EE312 Macroeconomic Theory

Chapter 11 Williamson (2018 edition)

A Real Intertemporal Model

with Investment (Part 2)

Competitive equilibrium

- Interaction of the three economics agents; household, firm and government

- Their interactions take place in three markets
  - Labor market
  - Goods market
  - Credit market

Competitive equilibrium

- **The labor market**:
  - The consumer supplies labor service.
  - The firm demands labor service.
  - **The "real wage" and the level of employment are determined**

- **The goods market**:
  - The consumer, the firm and government purchase output.
  - The firm supplies the goods.
  - **The "real interest rate" and the level of aggregate output are determined**

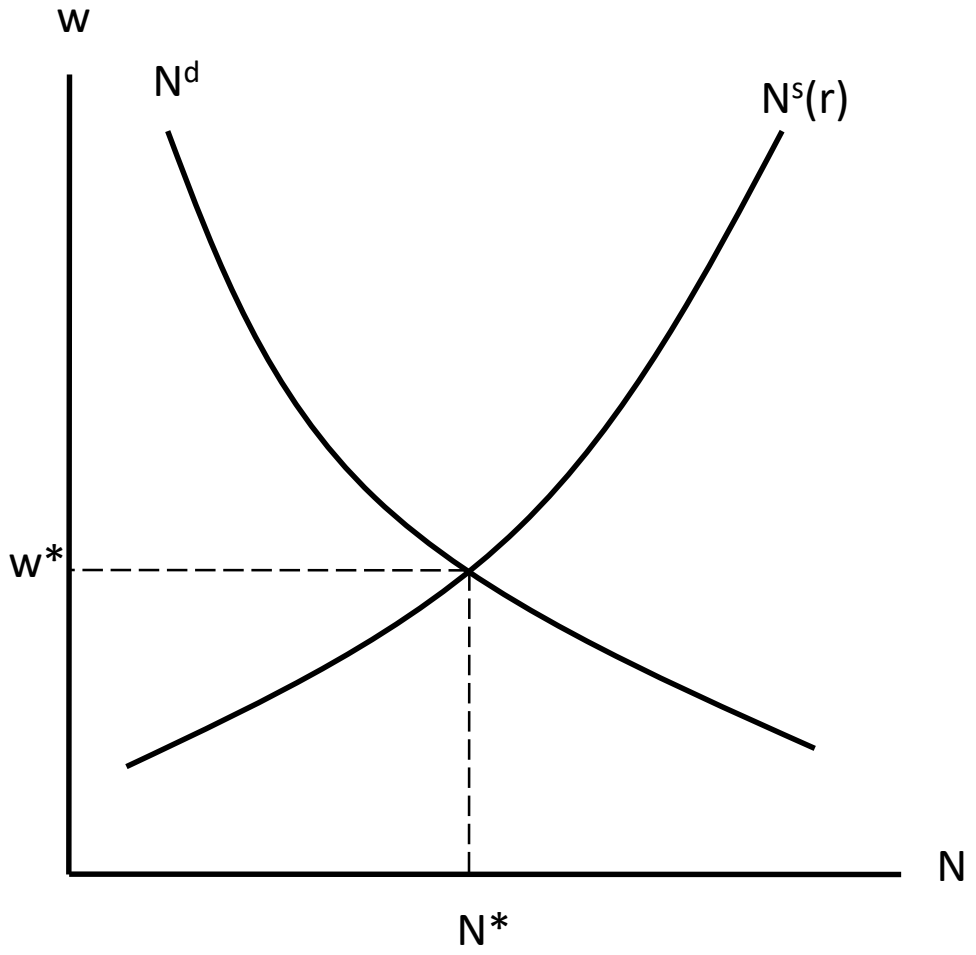
Competitive equilibrium

- **The credit market**
  - Demand for credit (borrowing)
  - Supply for credit (saving)
  - **The amount of credit loan, total saving, and interest rate are determined.**

- **Note:** with the Walras's law, we can abstract the analysis of credit market equilibrium. If the other two markets were already in the equilibrium, the equilibrium in credit market would be reached.

Equilibrium in the labor market

- Optimizing labor supply (N^s) is sloped upwards with dominant substitution effect, given r.
- Optimizing labor demand (N^d) is MP_N for the firm.
- N*= equilibrium employment.



Equilibrium in goods market

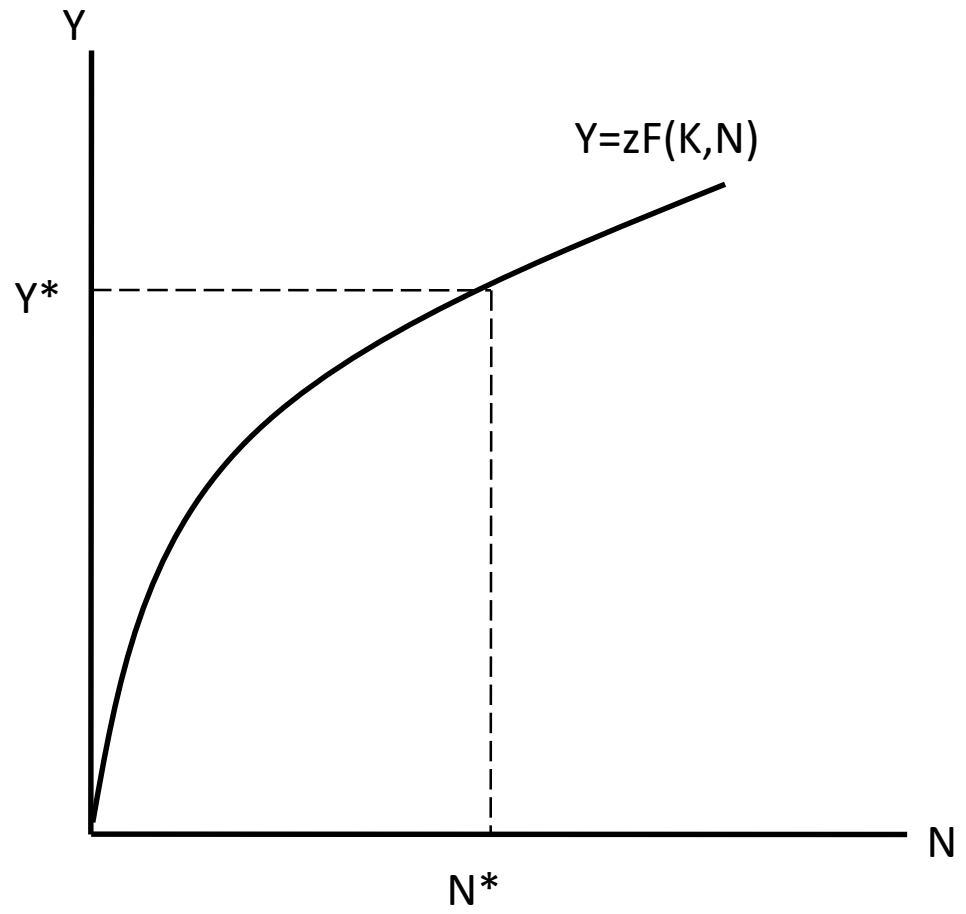
- We characterize equilibrium in goods market using AD-AS diagram.

- Our AD-AS diagram is derived from the optimizing behaviors.

