EE312 Macroeconomic Theory

Chapter 8

A Real Intertemporal Model

with Investment (Part 3)

Exogenous shocks in the model

- A shock in the model occurs when one of **exogenous variables** changes, causing endogenous variables to change accordingly.
- The macro effect depends on whether it is temporary or permanent.
- An expected shock in the future has effects in the current period.

Shock experiments

- Current government purchases increase temporarily (G);
- Current capital stock decreases due to a natural disaster or war (K);
- A temporary increase in current total factor productivity (z);
- An increase in future total factor productivity (z').

A temporary increase in G

- Assume an increase in G with G' unchanged.
- **Keynesian (EE212) analysis**:
  - A higher G causes the demand for goods to increase.
  - Output and income increases.
  - Part of the increase in income is spent on consumption goods --- more demand for output.
  - Direct and indirect increases in the demand for output --- **the multiplier effect**.

The Keynesian Y^d multiplier

$$\Delta Y^d = \Delta G$$

$$\Delta C = MPC \Delta Y^d \; where \; 0 < MPC < 1$$

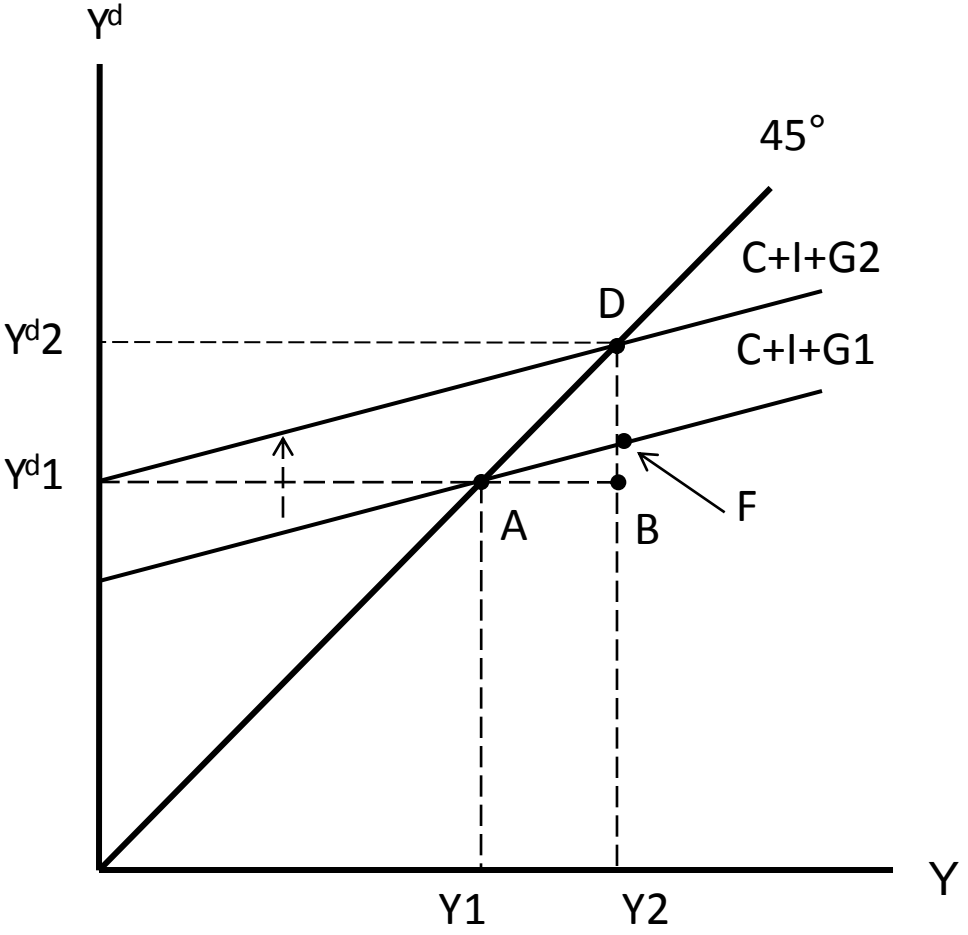
$$\Delta Y^d = \Delta G + MPC \Delta Y^d$$

$$\Delta Y^d = \frac{1}{1 - MPC} \Delta G$$

- The larger is MPC, the larger the Y^d multiplier, and the more powerful ΔG!

The Keynesian Y^d multiplier > 1

- Assume constant MPC.
- $\Delta G = DF$
- $\Delta Y = \Delta Y^d = AB = DB$
- But DB > DF
- So $\Delta Y/\Delta G > 1$!



Keynesian assumptions

- The increase in G has no negative effect on lifetime wealth and consumption spending.
  - But PV of taxes must rise and lifetime wealth falls.
- Total income or output (Y) increases by the same amount as the demand for goods (Y^d).
- The effect on the real interest rate?
- Increases in C and Y come as a free lunch!

Demand multiplier = 1

- The increase in total current demand for goods (Y^d):
  - The increase in government spending = ΔG.
  - The multiplier effect = MPCΔG.
  - Lifetime wealth drops = PV of taxes = ΔG; so current consumption falls by -MPCΔG.

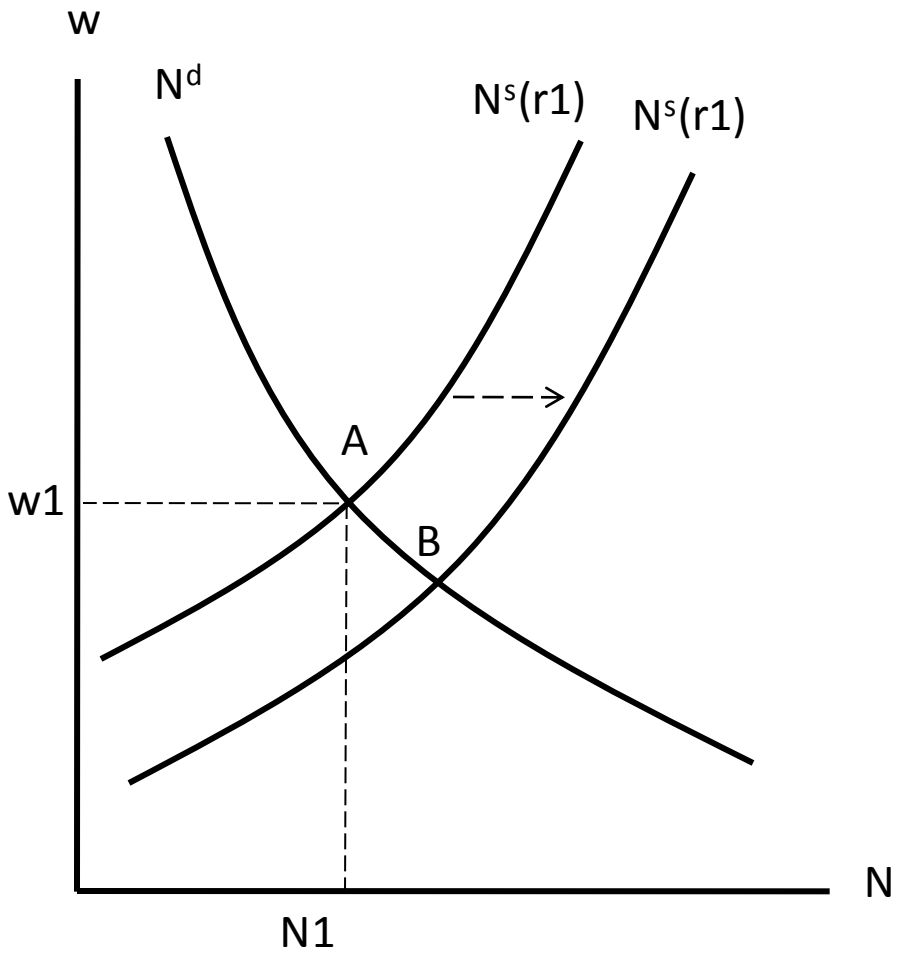
$$\Delta Y^d = \Delta G + MPC\Delta G - MPC\Delta G$$

