

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

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

$$\Delta C = MPC \Delta Y^d \text{ where } 0 < MPC < 1$$

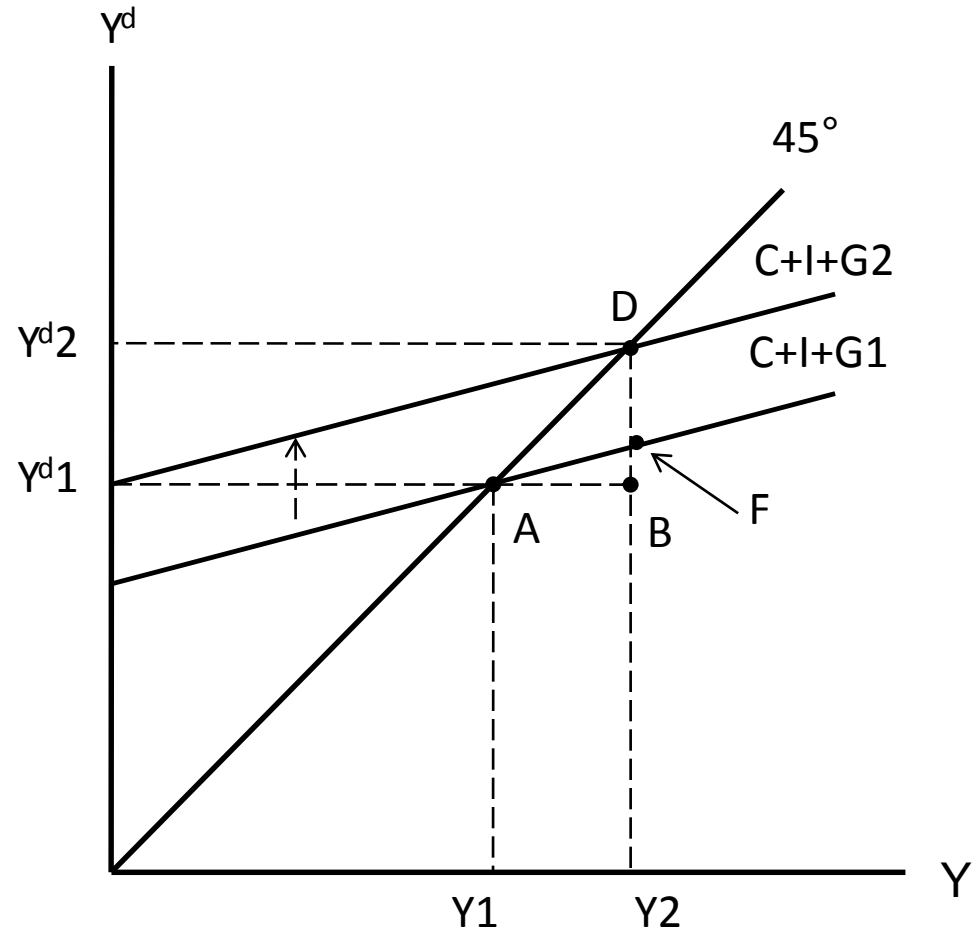
$$\Delta Y^d = \Delta G + MPC \Delta Y^d$$

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

- 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? **FIXED**
- **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 = $MPC\Delta G$.
 - Lifetime wealth drops = PV of taxes = ΔG ; so current consumption falls by $-MPC\Delta G$.

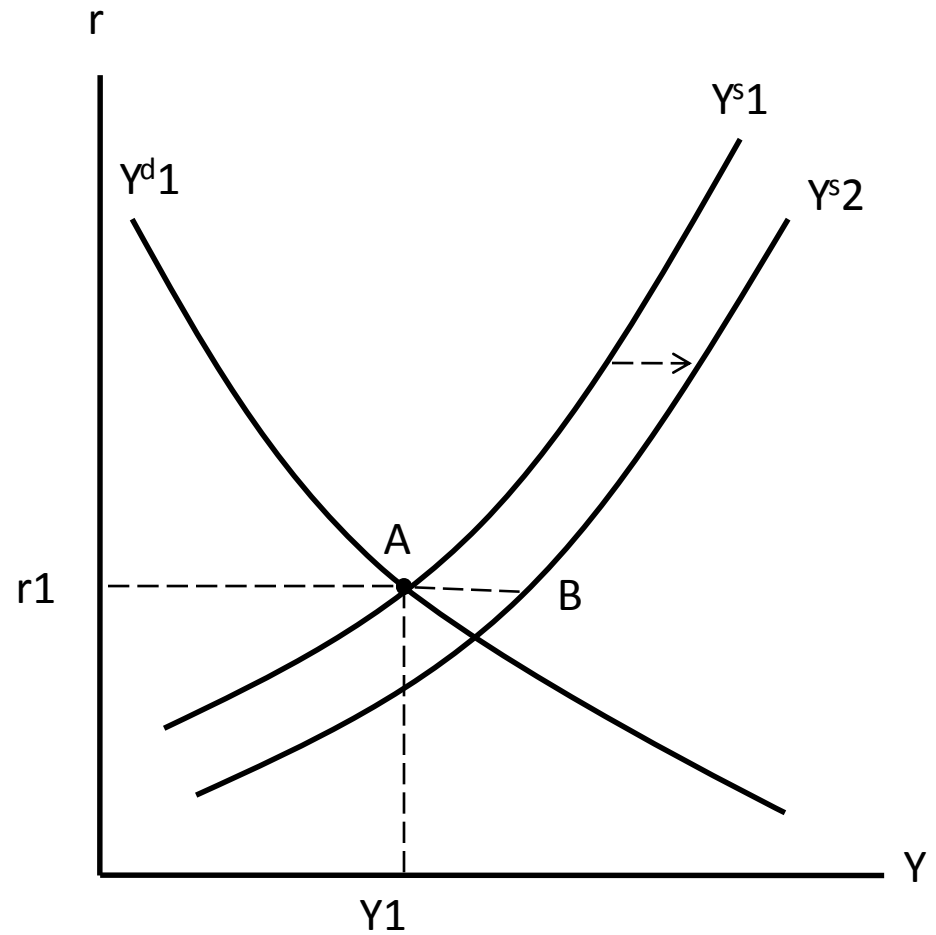
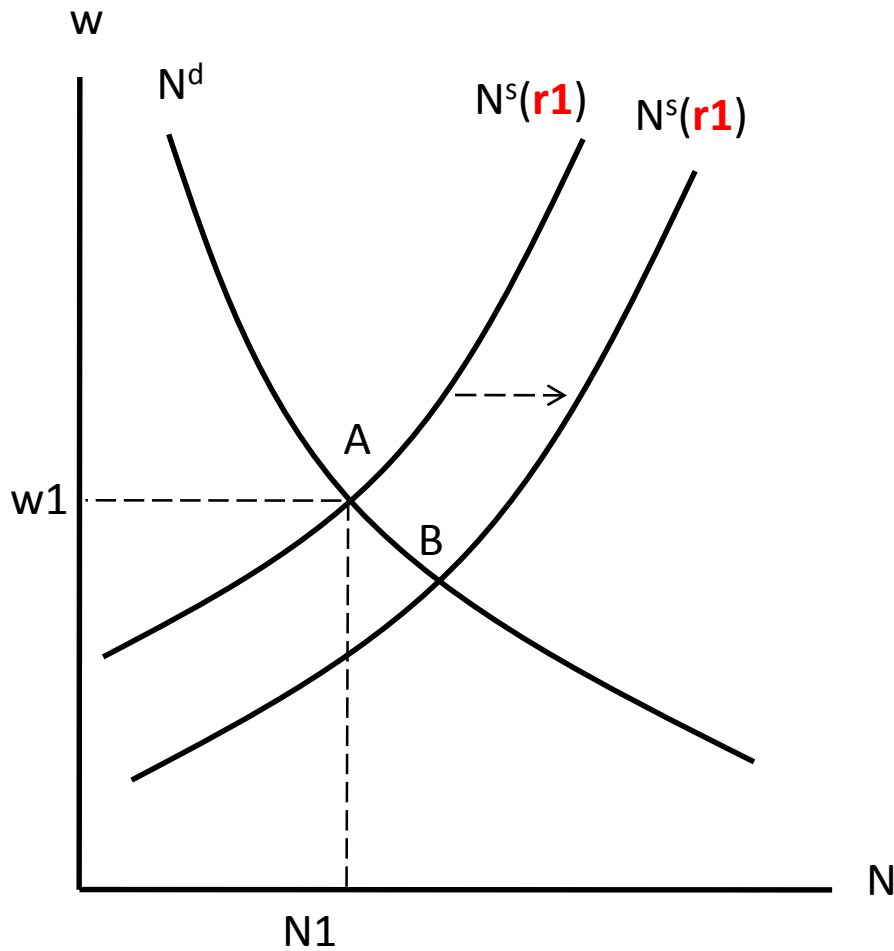
$$\Delta Y^d = \Delta G + MPC\Delta G - MPC\Delta G$$