- **Diagrammatically, aggregate supply is upward sloping in "r" while aggregate demand is downward sloping in "r".**
  - **Different from the conventional AD-AS diagram used in EE212**

Aggregate output supplied

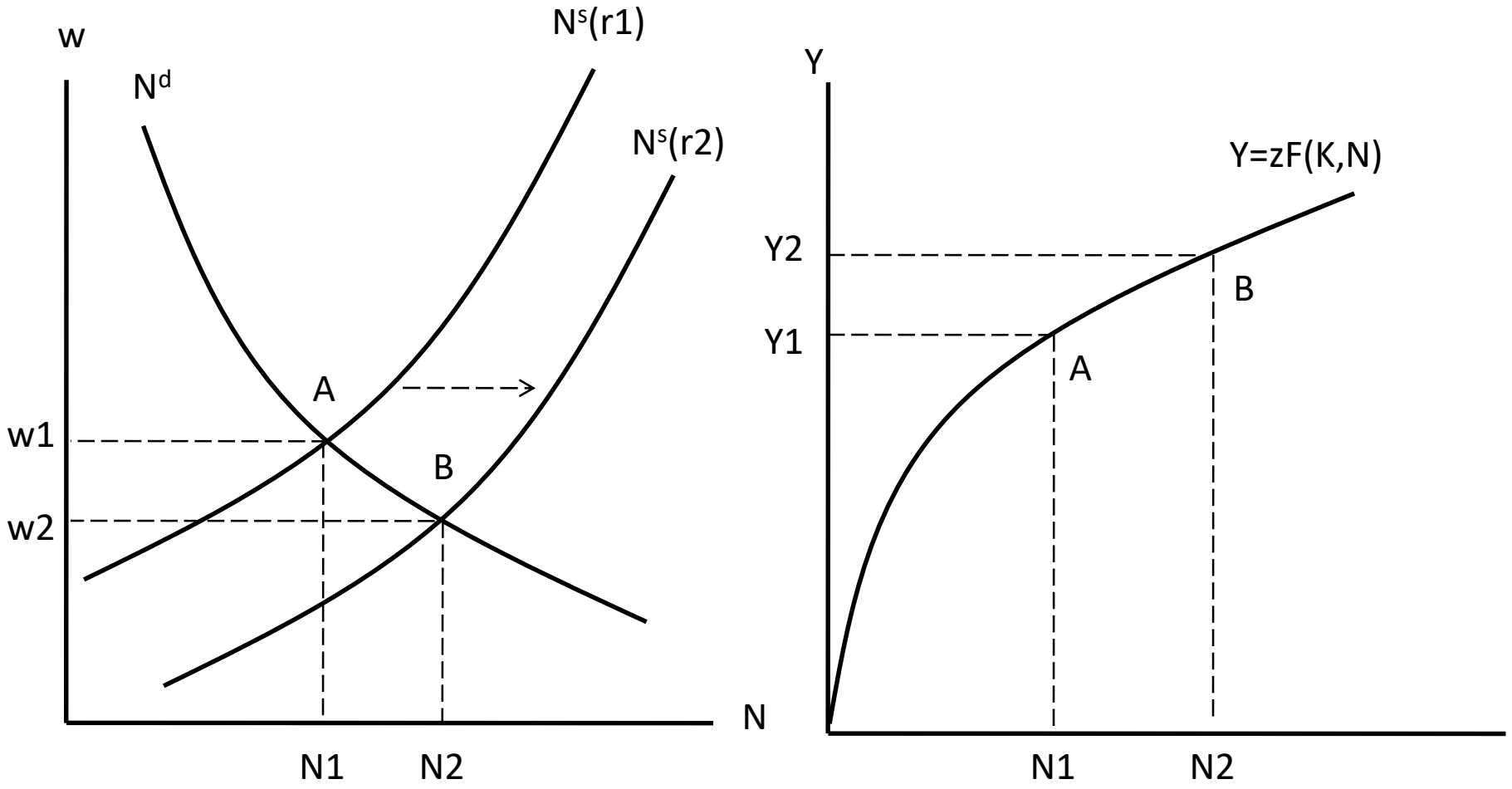
- With N* input, Y* is the quantity of aggregate output supplied, given z and K.



Output supply and real interest rate

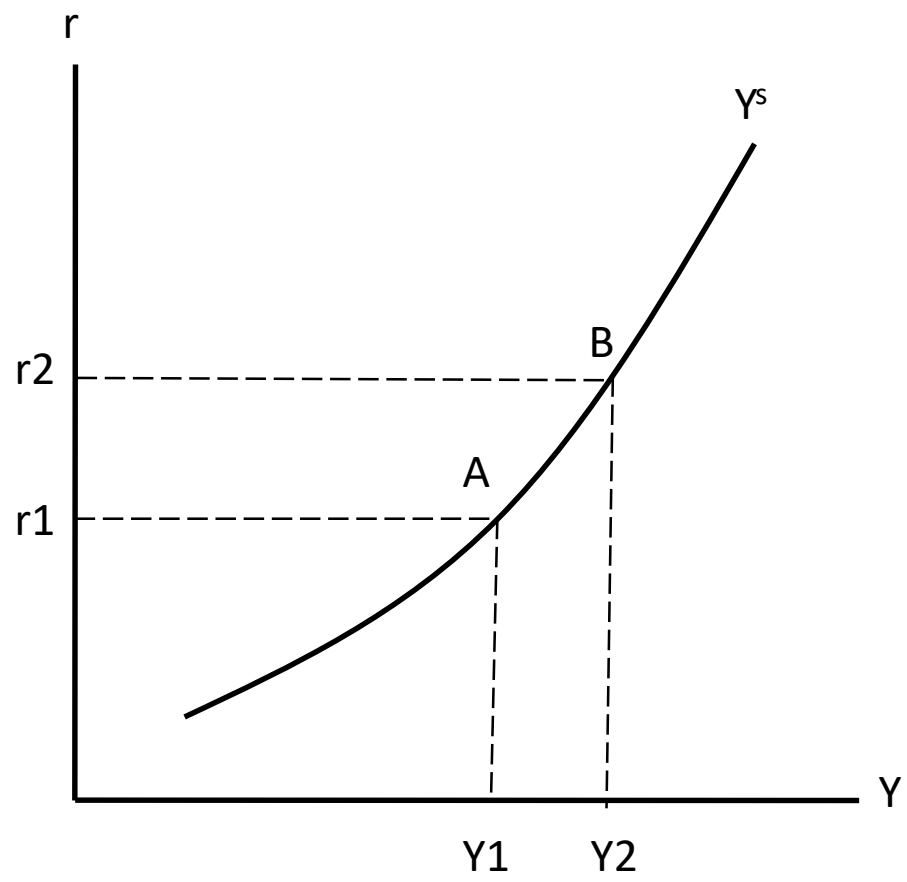
- The relationship between the real interest rate and the level of aggregate output.
- An increase in the real interest rate causes a reduction in current consumption and leisure.
  - **The labor market**: current labor supply increases.
  - **The production function**: current aggregate output increases.
- The output supply curve is sloped upwards.

Employment and output



Output supply curve (aggregate supply)

- The higher r causes more labor supply, employment and output.
- The labor market is in equilibrium at each level of r.



Output supply shifts

- Changes in **exogenous variables** shift the output supply curve.
  - Lifetime wealth (labor supply shift);
  - Current total factor productivity or current capital stock (labor demand and production function shifts).

- Changes in the real interest rate move along the output supply curve.