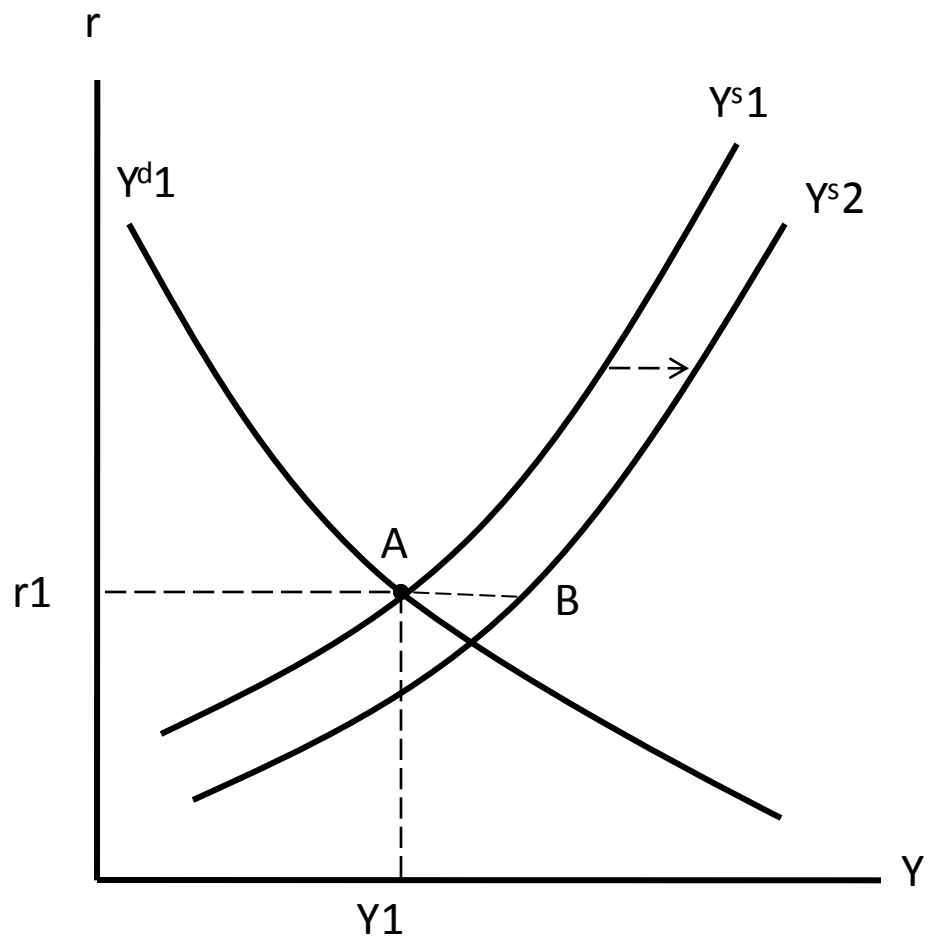
$$\Delta Y^d = \Delta G$$

Intertemporal model analysis

- **Step 1:** direct effect of ΔG:
- **Effects on Y^s**:
  - The PV of taxes rises; the consumer's lifetime wealth falls.
  - Leisure decreases and **labor supply** increases, given the real wage.
  - The output supply curve shifts rightwards.

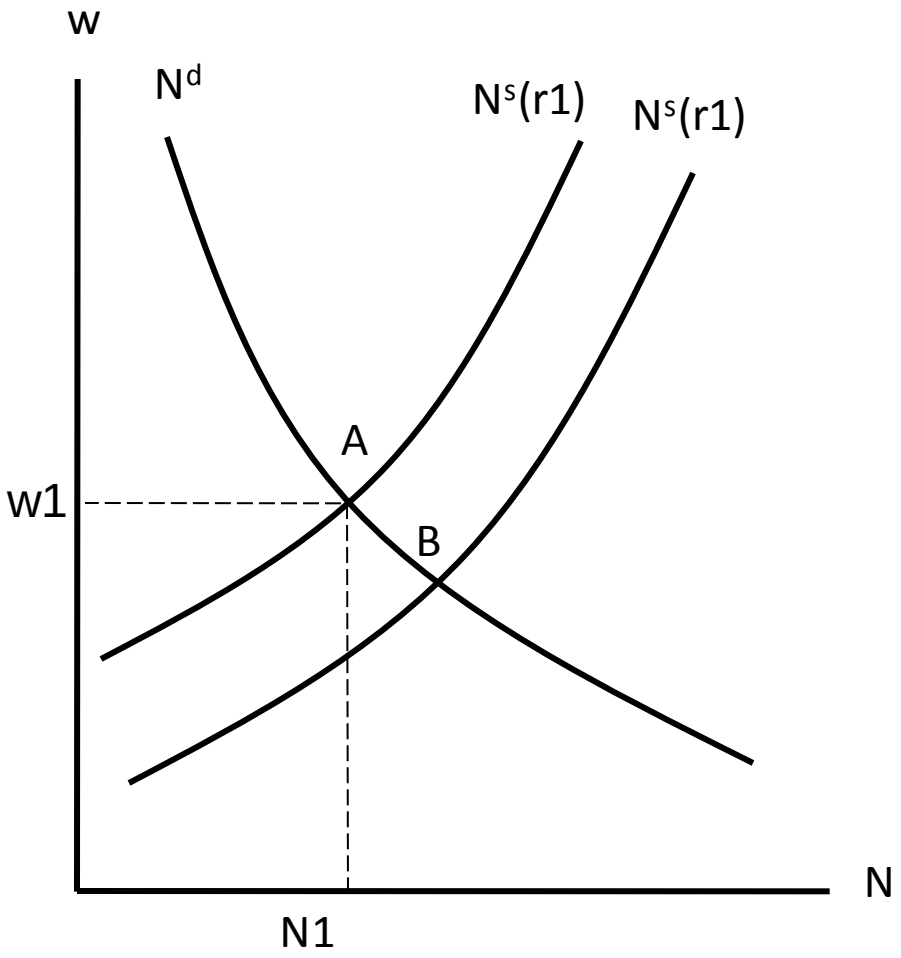
Step 1 An increase in G: Y^s shift

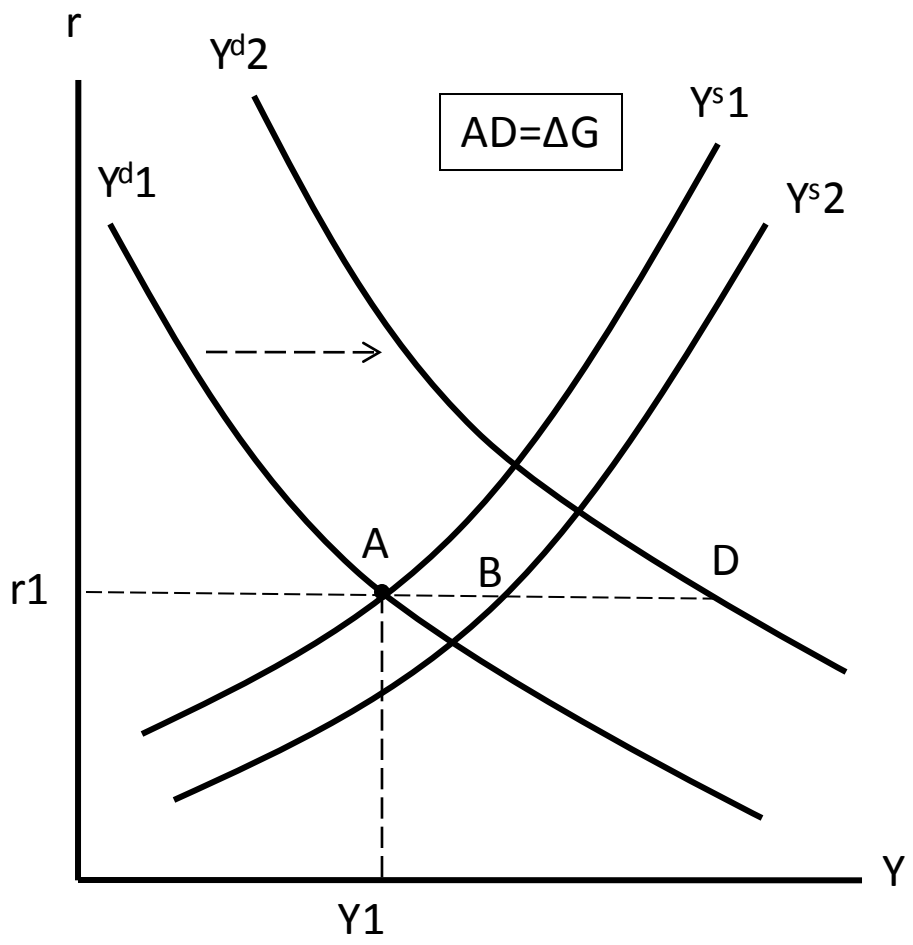




- **Effects on Y^d**:
  - Government's demand for output (G) increases.
  - Falling lifetime wealth reduces the consumer's demand for current consumption goods (C^d).
  - **Current demand for goods** increases by the amount of $\mathbf{\Delta Y^d = \Delta G}$; the Y^d multiplier = 1 .
  - Y^d shifts rightwards by the amount of ΔG.
- Both Y^s and Y^d shift to the right; what happens to the real interest rate?