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

Intertemporal model analysis

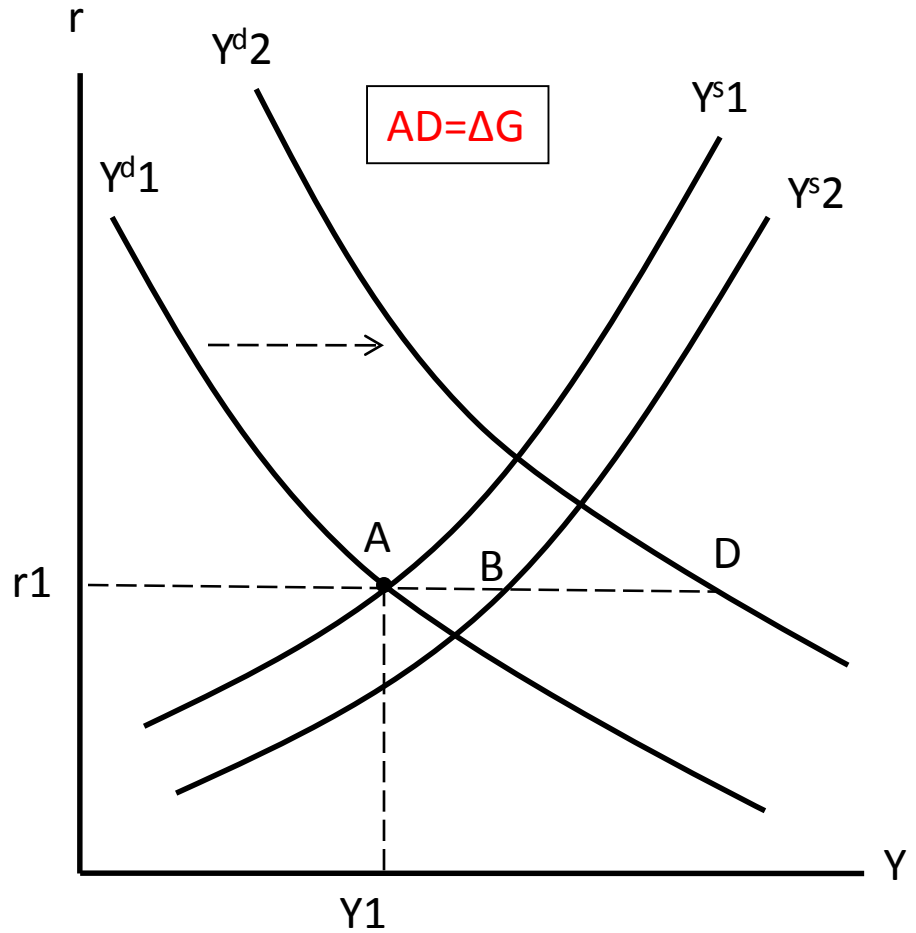
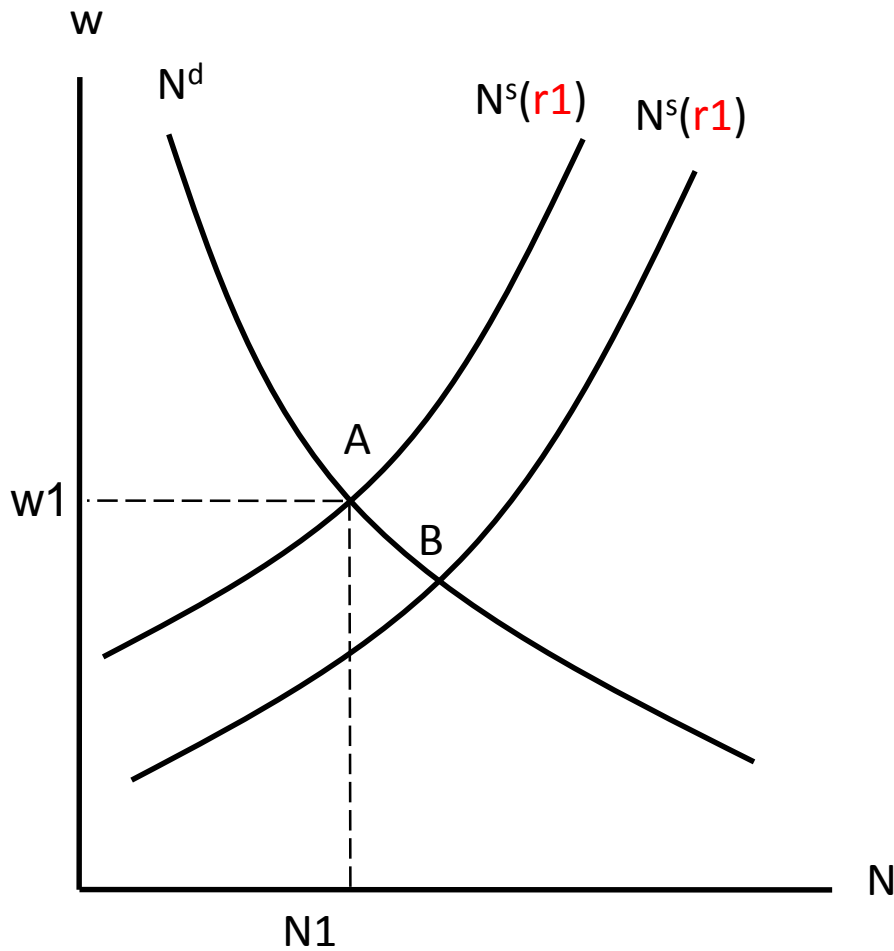
- **Step 1:** direct effect of ΔG :
- **Effects on Y^s :**
 - The PV of taxes rises; the consumer's lifetime wealth falls.
 - Leisure decreases and **labor supply** increases, given the real wage.
 - The output supply curve shifts rightwards.

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

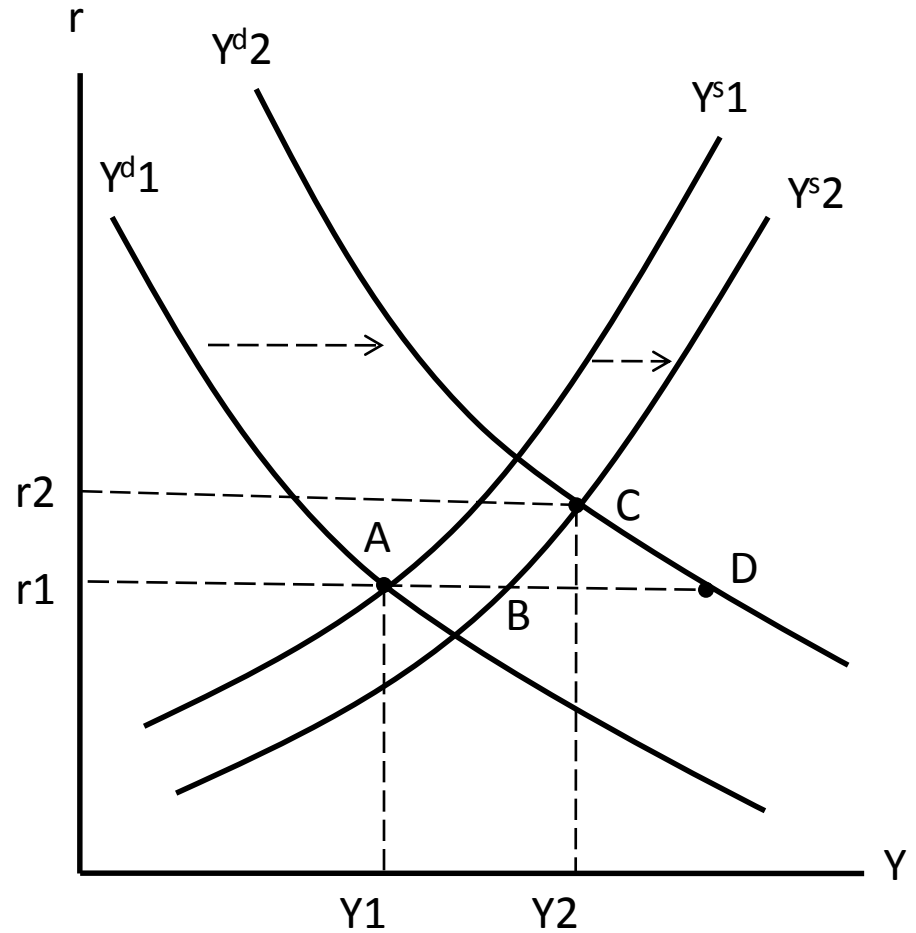
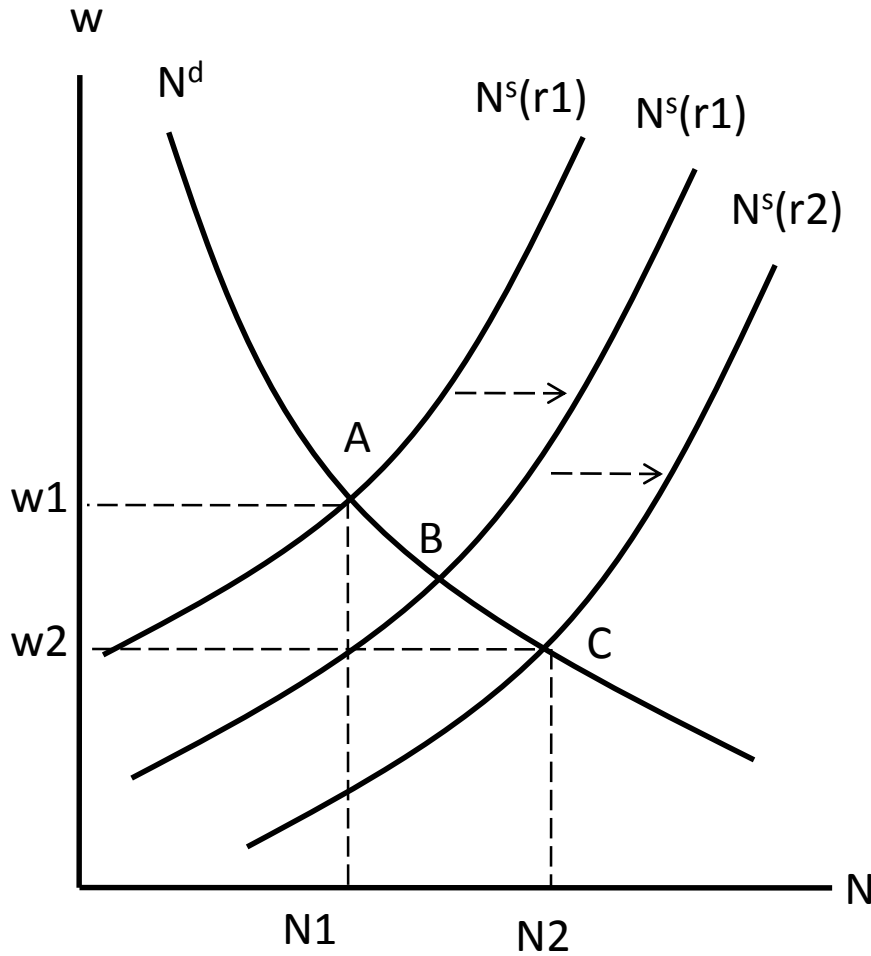
Step 1 An increase in G : Y^d shift