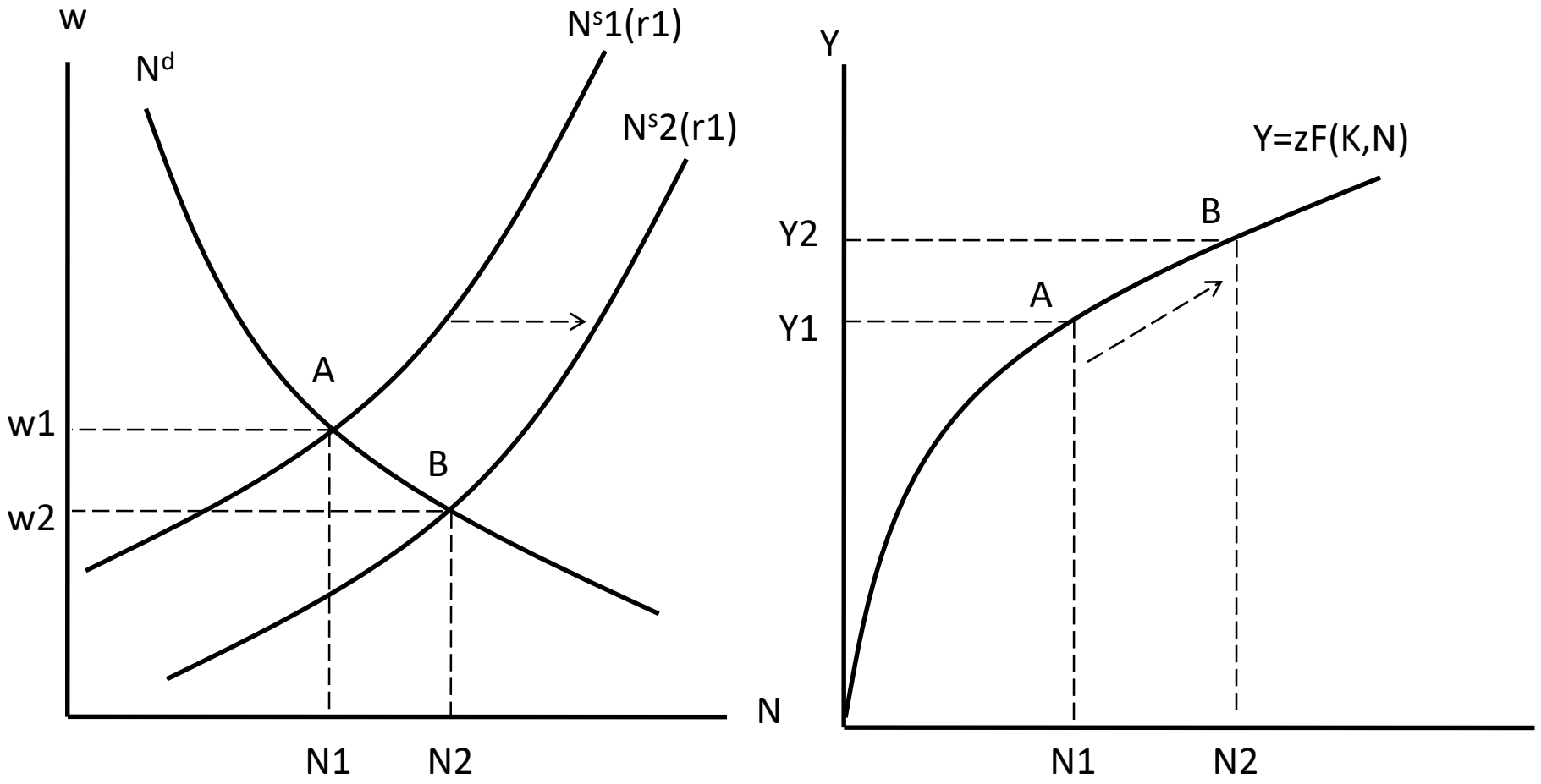
Changes in lifetime wealth

- A decrease in **lifetime wealth** reduces leisure (income effect) and increases labor supply, given the real wage.
  - An increase in **current or future government spending** reduce lifetime wealth.
  - The government PV budget constraint implies increases in the PV of taxes.

$$G + \frac{G'}{1+r} = T + \frac{T'}{1+r}$$

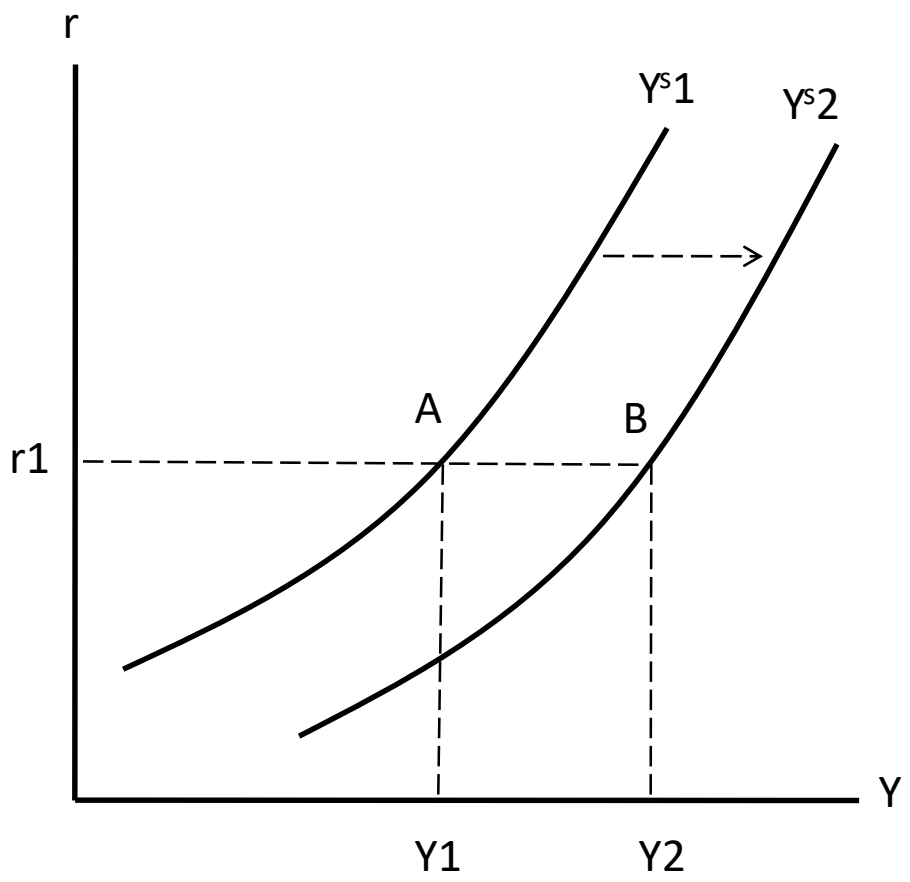
- **The labor market**:
  - The labor supply curve shifts to the right. (work more)
  - The real wage falls while employment increases
- **The production function**:
  - More labor input increases production.
  - Output increases, given r.
- **The output supply curve shifts to the right.**

A decrease in lifetime wealth



Rising output supply for lower we

- Output supply increases, given r, when lifetime wealth decreases and labor supply increases.