Step 1 An increase in G: Y^d shift

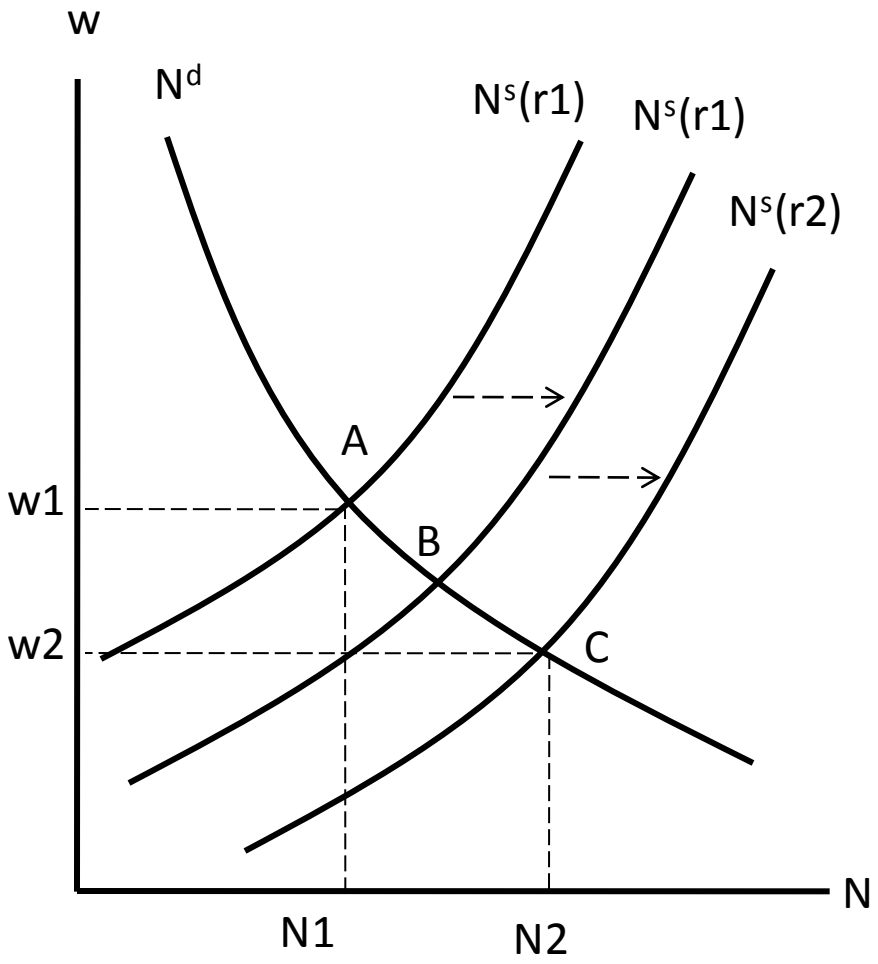


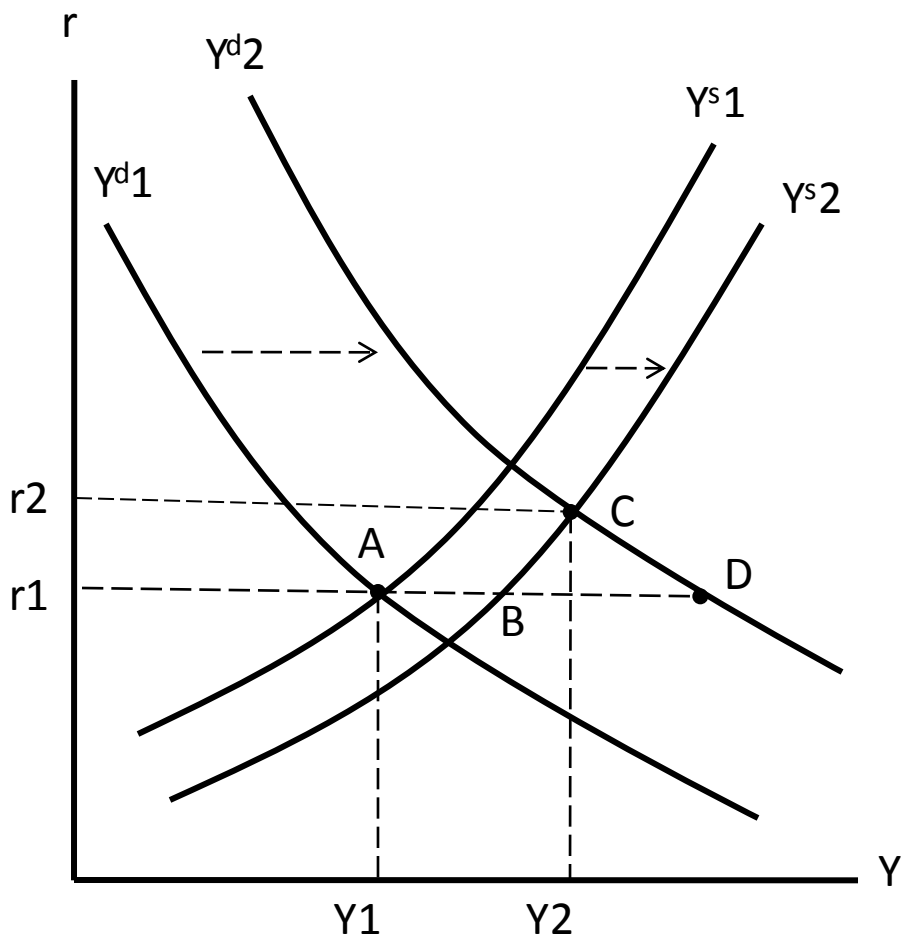


- The real interest rate increases as **Y^d shifts more than Y^s**.
  - ΔG is temporary and has a small negative effect on lifetime wealth.
  - A small decrease in leisure, and small increases in labor supply and output supply (small Y^s shift).
  - A small decrease in current consumption while the increase in G remains large (larger Y^d shift).
- **Step 2**: effect of the rising r.
  - A higher r reduces leisure, current consumption and investment.

- Leisure falls and **labor supply** increases again.
  - The real wage falls further; employment and output increase, a movement along the Y^s (BC).
- **Investment** decreases due to the higher real interest rate (DC).
- **Current consumption** falls (DC):
  - Falling lifetime wealth reduces current consumption while higher income raises it --- small net effect.
  - The higher r also reduces it --- dominant effect.

Step 2 An increase in G: rising r

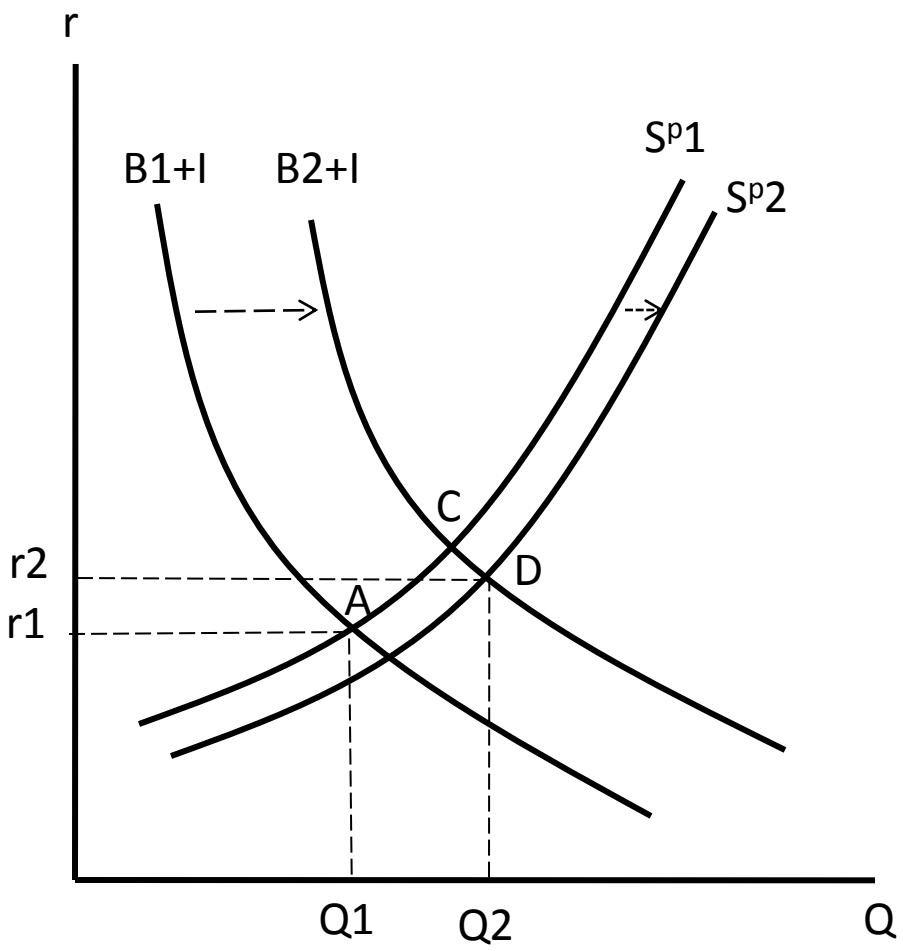




- Assume the government finances the spending increase by bond sale in the credit market ($\Delta G = \Delta B$).
- Private savings increase:
  - Larger current income (Y) and lower current consumption raise private savings.
  - $\Delta S^p = \Delta Y - \Delta T - \Delta C$ where $\Delta T = 0$ and $\Delta C < 0$.
- The increase in bond sale raises the real interest rate.

The credit market

- The government increases current borrowing (B).
- Savings increase from higher r (AC) and larger Y (CD).
- The real interest rate increases.



