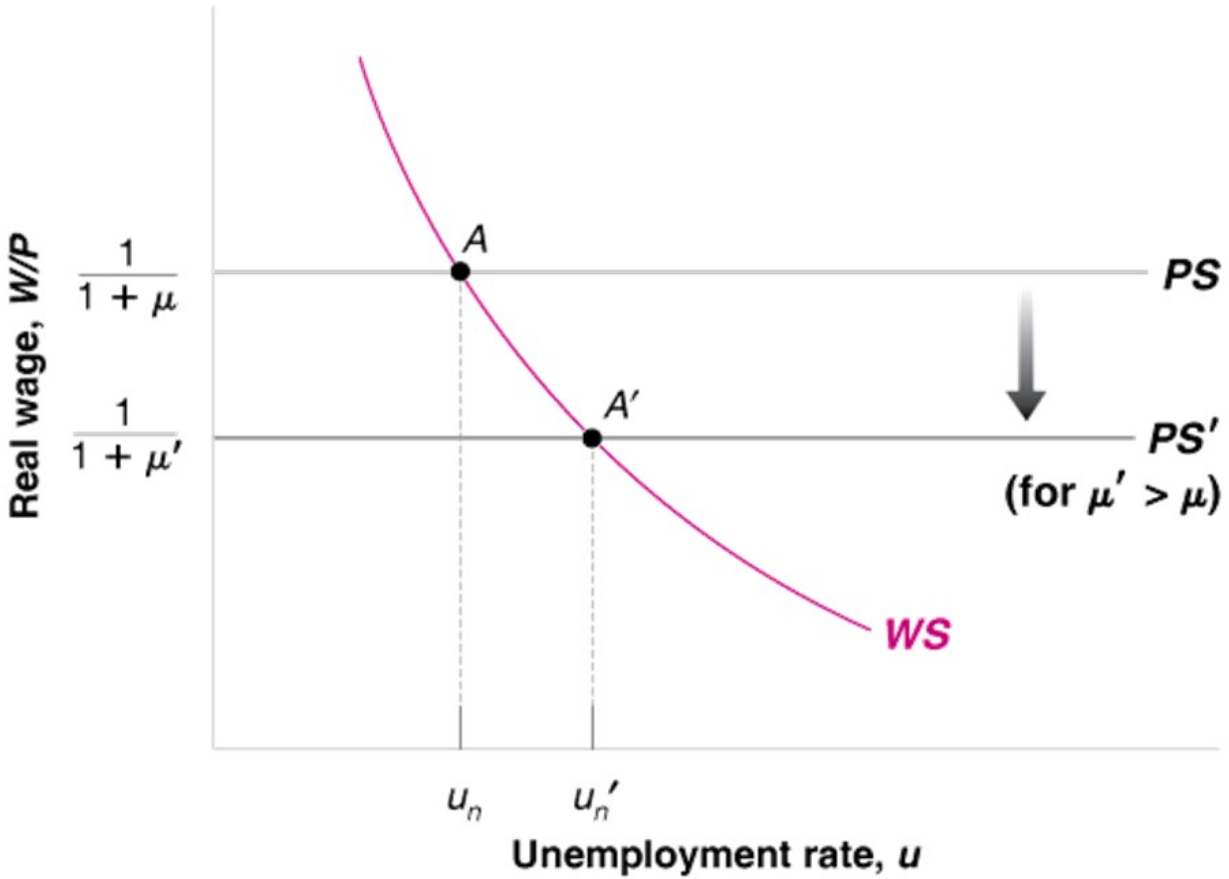
$$\frac{M}{P} = d_0 + d_1 Y - d_2 i \tag{3}$$

- Income and taxes are unchanged $\Rightarrow$ consumption on the same level as before.
- Government expenditure has decreased $\Rightarrow$ investment must have increased. Increase in investment is equal to the decrease in government expenditure.
- A fiscal consolidation of the government budget leads – in the medium run – to a reduction of the interest rate level and an increase in investment activity.

Oil price development over time



Oil price shock: Increase of the mark-up



Oil price shock: AS AD analysis