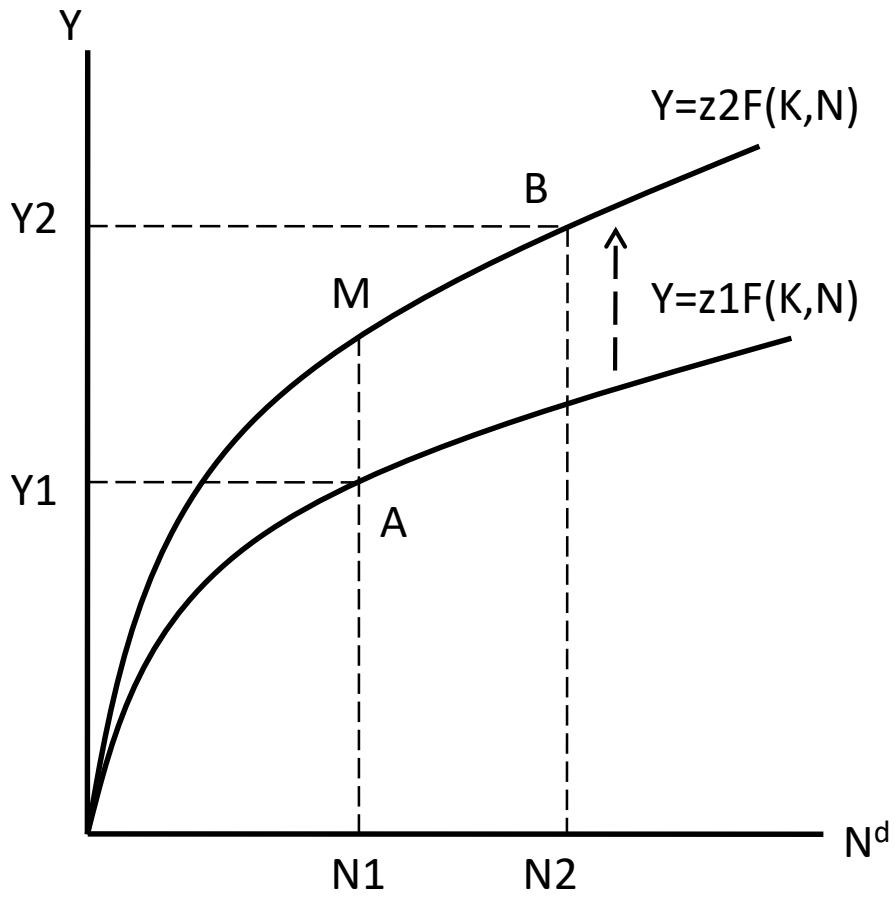


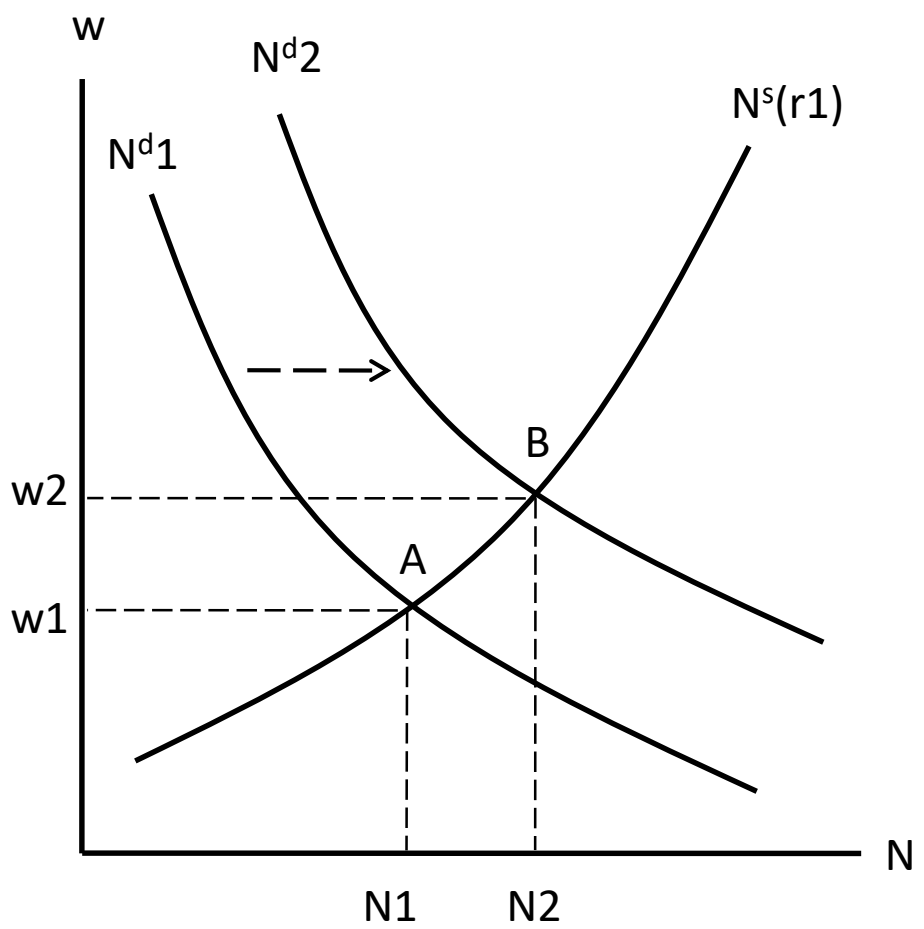
Changes in z or current K

- An increase in total factor productivity or current capital stock.
  - The production function shifts up.
  - Marginal product of labor (MP_N) increases.
  - The labor demand curve shifts to the right.
  - Employment increases with the real wage.
  - Output increases, given the real interest rate.

- The output supply curve shifts to the right.

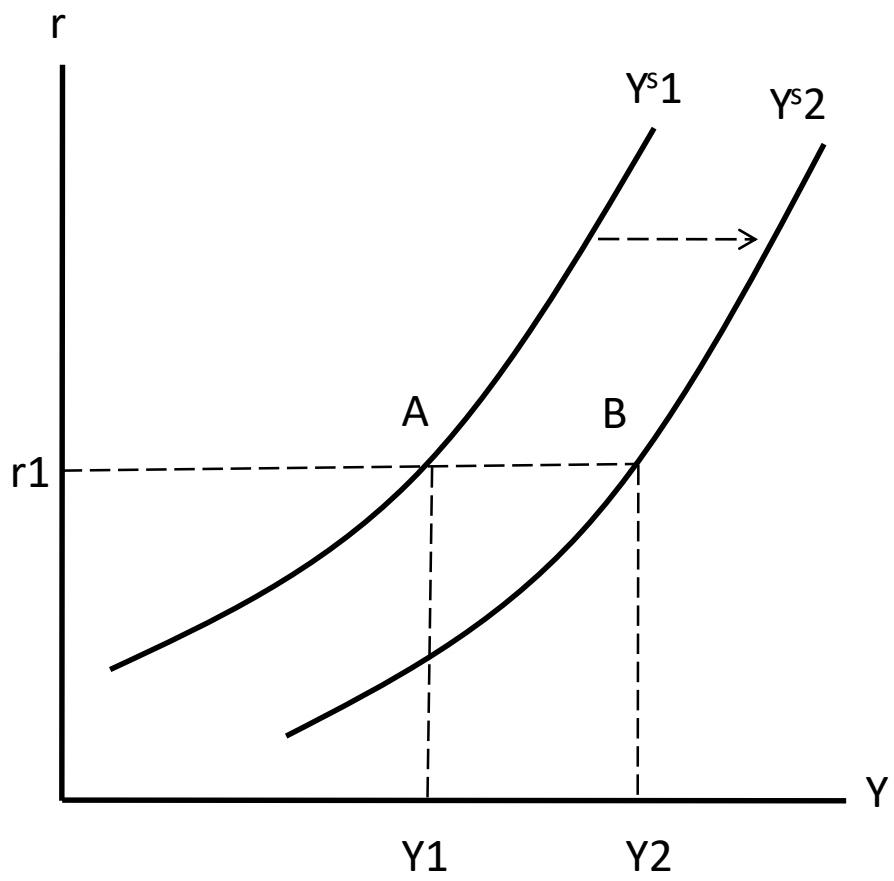
An increase in z or K





Rising output supply for higher z, K

- Higher z or K raises labor demand and the real wage.
- Rising employment and output supply, given r.



Total current demand for goods

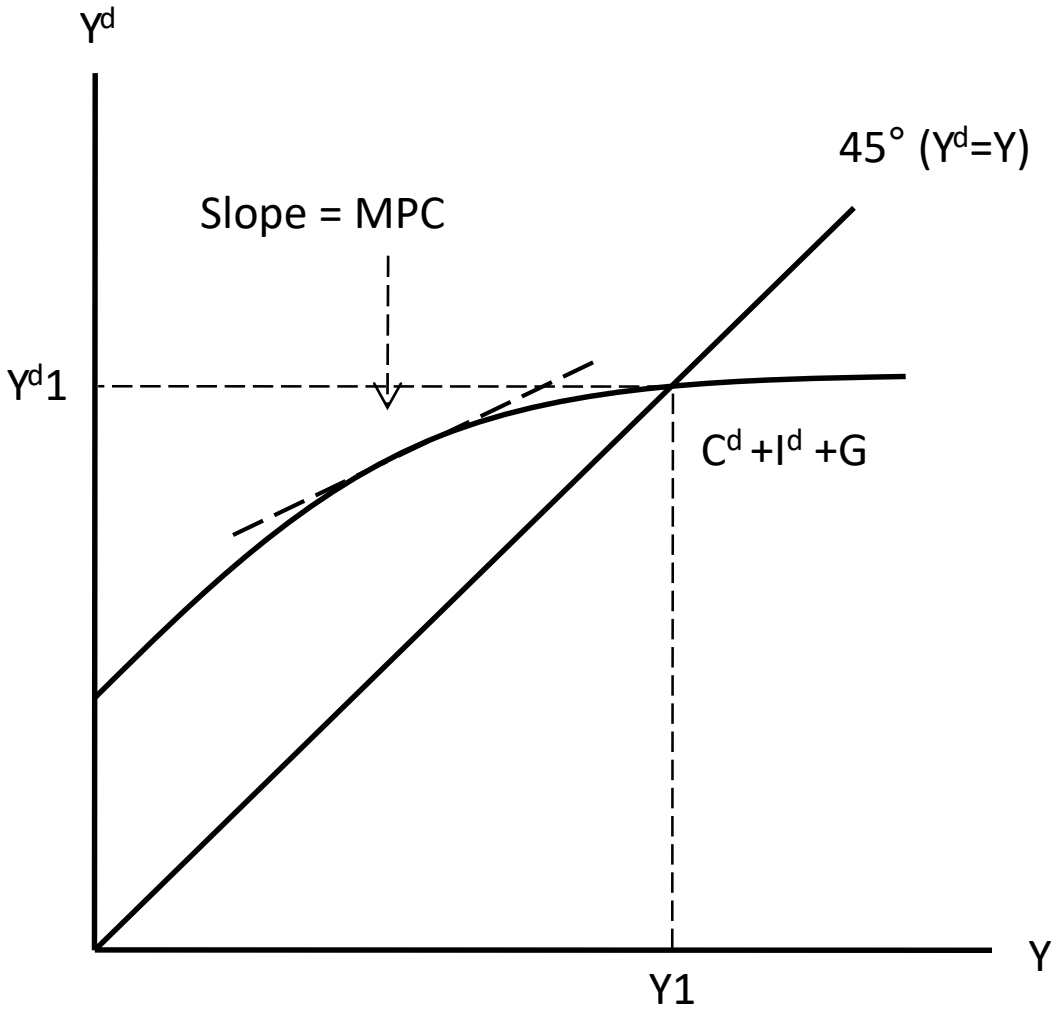
- **Total current expenditure for goods** (Y^d) equals the sum of:
  - The consumer's expenditure for current consumption goods (C^d);
  - The firm's expenditure for investment goods (I^d);
  - The government purchases of current goods (G).