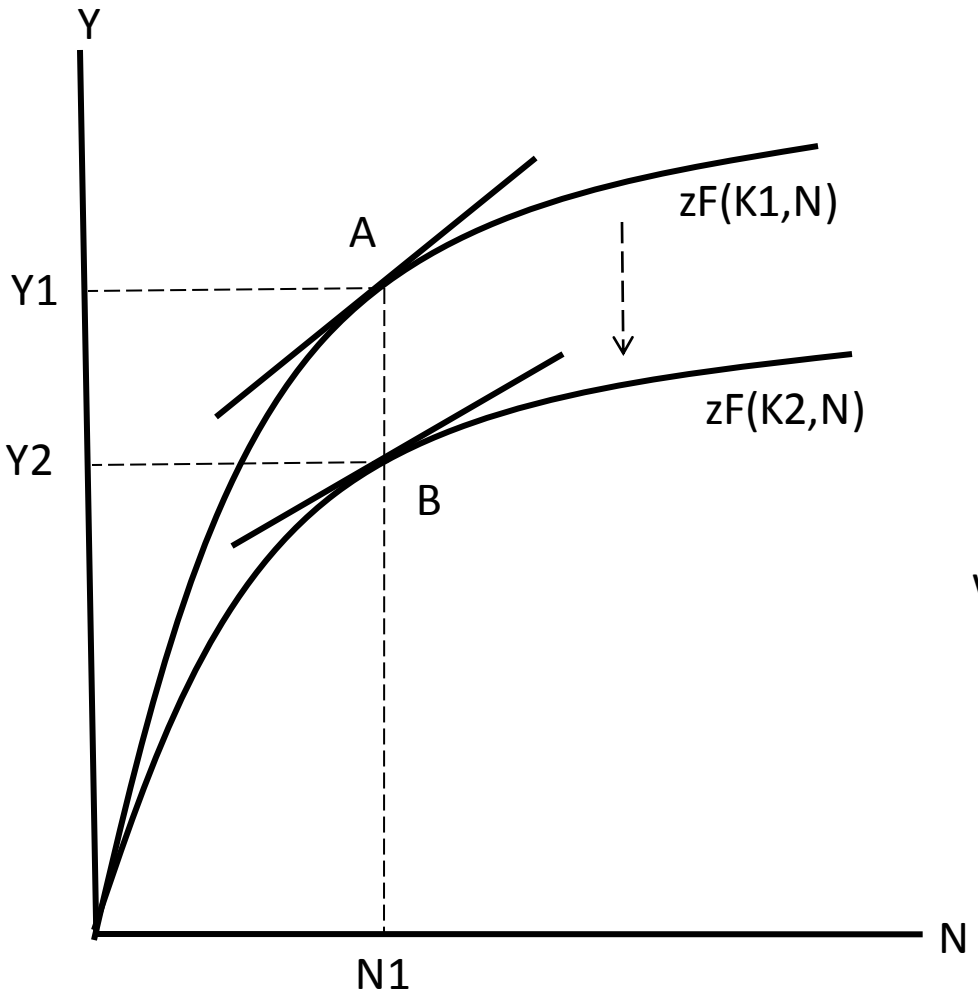
- The **total output multiplier** is less than 1.
  - $\Delta Y^d = \Delta G = AD > Y1Y2$.
  - So $\Delta Y/\Delta G < 1$; income increases less than the increase in government spending.
  - Although income increases, both current consumption and investment decrease from the higher real interest rate (**the crowding-out effect**).
  - Employment increases but the real wage drops.
  - Private savings increase to pay for higher future taxes.

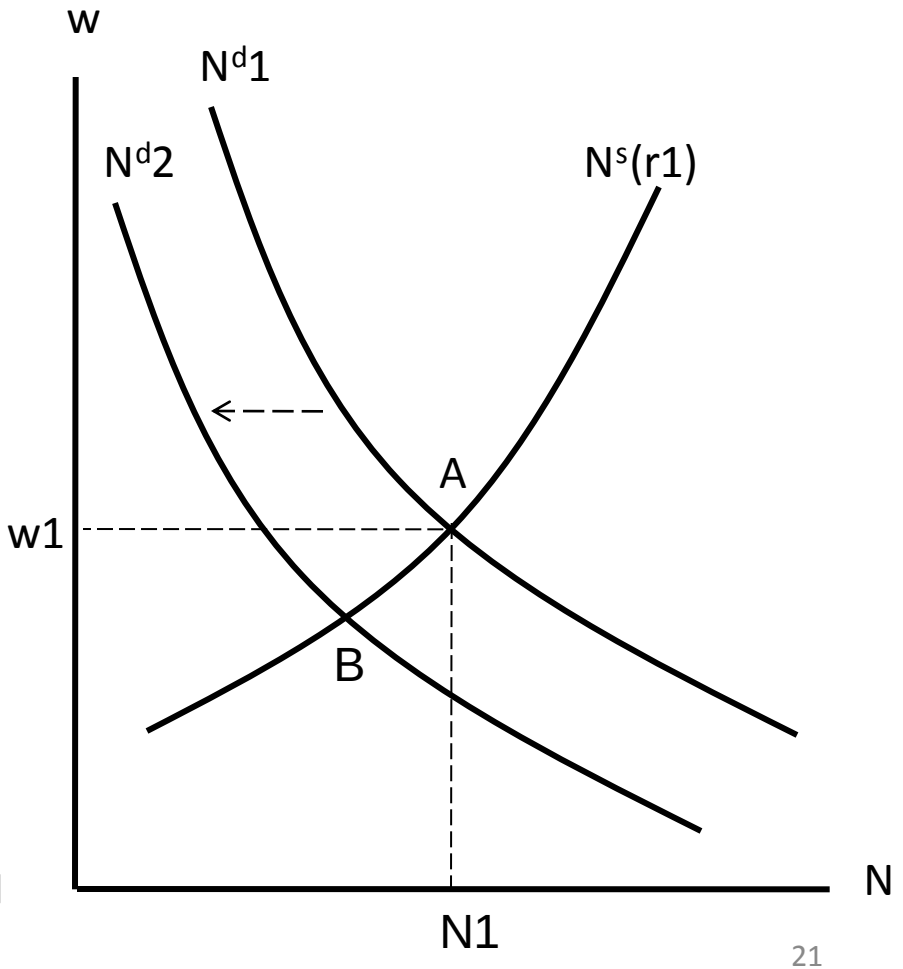
- **The crowding-out effect** on private spendings.
  - A temporary increase in G *crowds out* both current consumption and investment by raising the real interest rate.
  - The consumer works more for a lower real wage and consumes less.
  - Lower investment means lower future capital stock and future productive capacity.
- Higher government spending and larger output come at a cost --- no free lunch!

A decrease in current capital stock

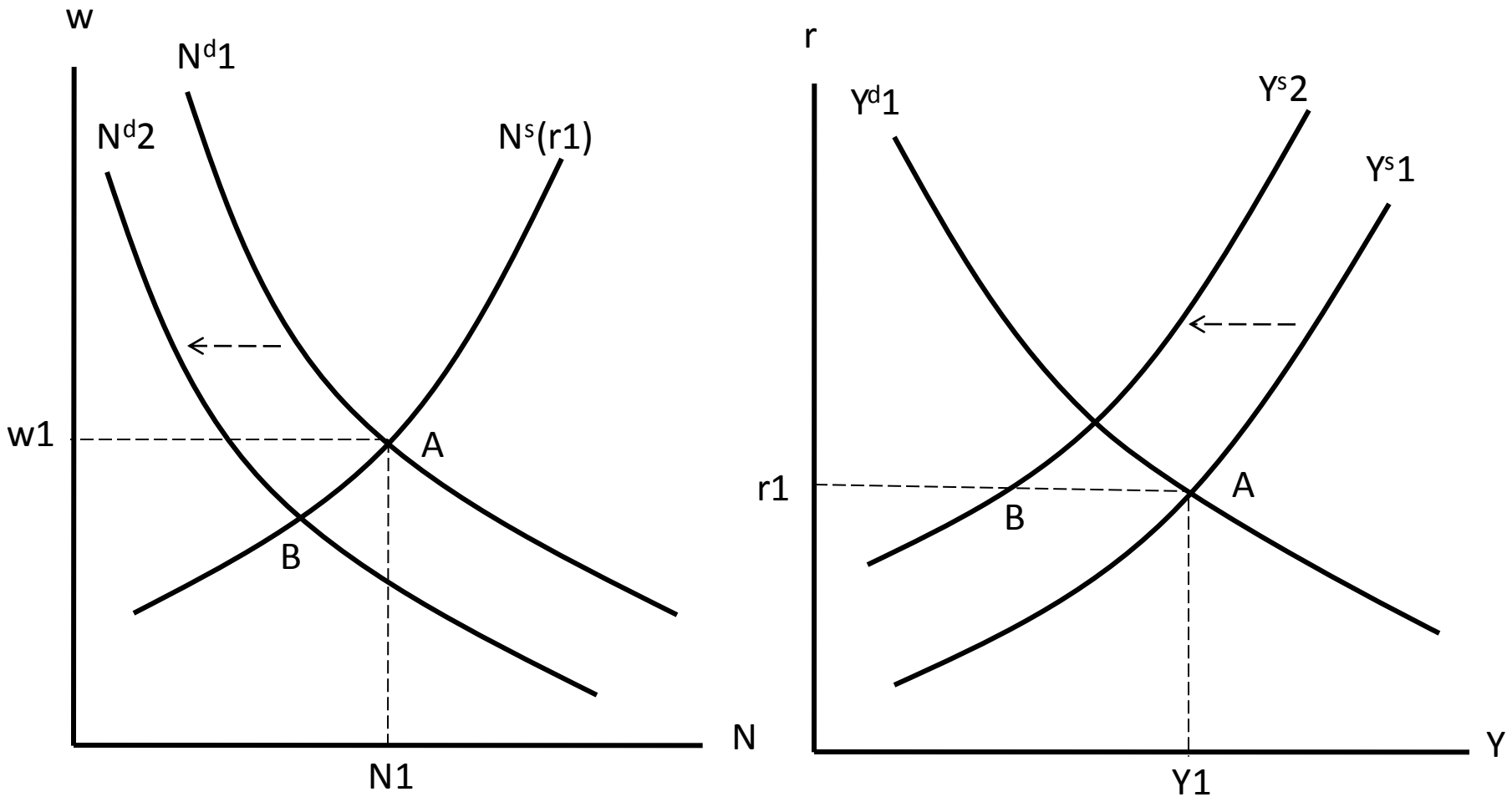
- Reduction in current capital stock (K) due to a natural disaster or war.
- **Step 1: Effect on Y^s**:
  - A smaller K with the same N, current MP_N drops.
  - The firm reduces its demand for labor. The labor demand curve shifts left (given w).
  - The output supply curve (Y^s) shifts left.