- 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*.

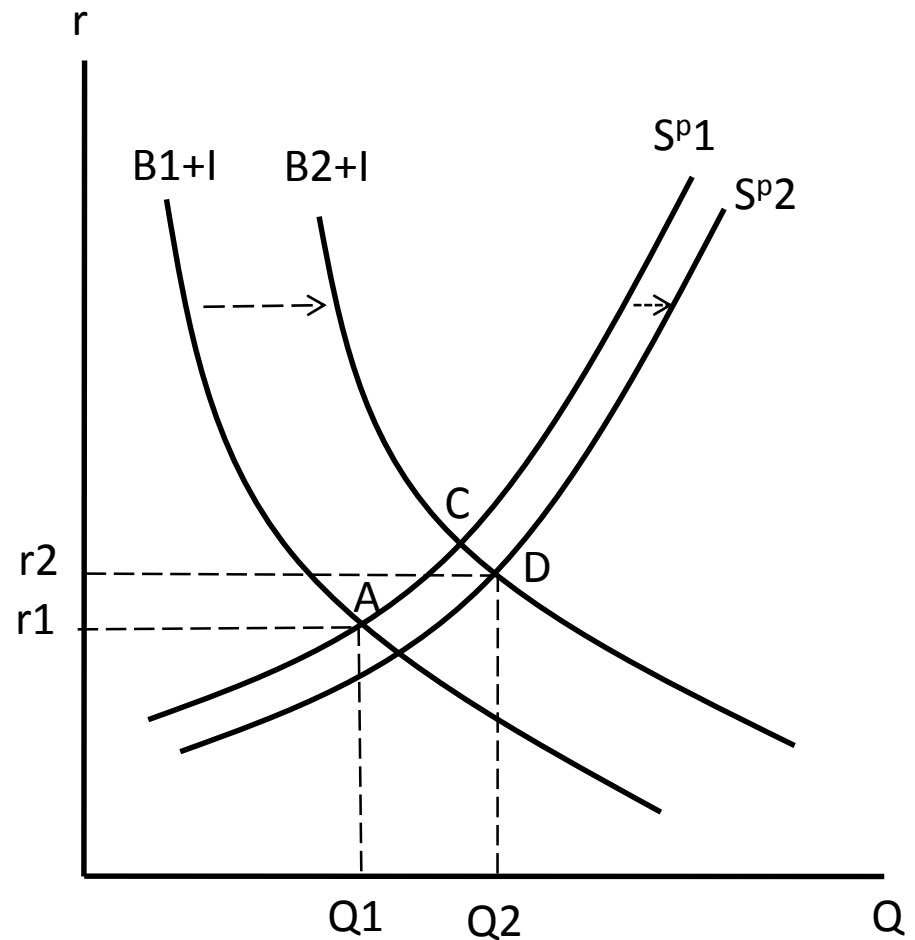
Step 2 An increase in G: rising r



- 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.
 - $\Delta Y^d = \Delta G = \Delta D > \Delta Y$.
 - 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!***

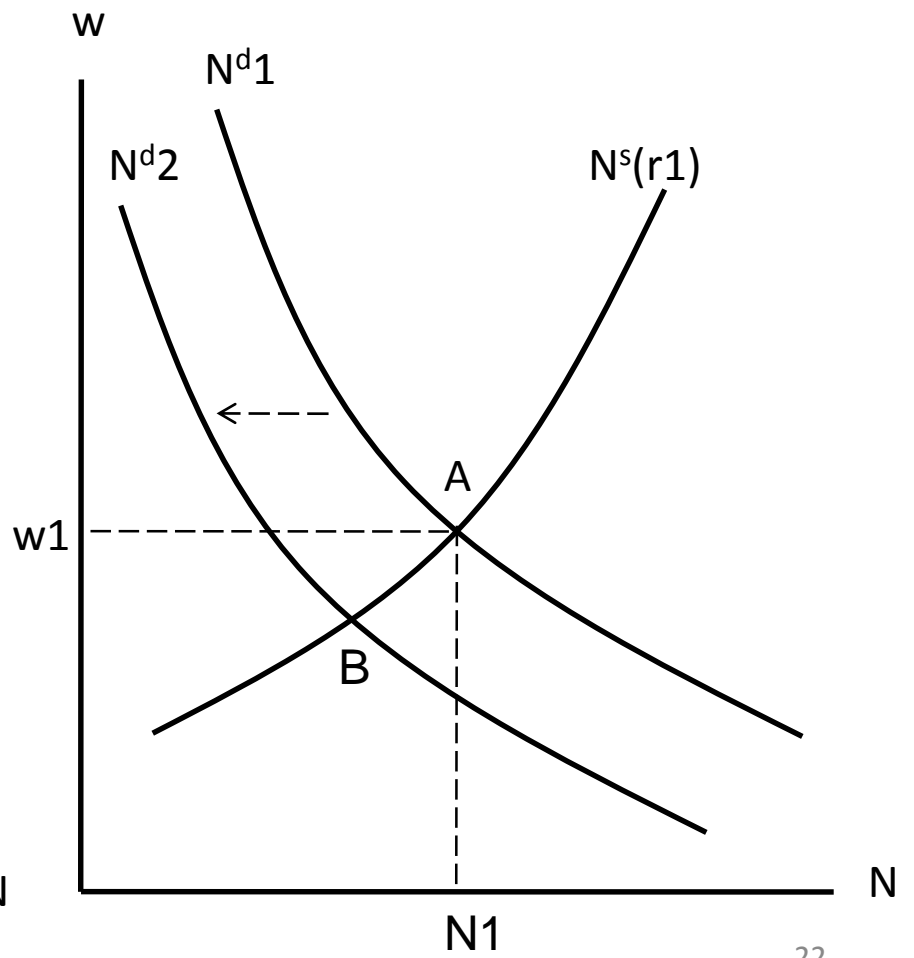
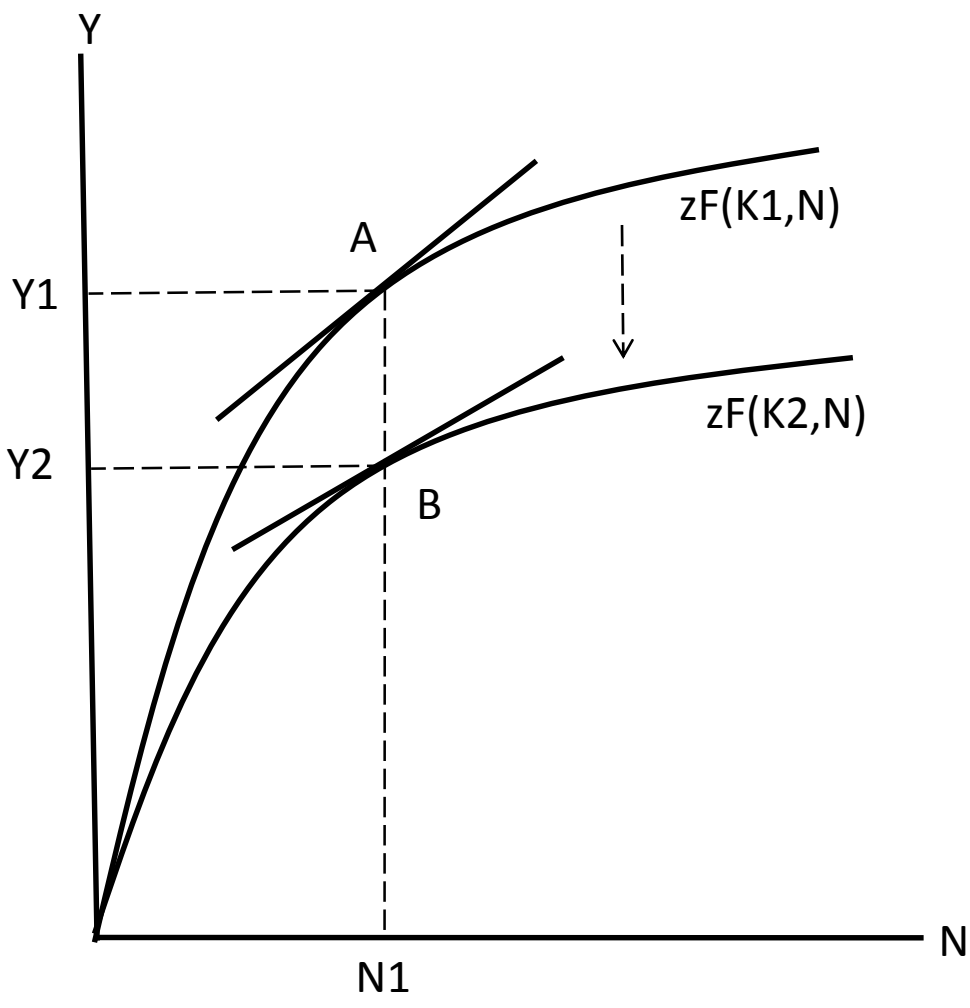
Shock experiments