- C^d and I^d are negatively related to the real interest rate.

$$Y^d = AE = C^d(r,Y) + I^d(r) + G$$

- For a given r, Y^d is upward sloping in Y (income/output).
  - Consumption expenditure increases in Y while I and G are not related to Y.
  - The slope of Y^d is equal to MPC.

- **Equilibrium: Y^d = Income (output)**



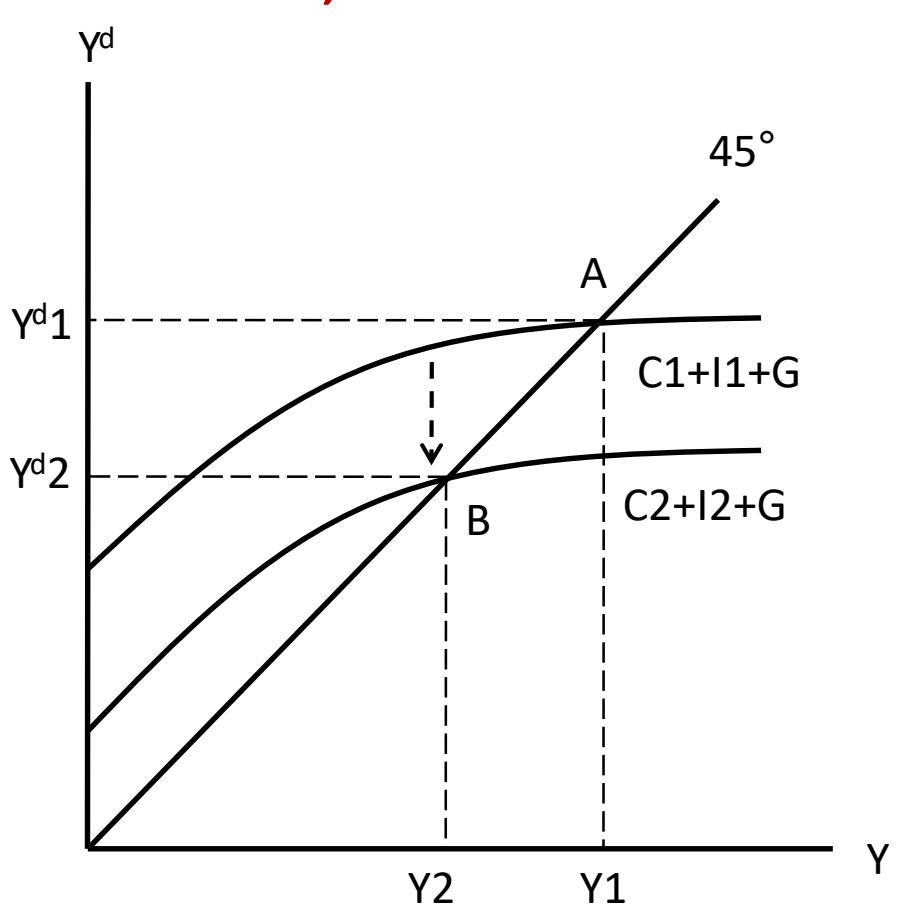
Output demand and real interest rate

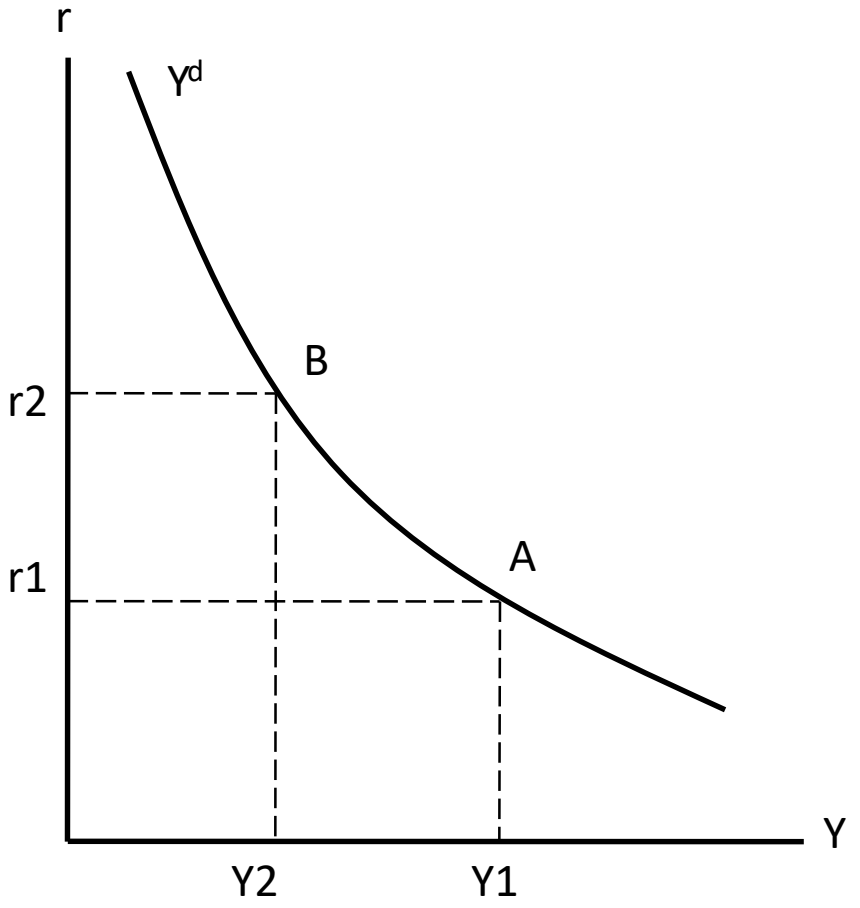
- An increase in the real interest rate causes a reduction in demand for current output.
  - Shifts towards future consumption: falling demand for current consumption goods.
  - Lower optimal investment: higher opportunity cost of capital.

- The output demand curve is **sloped downwards**.
  - Very much like the IS-curve!