Step 1 A lower K reduces MP_N



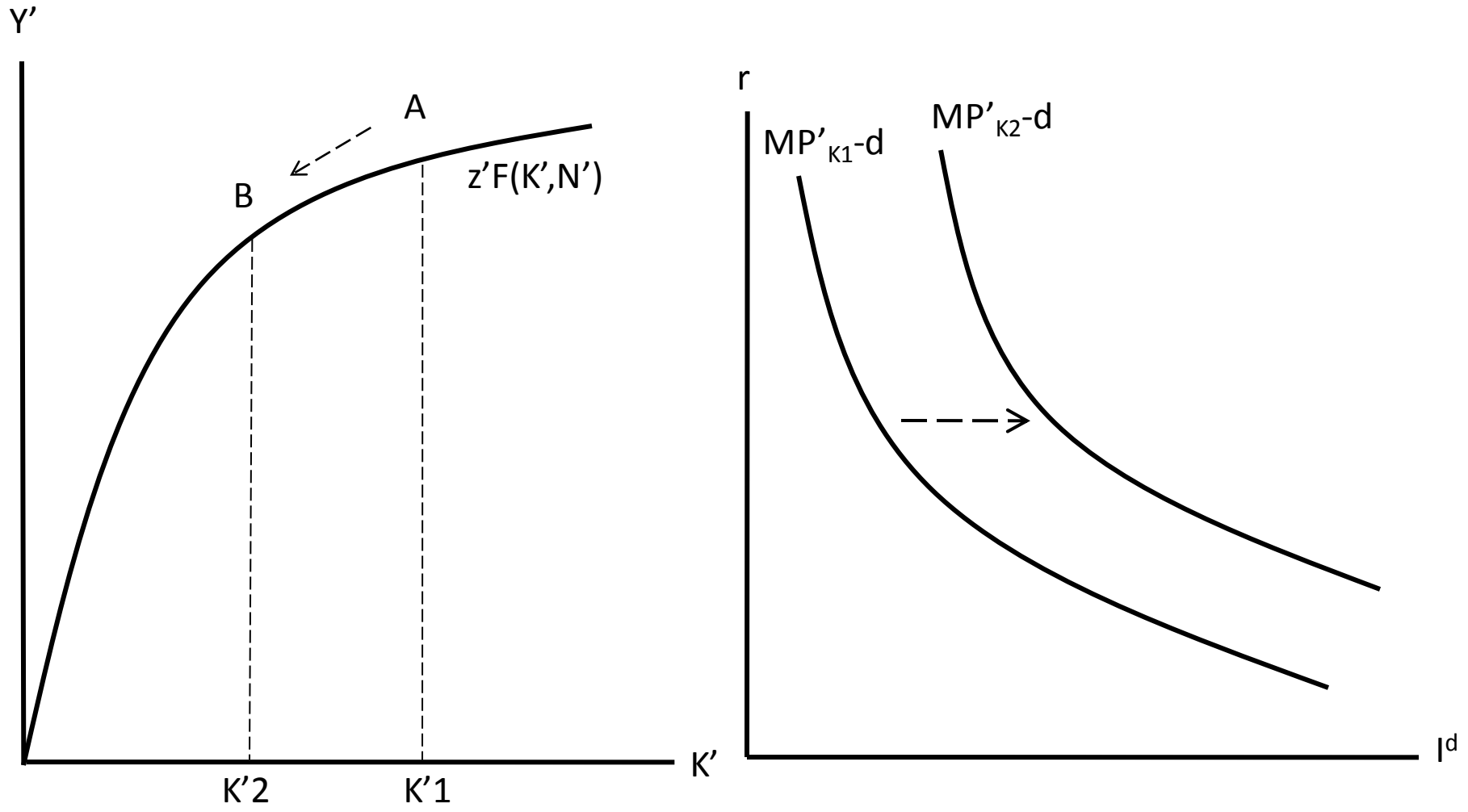


Step 1 Lower N^d: Y^s shifts left.

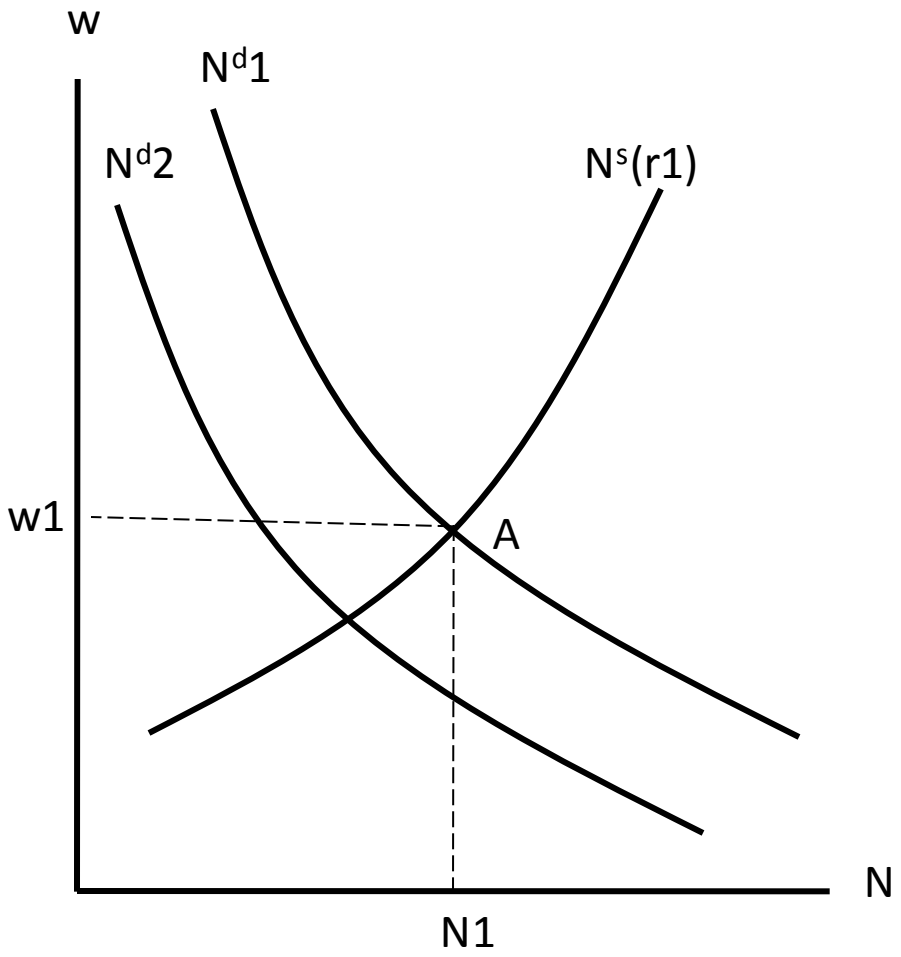


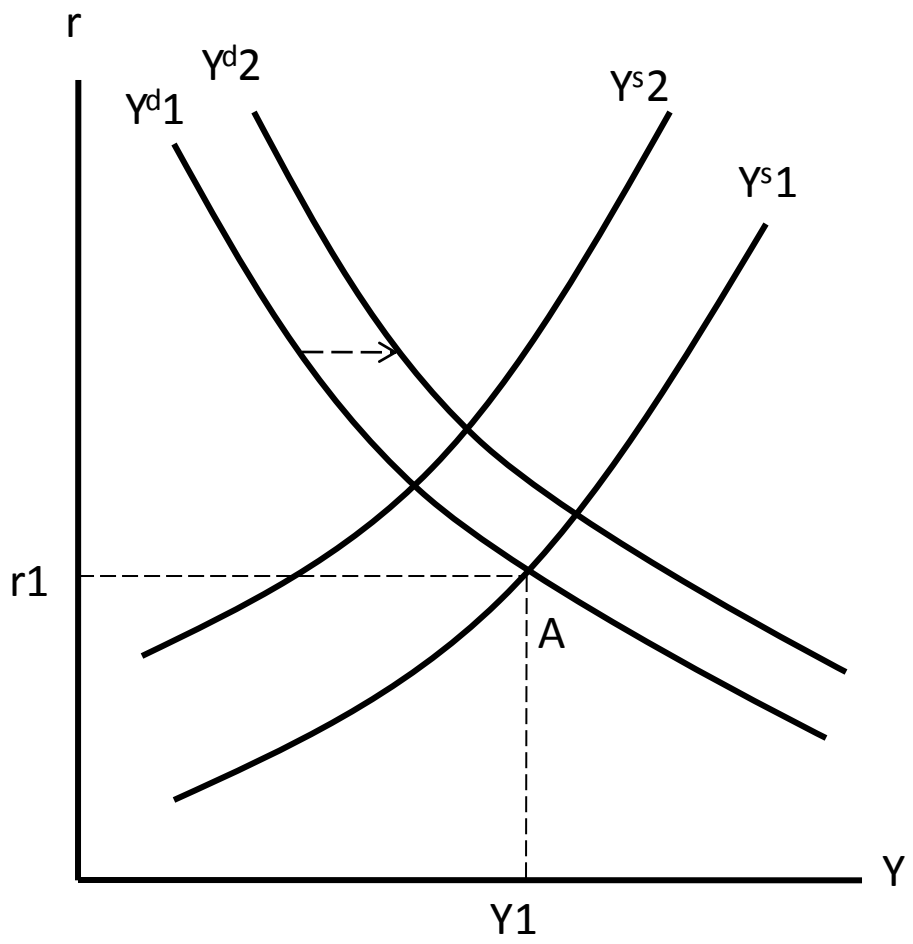
- **Effect on Y^d**:
  - A smaller current K means a smaller future K'.
  - Future MP'_K rises; investment increases, given r.
  - The optimal investment curve (I^d) shifts right.
  - The output demand curve (Y^d) shifts right.
- **The real interest rate** must rise.
- **Step 2**: the higher real interest rate reduces leisure (increases labor supply), current consumption and investment.