- 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').

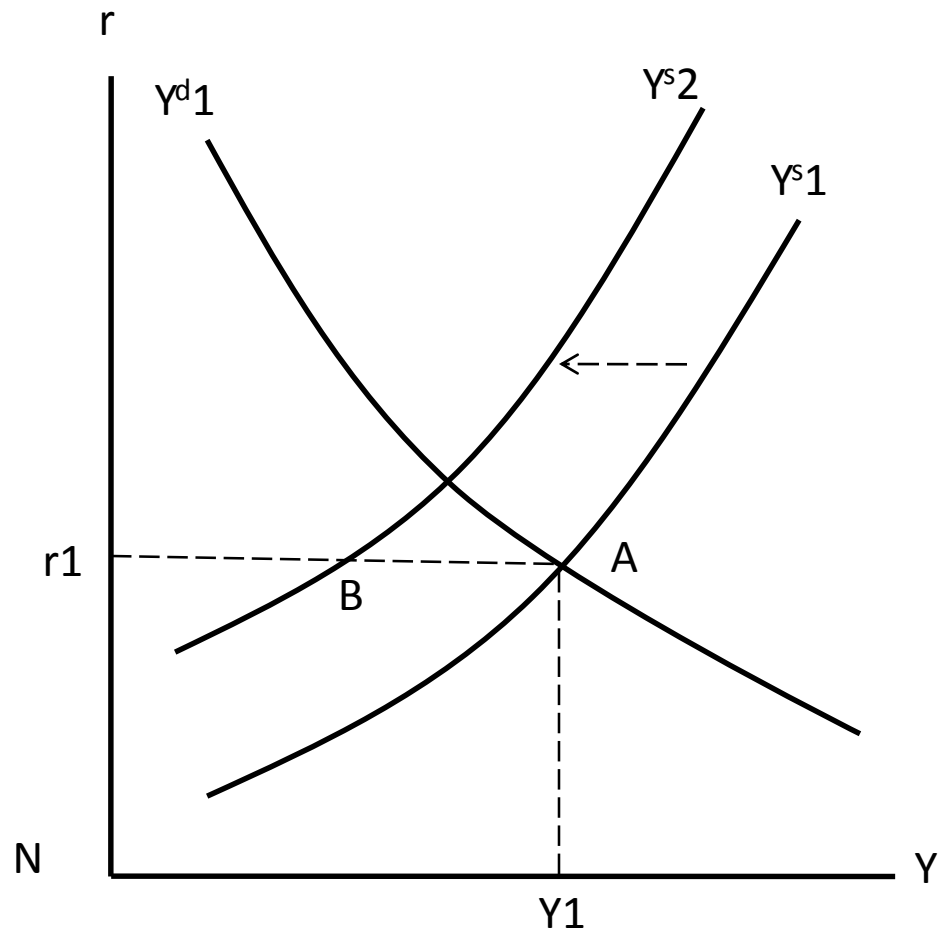
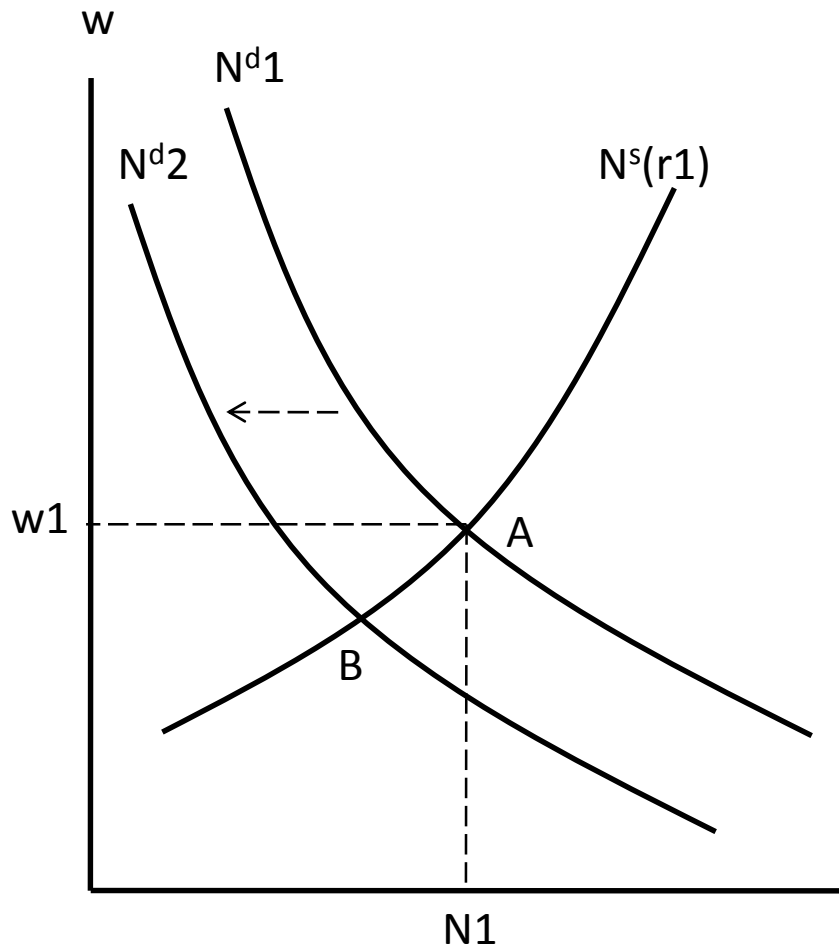
A decrease in current capital stock