Output demand curve

r2>r1; C2+I2 < C1+I1

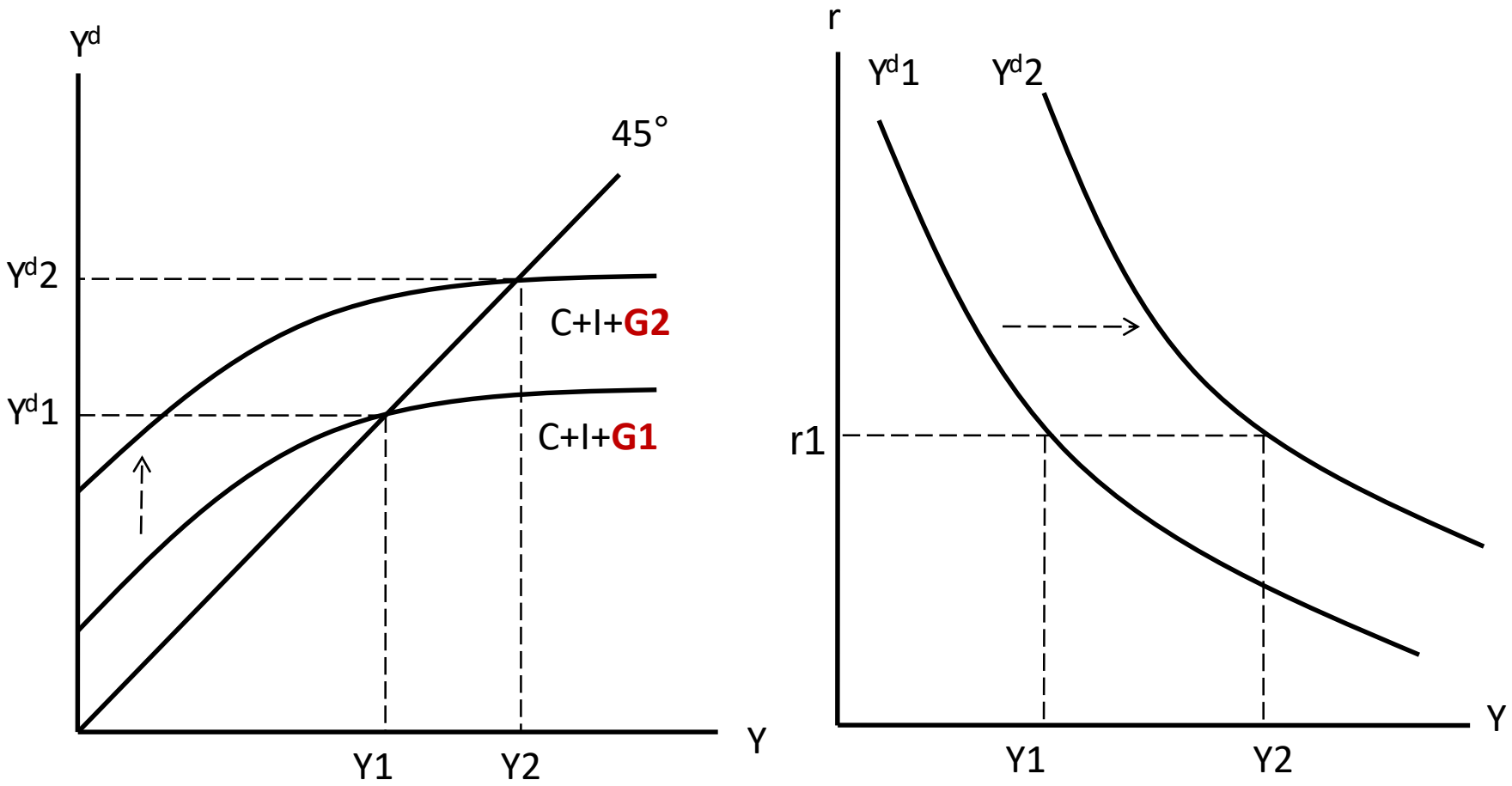




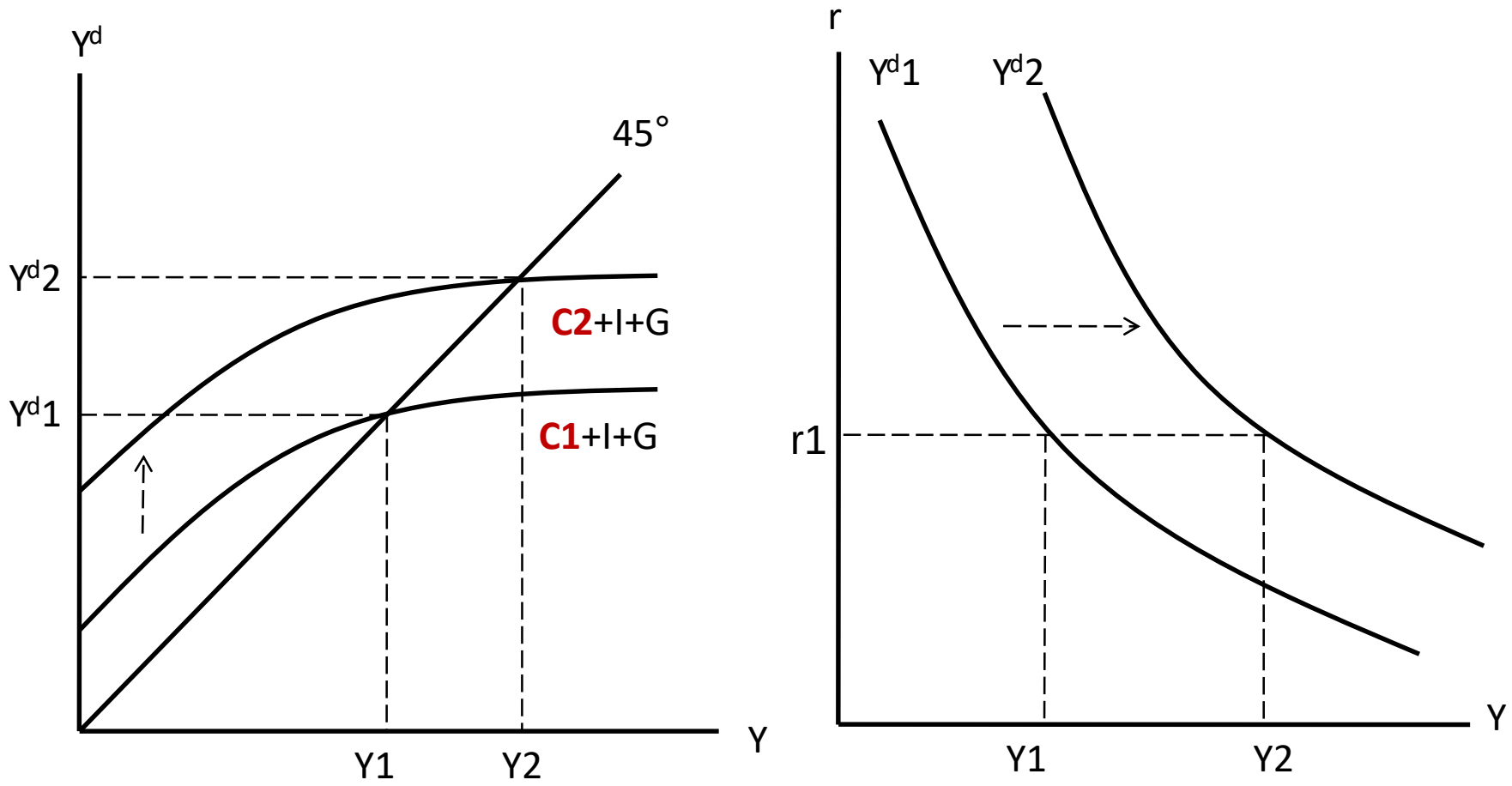
Rightward shifts in output demand curve

- An increase in current government purchases (G);
- A decrease in the PV of taxes (T or T’);
- A decrease in current capital stock (K) or an increase in future total factor productivity (z’).
  - Higher future MP'_K and rising current I^d;
- An increase in future income (Y’).