Step 1 Higher MP'_K and rising I^d



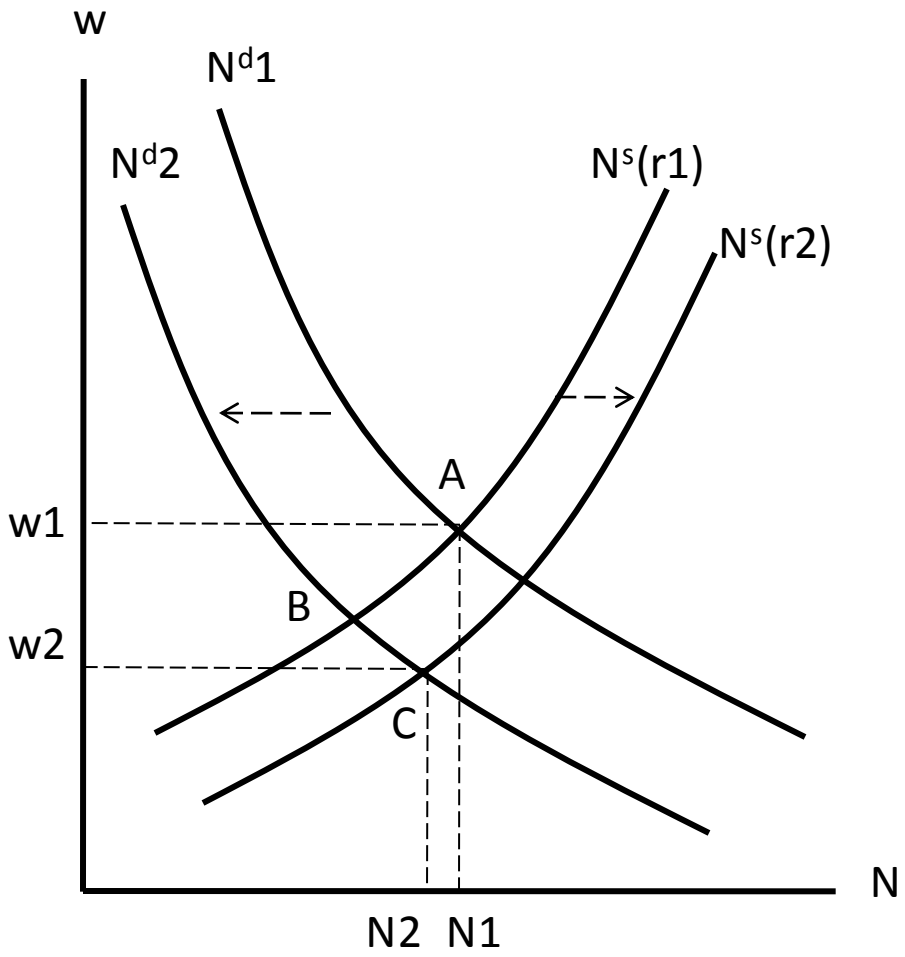
Step 1 A rising I^d shifts Y^d right.

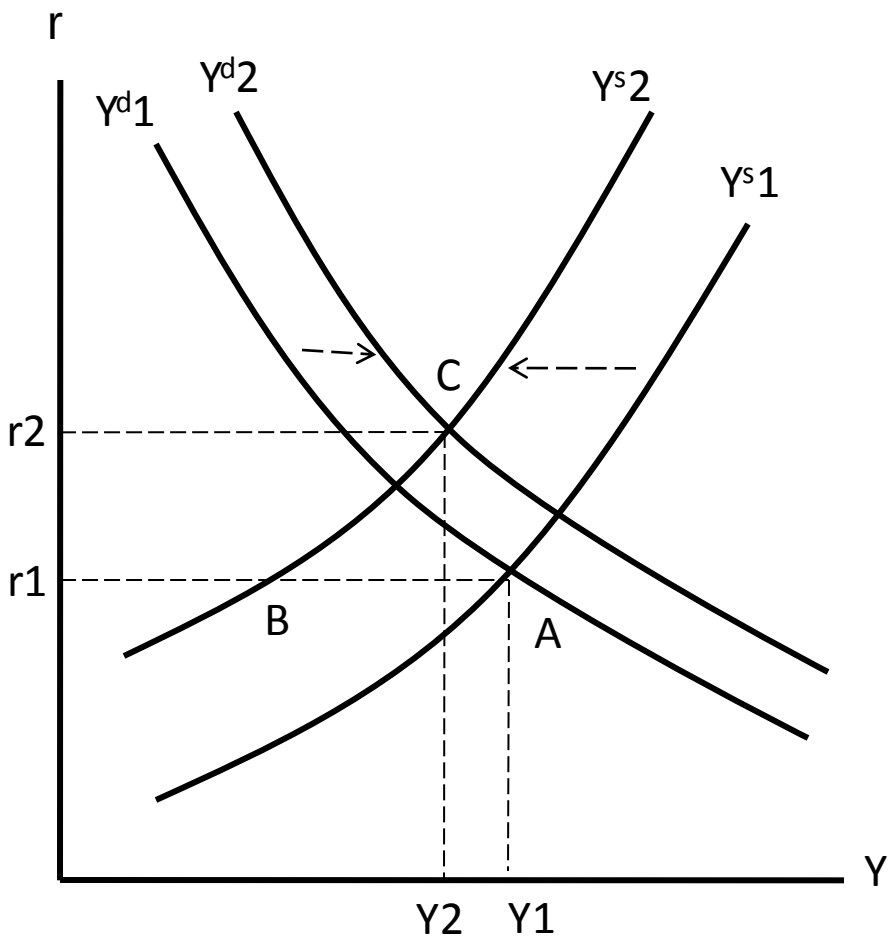




- Leisure decreases and labor supply increases.
  - The labor supply curve shifts to the right.
  - The real wage drops further.
  - A movement on the Y^s curve.
- Investment increases to make up for the decline in the capital stock:
  - The higher real interest rate depresses investment, but higher MP'_K raise it.
  - If investment finally decreases, current K will be falling indefinitely --- impossible.

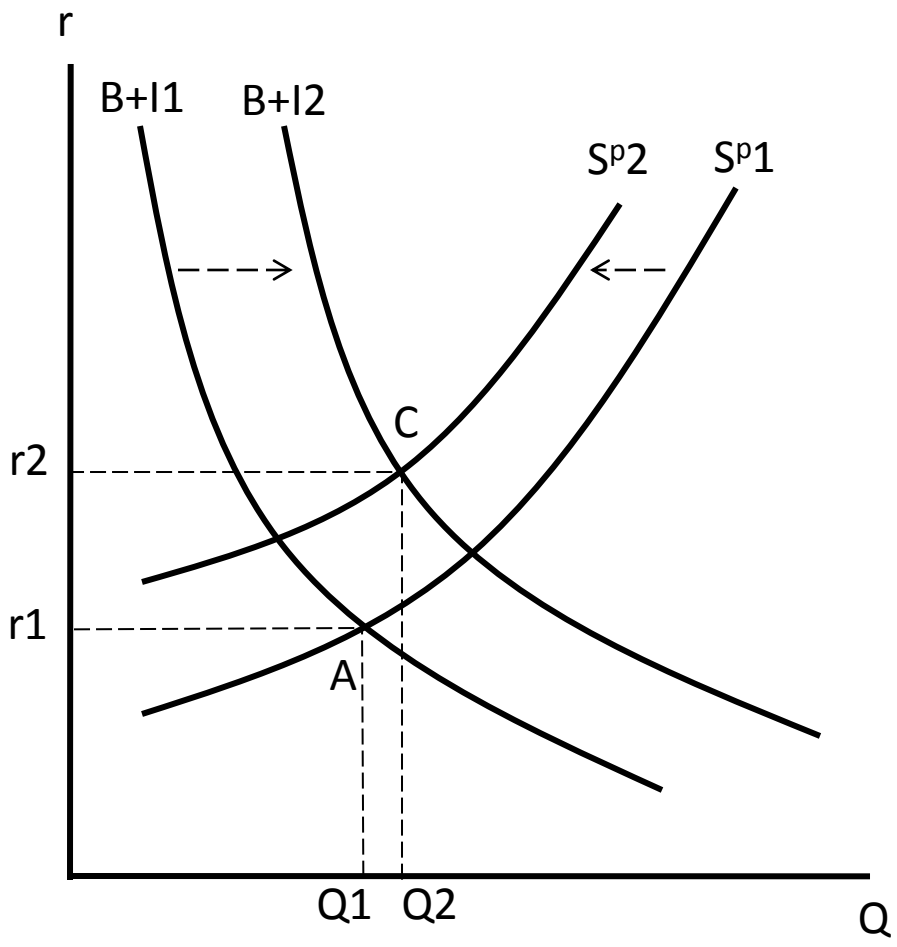
Step 2 A decrease in current K: rising r





The credit market

- C drops less than Y ($\Delta Y > C\Delta$).
- Consumption smoothing; S^p decreases.
- I^d increases.
- The real interest rate increases.