- 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

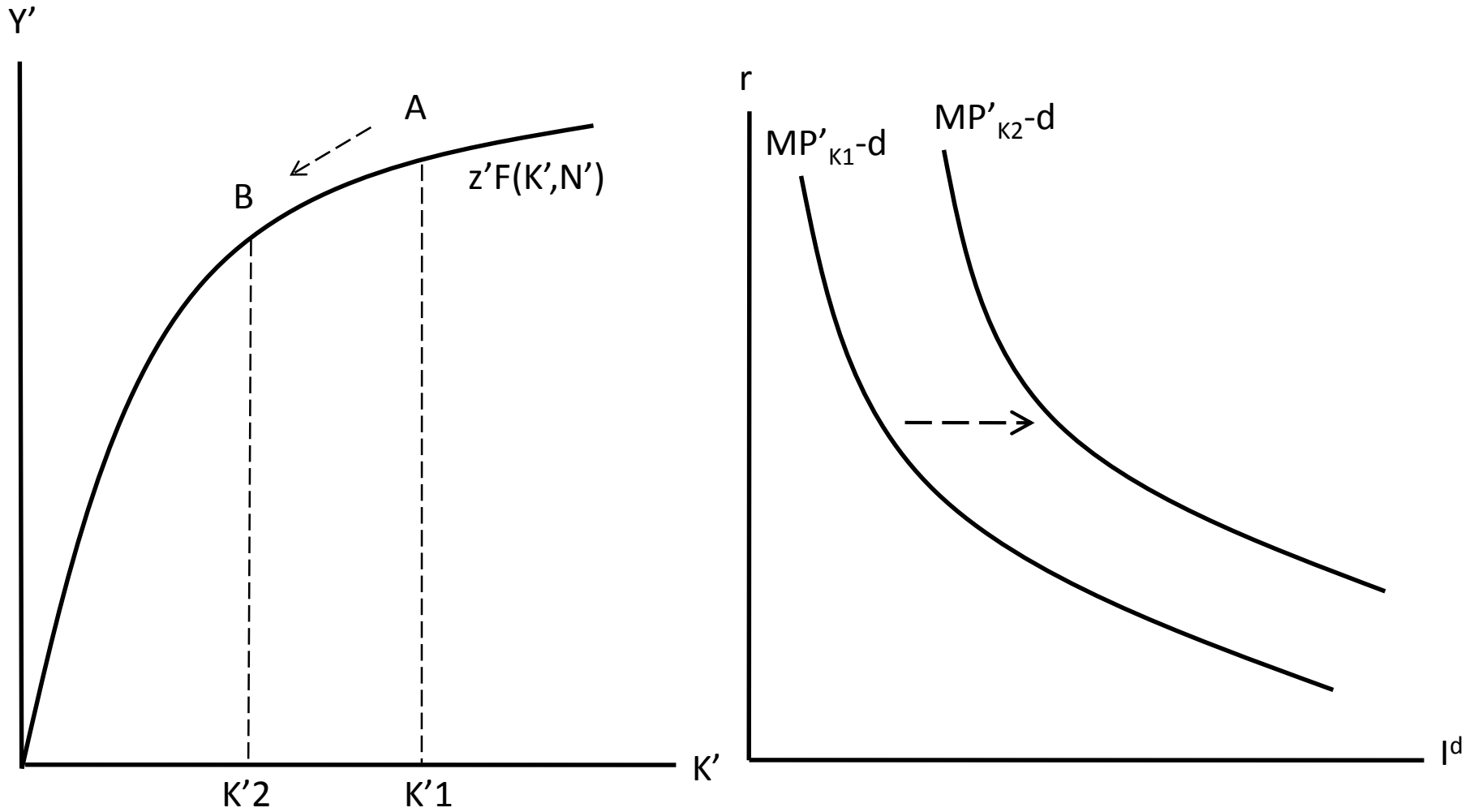


Step 1 Lower N^d : Y^s shifts left.

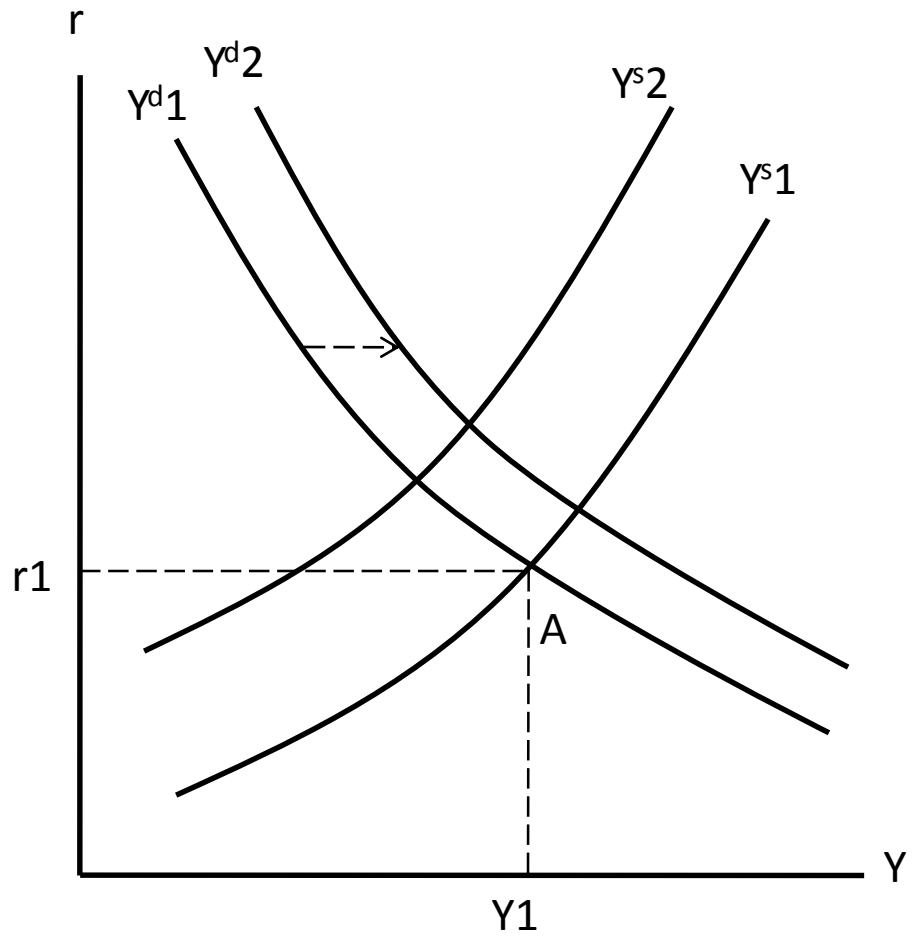
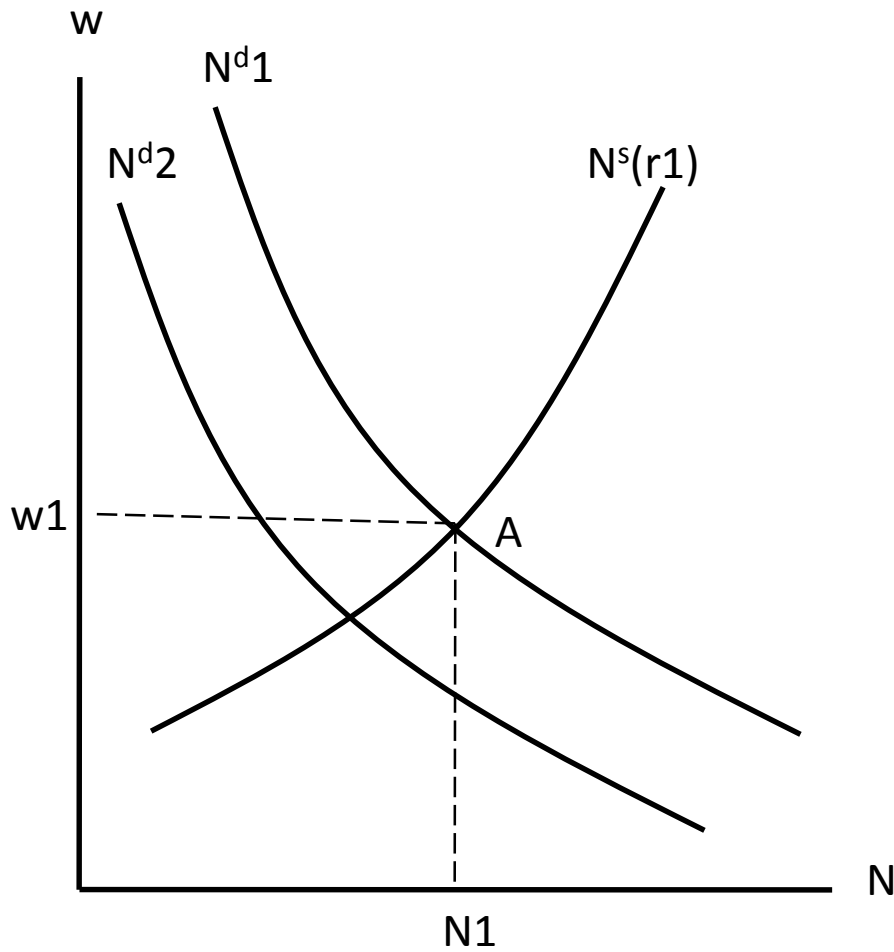