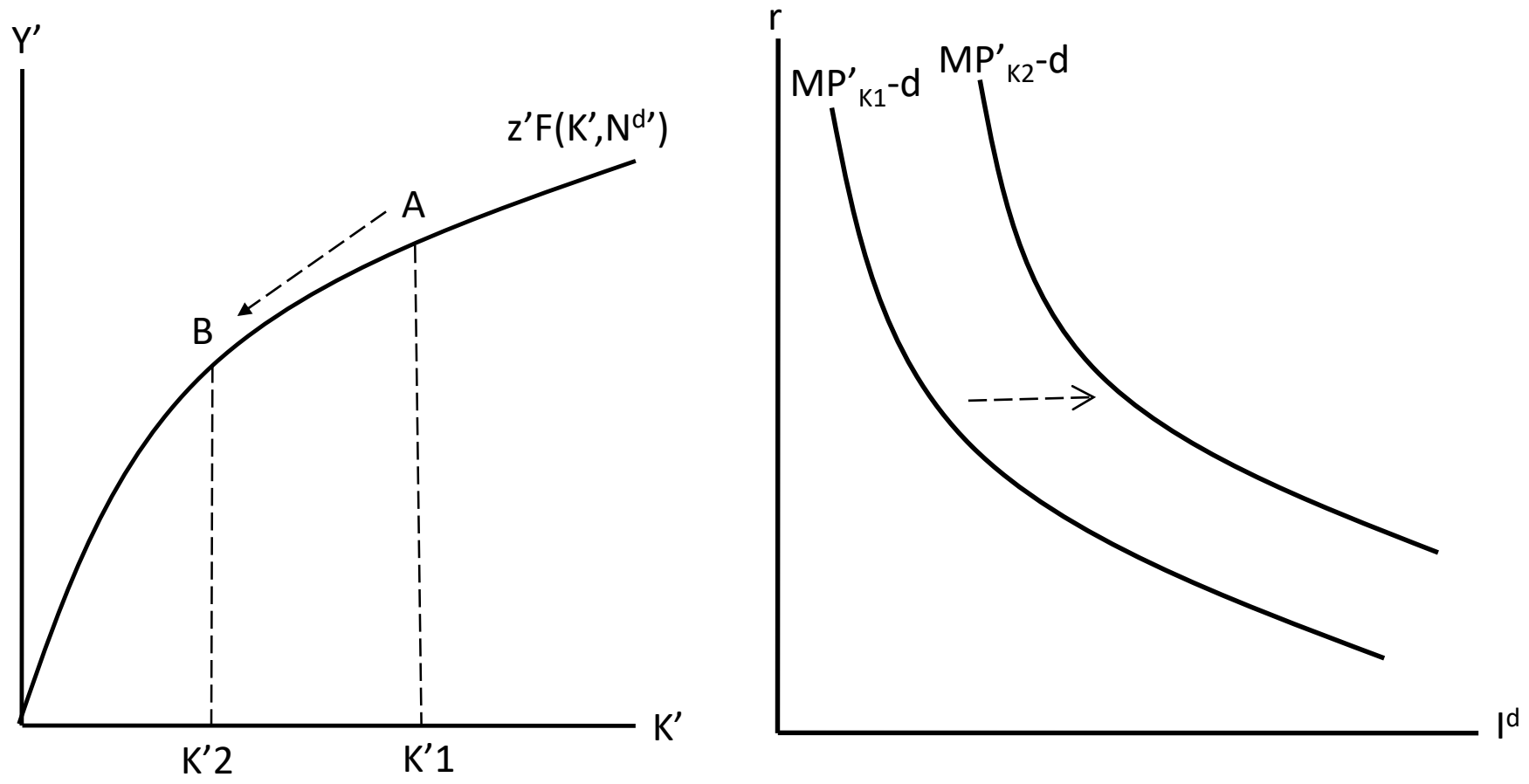
An increase in current G



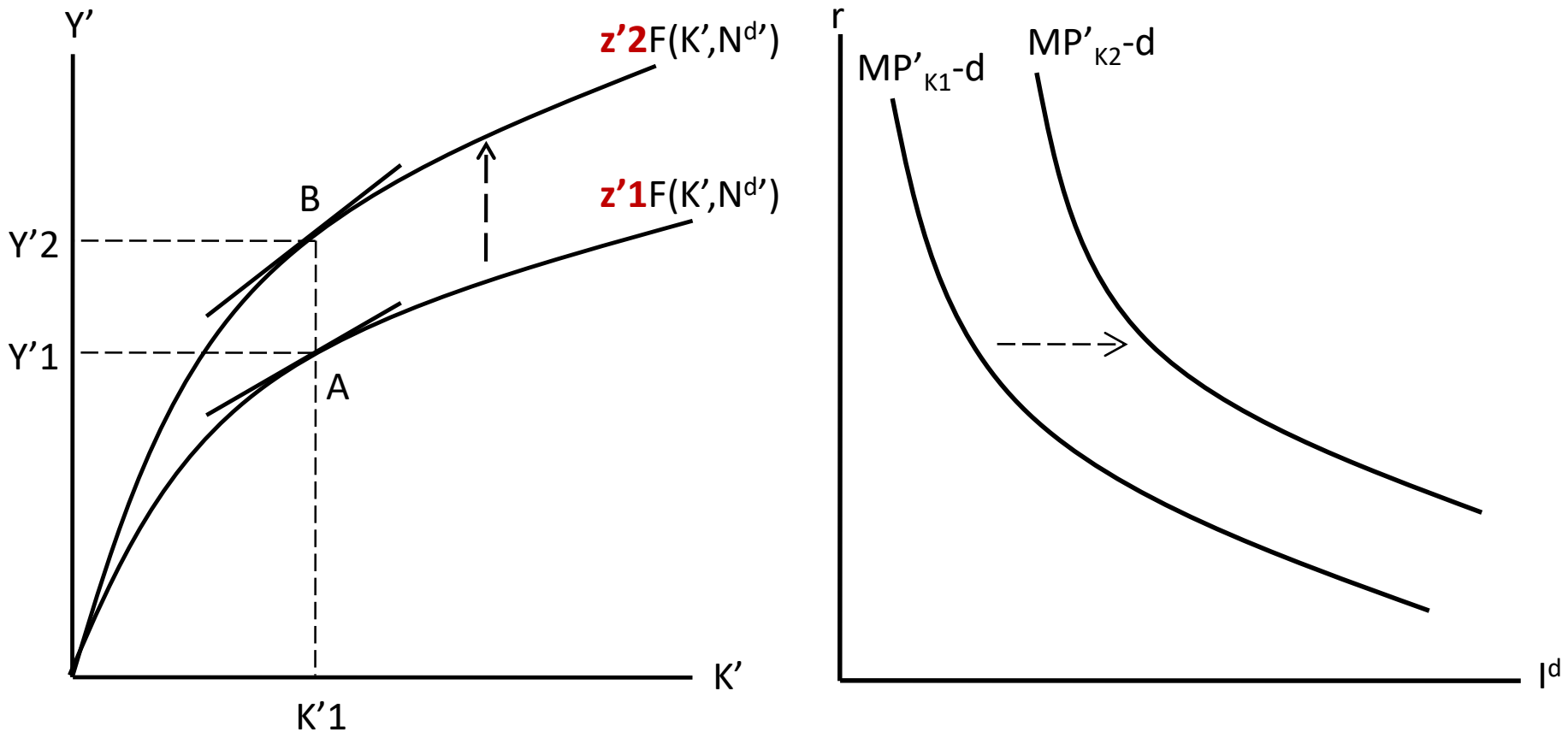
A decrease in PV of taxes (=increase in life-time wealth)