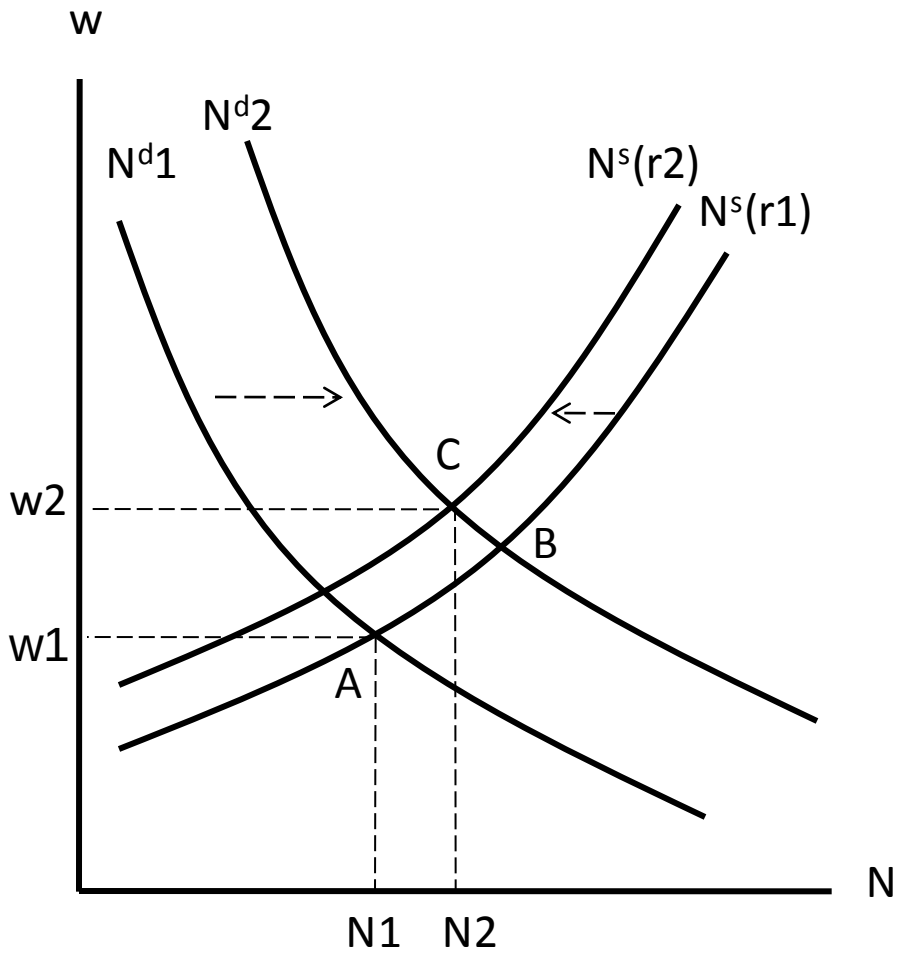
Overall effect of a drop in K

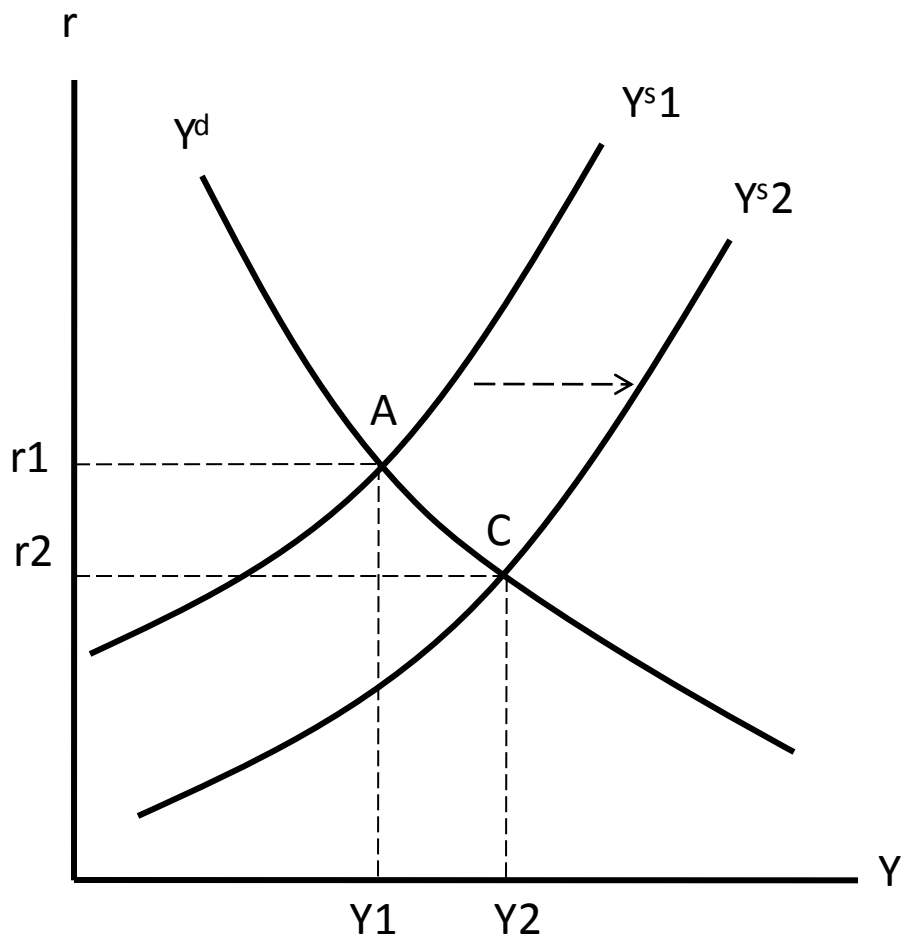
- A decrease in current K raises the real interest rate but may increase or reduce output.
  - Current consumption and leisure decrease.
  - Investment increases.
  - The real wage decreases.
  - Employment and output may increase or decrease.
- Destruction of K tends to reduce output and employment.

A temporary increase in z

- **Step 1:** An increase in current total factor productivity (z) raises MP_N.
  - Labor demand and **output supply shift right**.
  - The real interest rate decreases.
- **Step 2**: the lower real interest rate raises current consumption, investment and leisure.
  - Labor supply decreases; the labor supply curve shifts left.
  - Employment, output and the real wage increase.

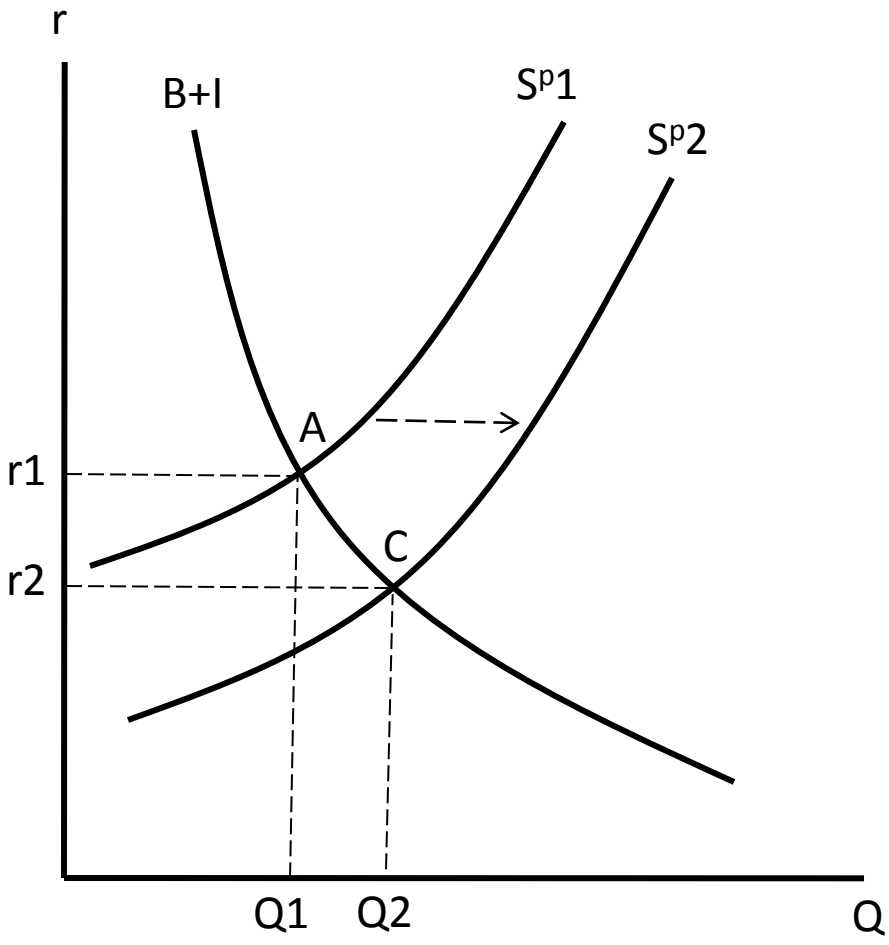
An increase in z





The credit market

- Consumption increases less than income (consumption smoothing).
- Private savings increase.
- The real interest rate decreases.