- **Effect on Y^d :**
 - A smaller current K means a smaller future K' .
 - Future MP'_K rises; investment increases, given r .
 - The optimal investment curve (I^d) shifts right.
 - The output demand curve (Y^d) shifts right.
- **The real interest rate** must rise.
- **Step 2:** the higher real interest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

Step 1 Higher MP'_K and rising I^d

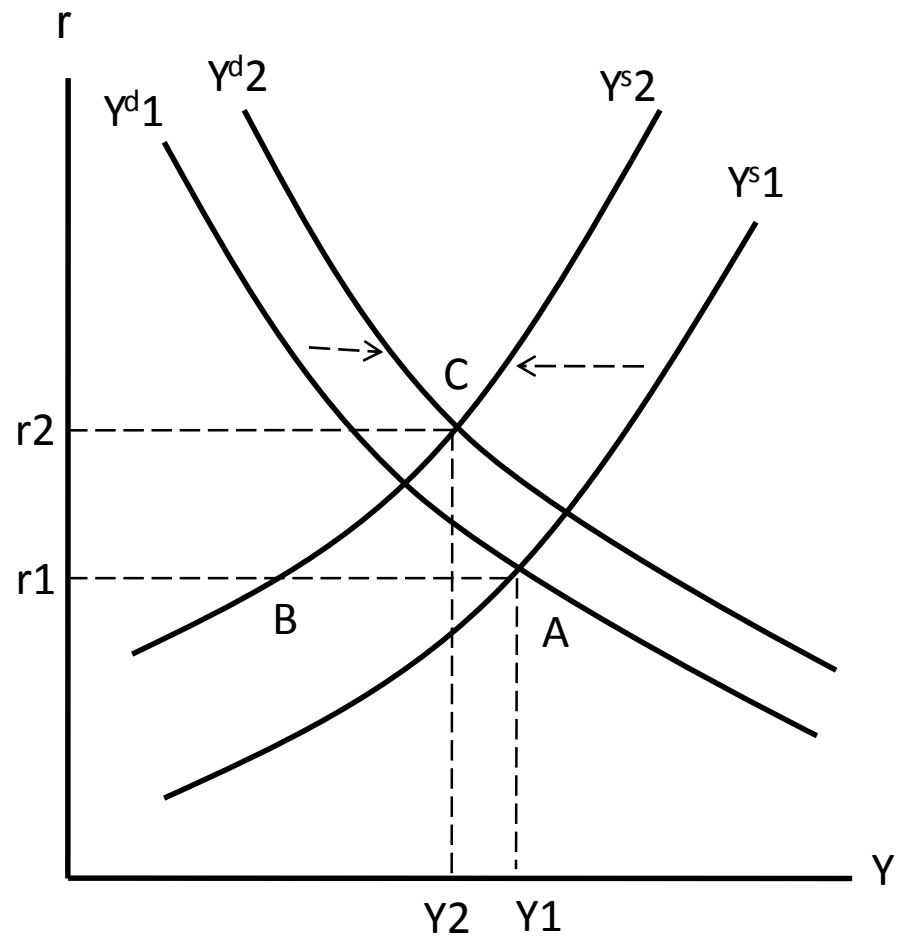
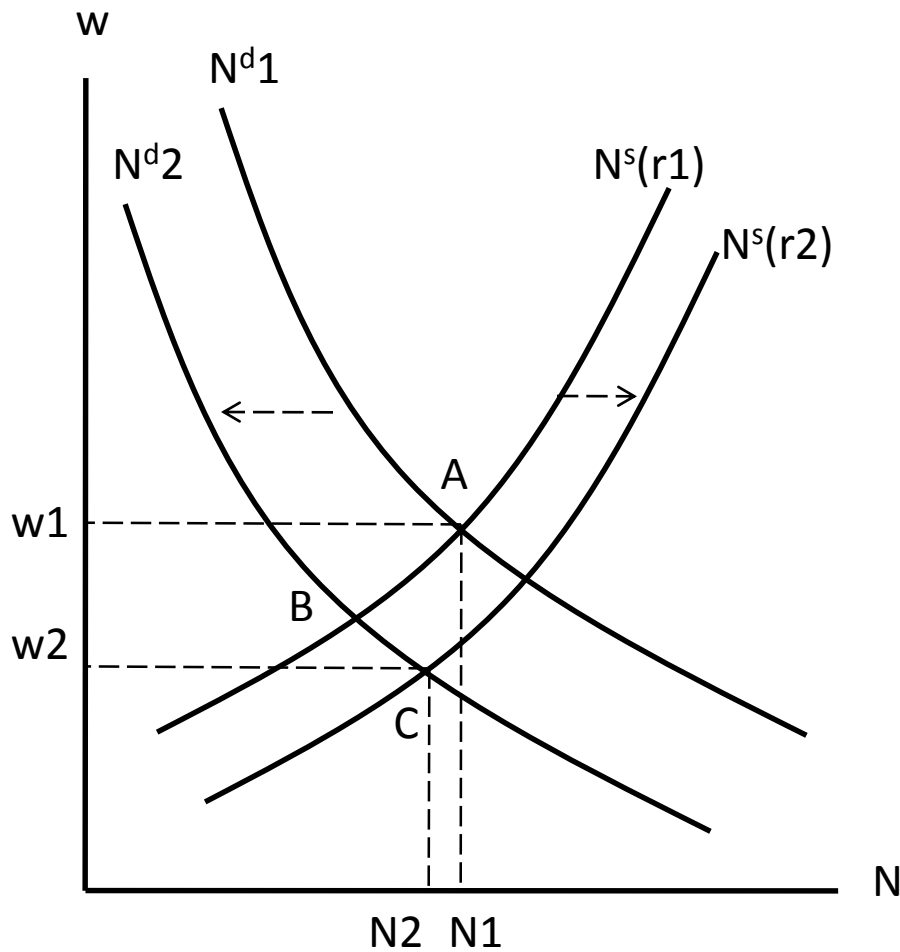


Step 1 A rising I^d shifts Y^d right.



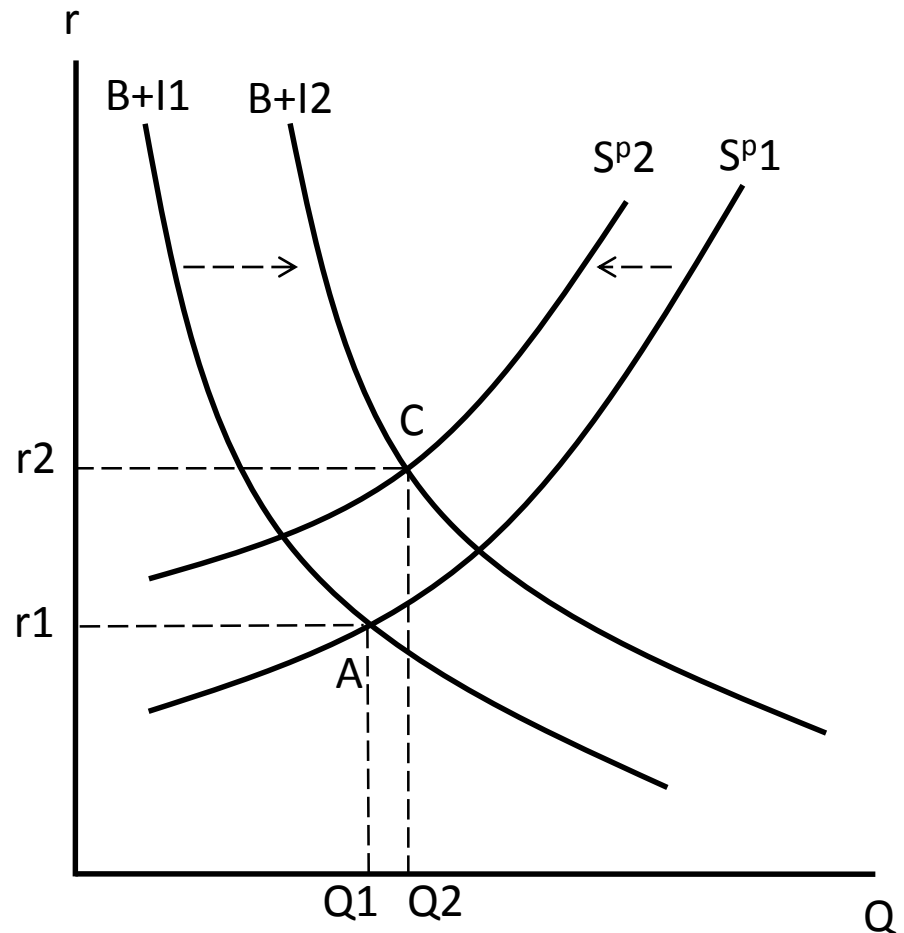
- Leisure decreases and labor supply increases.
 - The labor supply curve shifts to the right.
 - The real wage drops further.
 - A movement on the Y^s curve.
- Investment increases to make up for the decline in the capital stock:
 - The higher real interest rate depresses investment, but higher MP'_K 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.