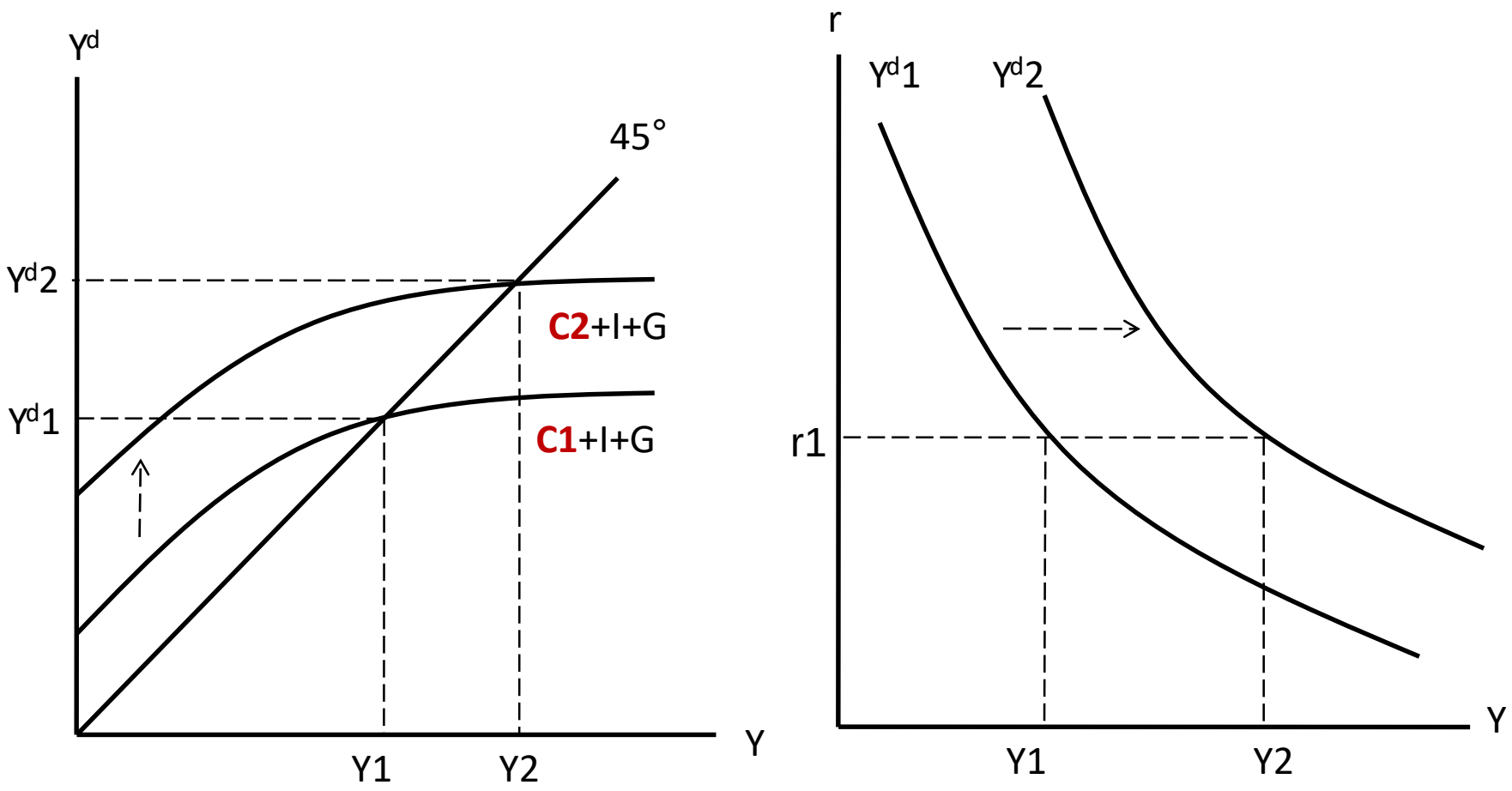
Lower current K and higher MP'_K



Higher z’ and MP'_K

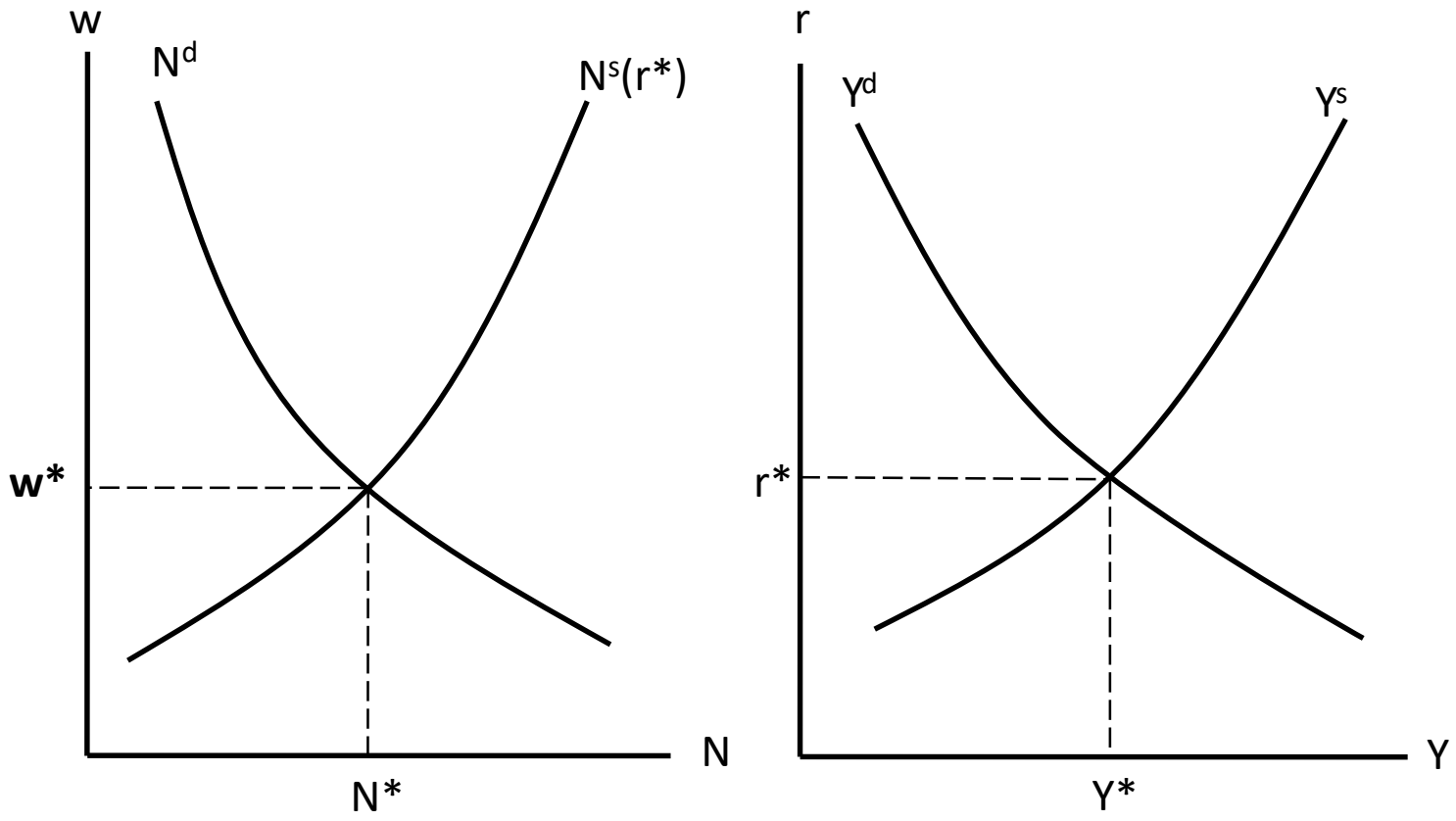


An increase in future income



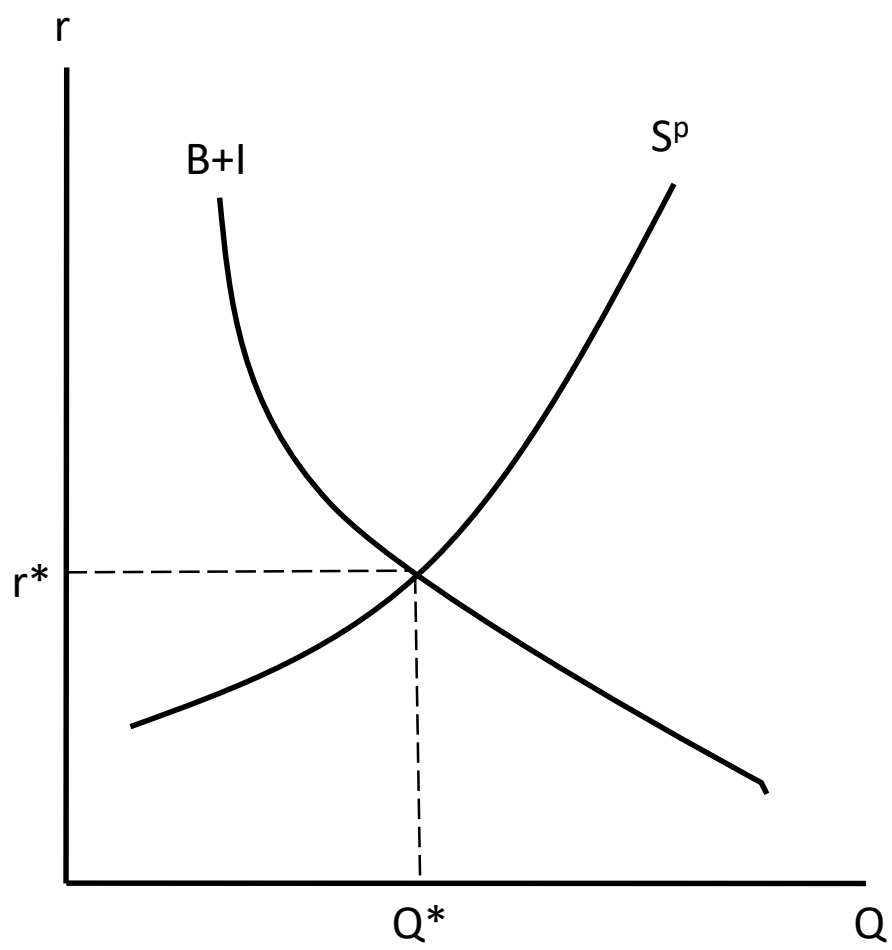
General equilibrium of real intertemporal model

- The equilibrium is characterized by the allocation (N*,Y*) and prices (w*,r*) that clear both labor and goods market.



The credit market

- The supply of credit is the consumer's private savings.
- The demand for credit is government's borrowing and the firm's investment demand.



- Investment is made out of current profit:
  - $\pi = Y - wN - I$

- But the firm can also finance its investment by borrowing in the credit market.
  - The real interest rate is the cost of capital.
  - The firm borrows by the amount of I^d in the current period and pays back $I^d (1+r)$ in the future period.