Overall effect of Δz

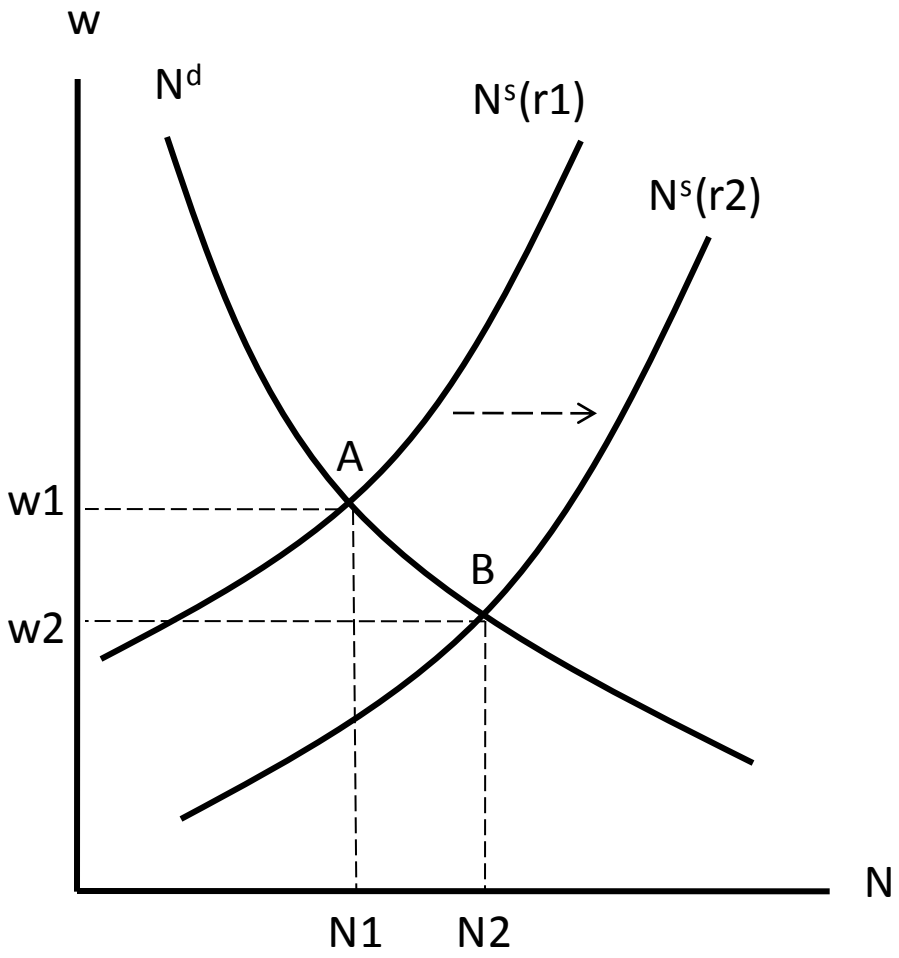
- An increase in the current z reduces the real interest rate but increases output.
  - Employment and output increase.
  - The real wage increases.
  - This is partly offset by the increase in leisure (with lower r and higher current income).
  - Investment increases (with lower r).
  - Current consumption increases with lower r and larger Y.

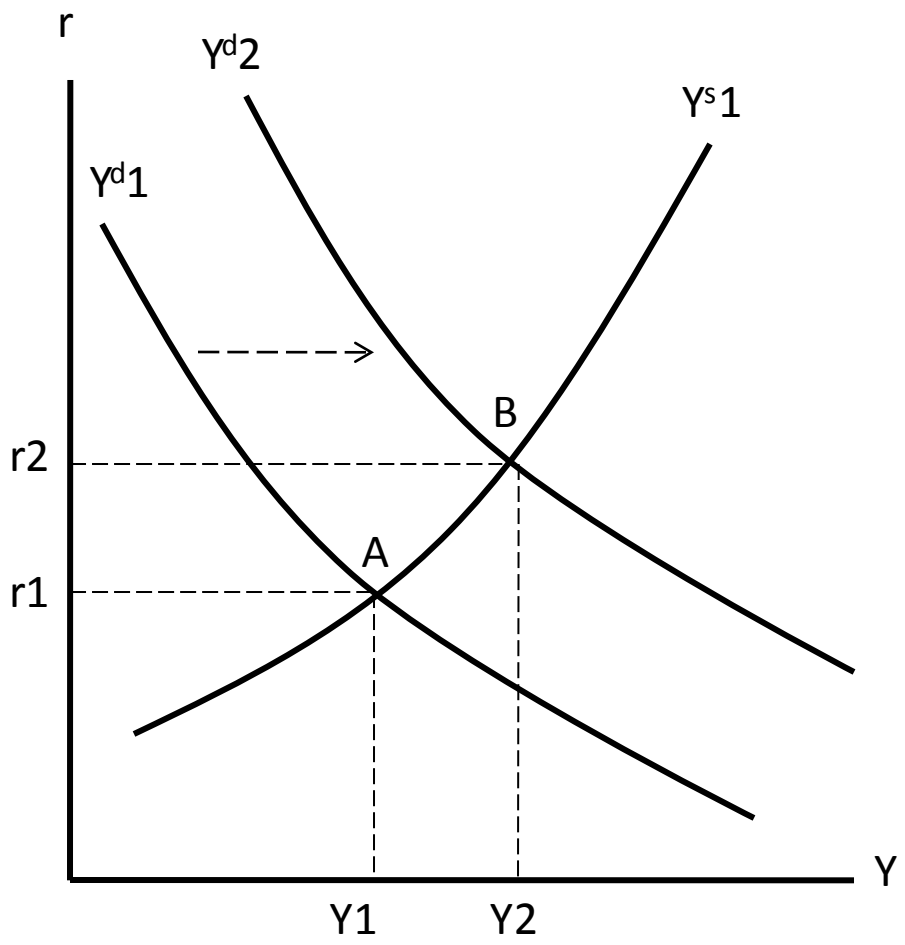
An increase in future z’

- **Step 1**: Future z’ is expected to rise; future MP'_K increases.
- Investment (I^d) increases; higher future income raises current consumption.
- Output demand shifts right (increases).
  - The real interest rate increases.
- **Step 2**: the higher r reduces consumption, investment and leisure.

- The labor supply curve shifts right; the real wage drops.
- Employment and output increase.
- Higher current consumption from higher income partially drops from the higher real interest rate.
- The higher investment from higher MP'_K is partially offset by the higher real interest rate.
  - Investment increases as the effect of MP'_K is stronger .

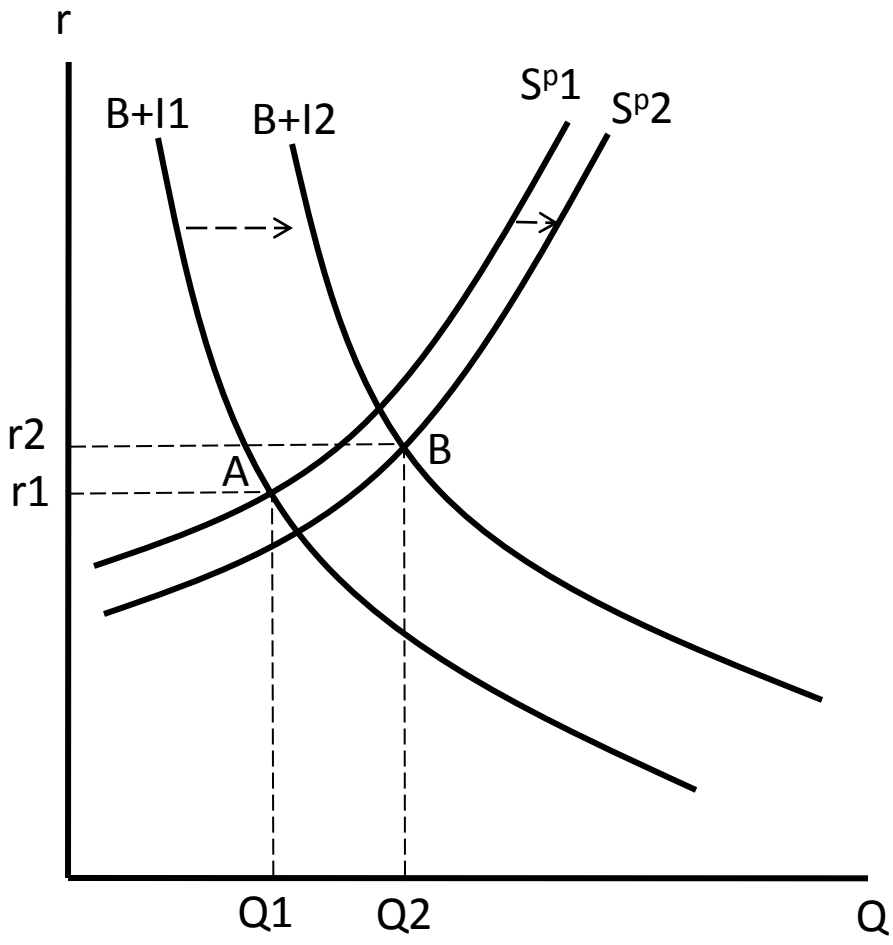
An expected increase in z’





The credit market

- Investment increases.
- C increases less than Y; private savings increase.
- The real interest rate increases.



Overall effect of Δz’

- Investment increases with higher expected MP'_K, partly offset by the higher r.
- Both real interest rate and output increase.
- Current consumption rises from higher current and future income but falls due to the higher real interest rate.
- Employment increases with falling real wage.