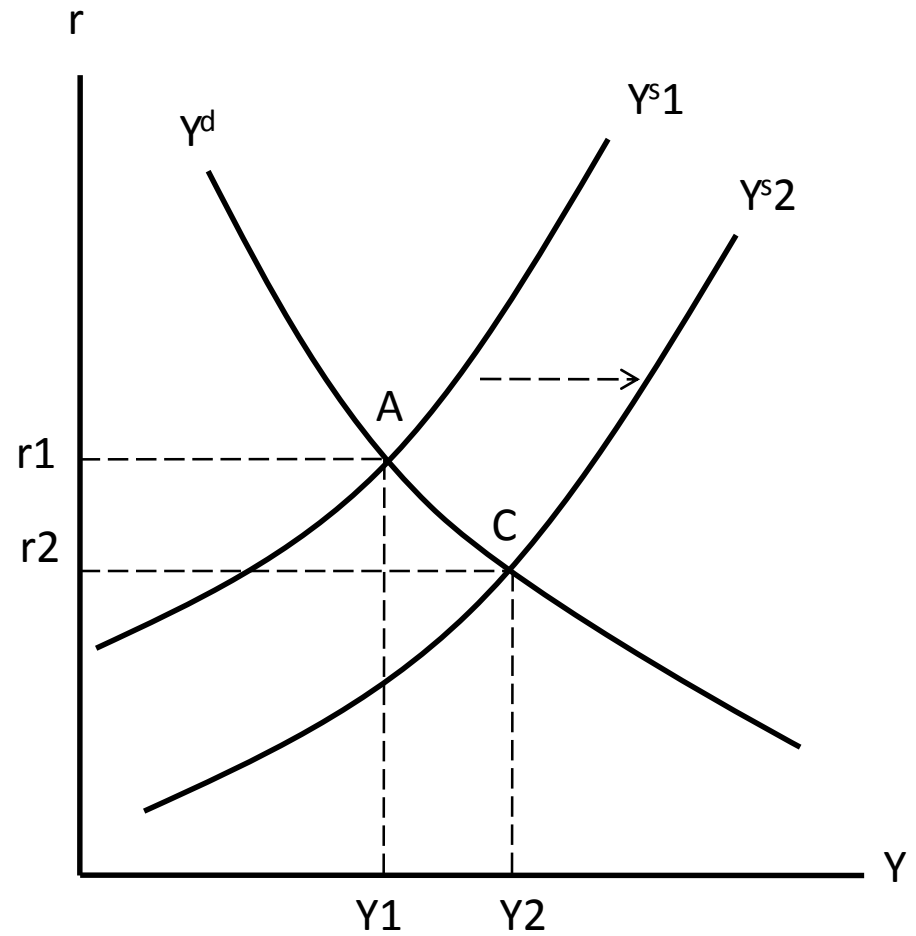
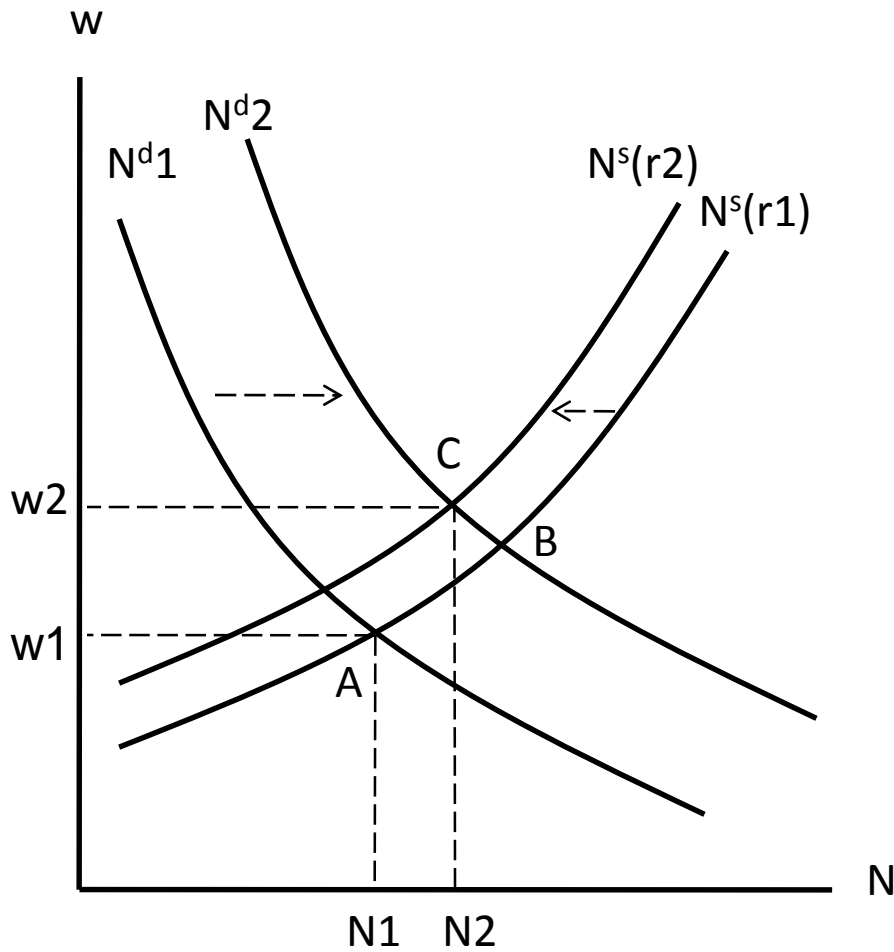
Shock experiments

- Current government purchases increase temporarily (G);
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A temporary increase in z

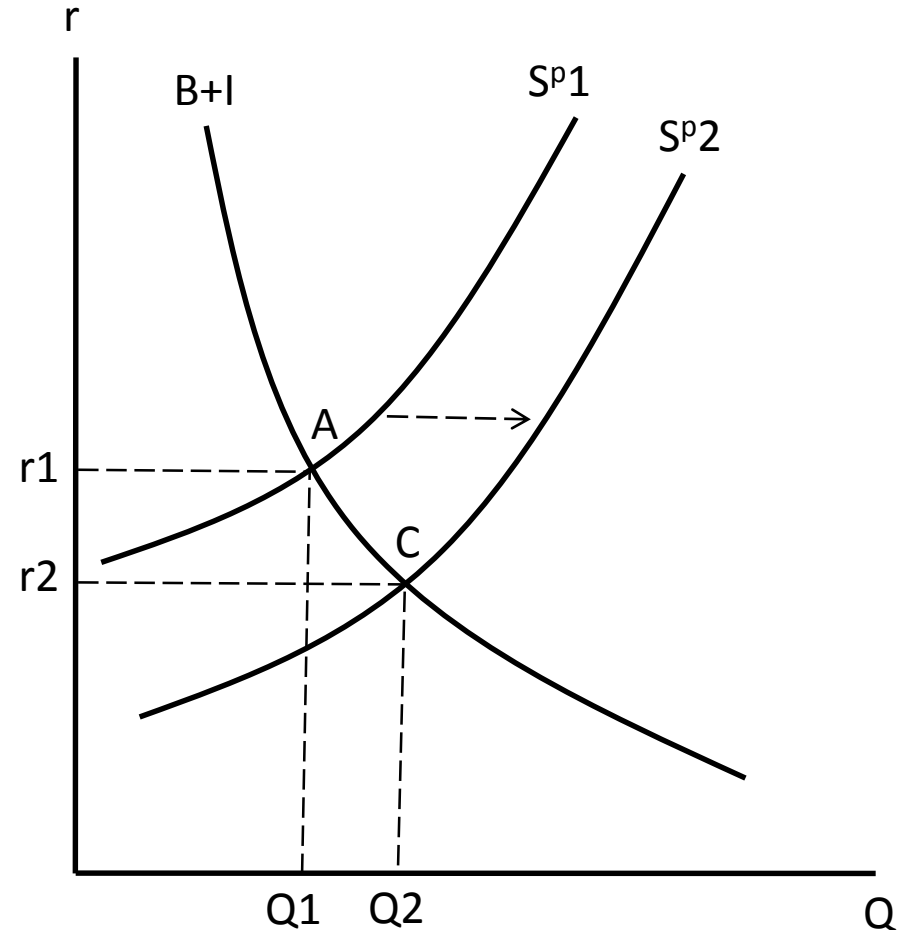
- **Step 1:** An increase in current total factor productivity (z) raises MP_N .
 - Labor demand and **output supply shift right.**
 - The real interest rate decreases.
- **Step 2:** the lower real interest rate raises current consumption, investment and leisure.
 - Labor supply decreases; the labor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

Question

- If market expects that government is to increase the government spending in the future, what would be the impact to

Shock experiments

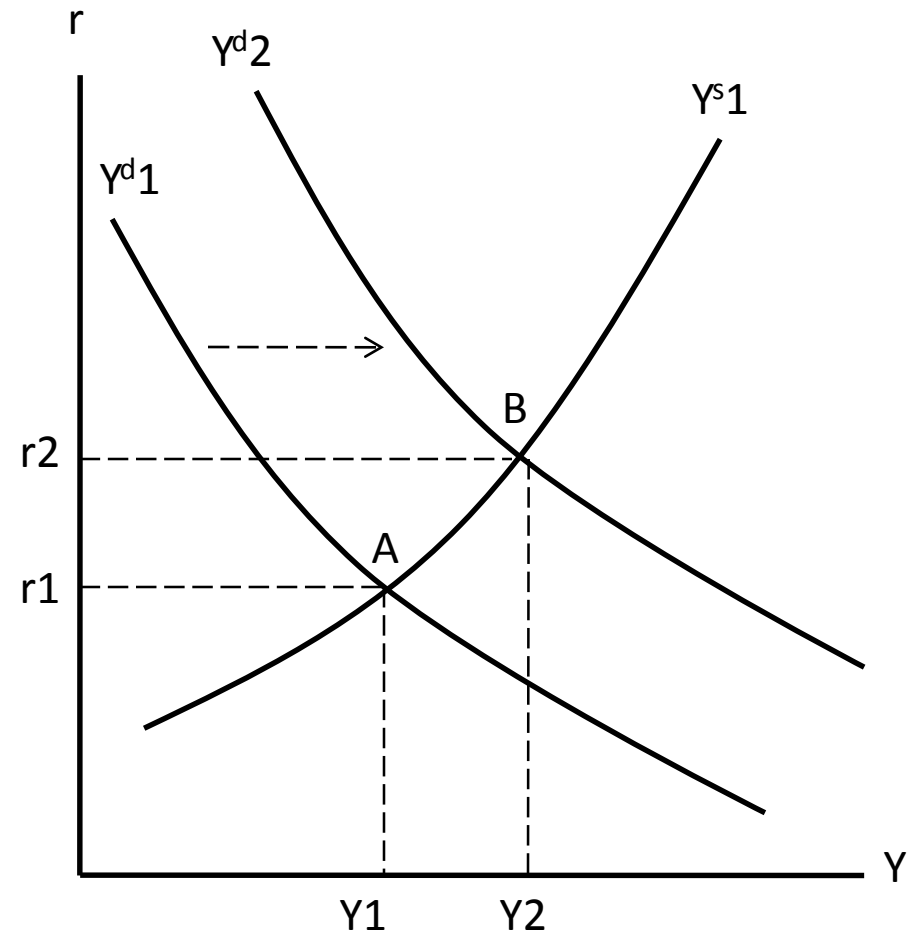
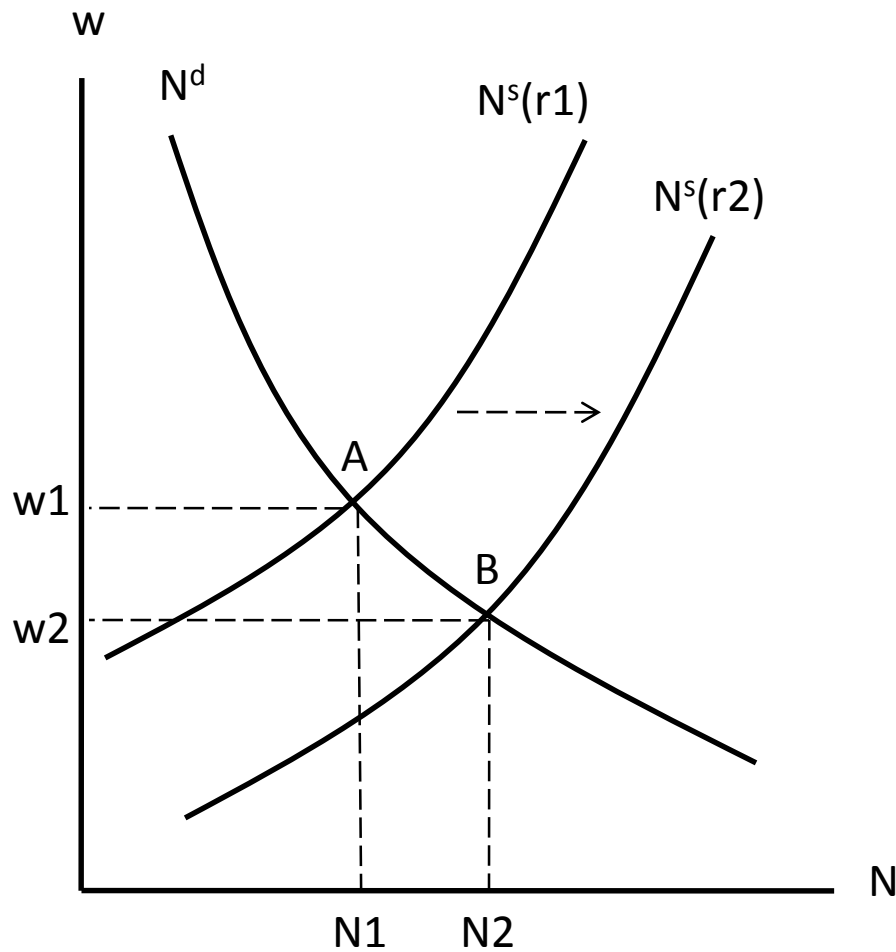
- Current government purchases increase temporarily (G);
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- A temporary increase in current total factor productivity (z);
- An increase in future total factor productivity (z').

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.

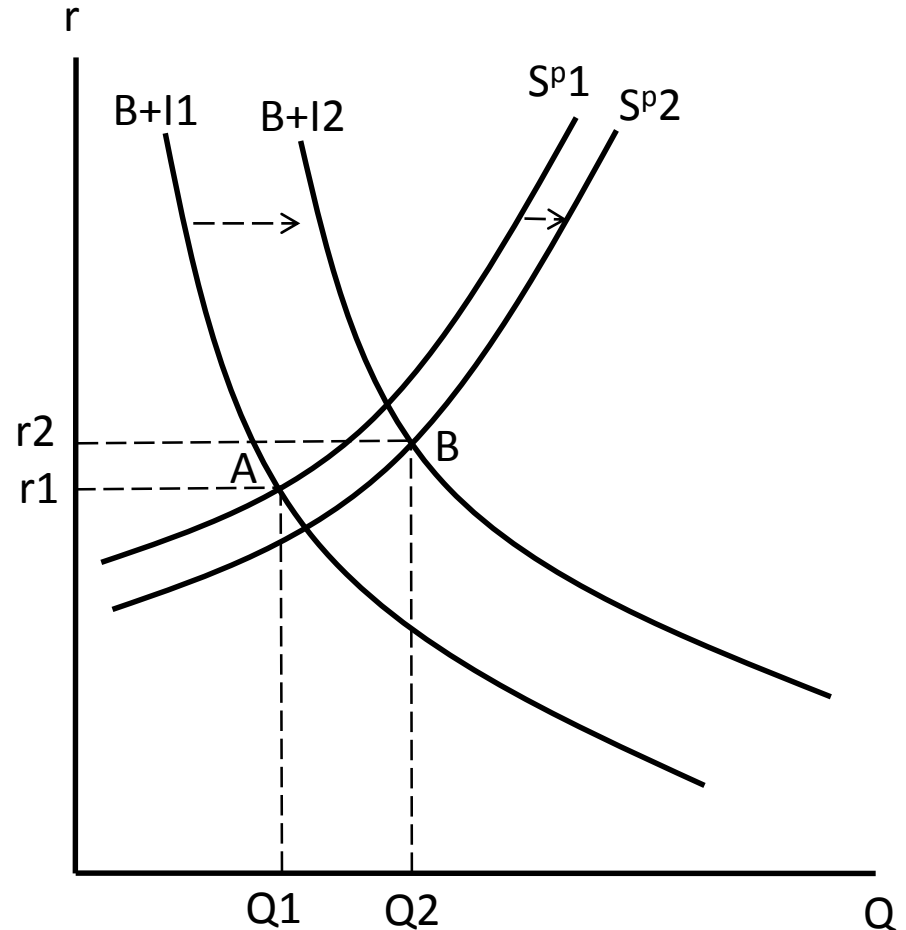
- The labor supply curve shifts right; the real wage drops.
- Employment and output increase.
- Higher current consumption from higher income partially drops from the higher real interest rate.
- The higher investment from higher MP'_K is partially offset by the higher real interest rate.
 - Investment 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 $\Delta z'$

- 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.