The Monetary Policy and Aggregate Demand Curves

This lecture explains the positive relationship between the real interest rate and inflation, which is illustrated by the monetary policy (MP) curve. The MP curve is combined with the IS curve to derive the aggregate demand (AD) curve.

The Federal Reserve and Monetary Policy

A. The Fed controls the federal funds rate, its primary policy instrument, by adjusting the level of reserves in the banking system.

B. The federal funds rate, which is a nominal interest rate (R), is linked to the real interest rate (r), which impacts investment and net exports, via the Fisher equation

$$R = r + \pi^e, \tag{1}$$

where π^e is the expected inflation rate.

C. Since prices are sticky in the short run, monetary policy will not have an immediate effect on current or expected inflation.

D. As a result, a reduction in the federal funds rate by the Fed will lower the real interest rate via (1), which will stimulate output by raising investment and net exports.

The Monetary Policy Curve

A. The Fed follows a nominal interest rate rule where monetary policy responds to inflation (π)

$$R = \bar{r} + \pi + \theta \times (\pi - \pi^*). \qquad (2)$$

1. The parameter $\theta > 0$, so that both the nominal and real interest rates rise in response to an increase in inflation.
2. The target inflation (π^*) is set directly by the Fed.
3. The autonomous real interest rate ($\bar{r} > 0$) represents all of the factors other than π and π^* that affect R.

B. The MP curve shows the relationship between the real interest rate, which is indirectly set by the central bank, and the inflation rate.

1. If $\pi = \pi^e$, we can substitute the Fisher equation (1) into the policy rule (2) to get the equation for the MP curve

$$r + \pi = \bar{r} + \pi + \theta \times (\pi - \pi^*),$$

$$r = \bar{r} + \theta \times (\pi - \pi^*). \qquad (3)$$

2. The equation for the MP curve is consistent with the Taylor principle.

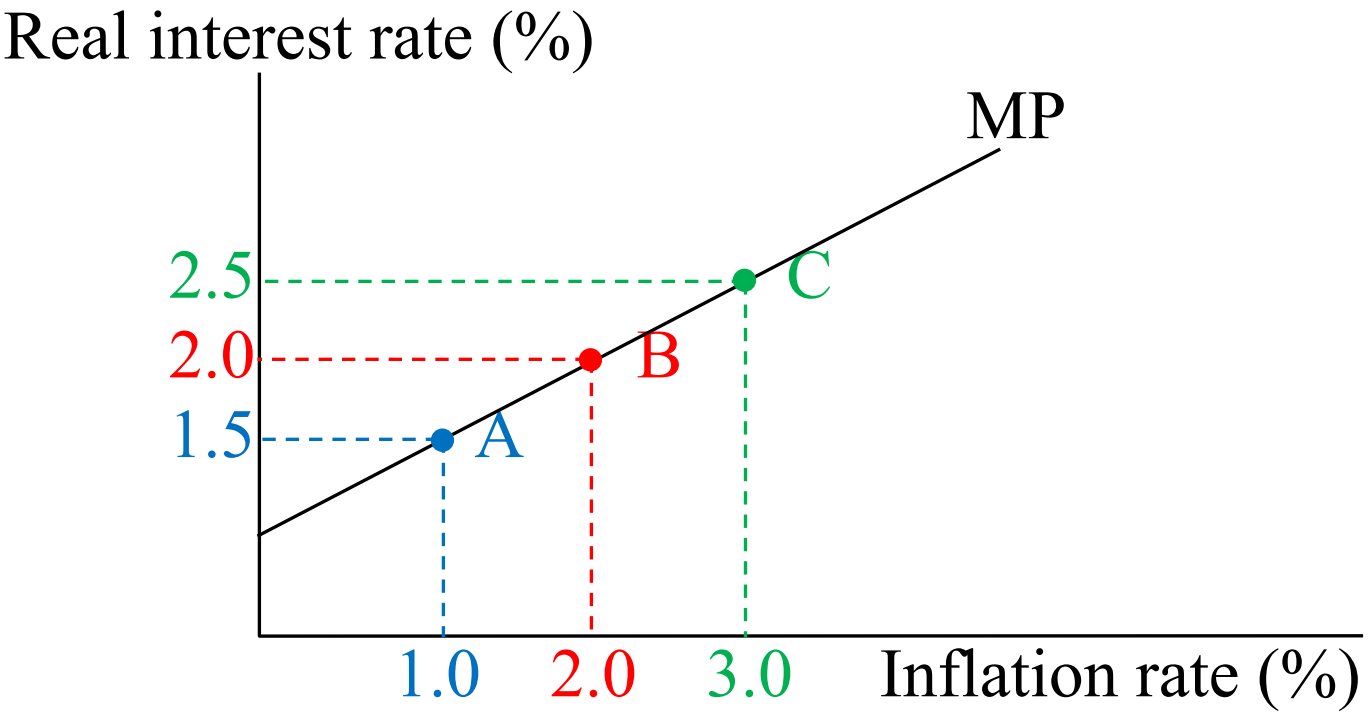
   a. The Taylor principle says the central bank should respond to an increase in the inflation rate by raising the nominal interest rate enough that the real interest rate also increases.

   b. Since $\theta > 0$, the Taylor principle holds for the MP curve equation (3).

C. A movement along the MP curve represents the central bank's automatic adjustment of interest rates when inflation changes.

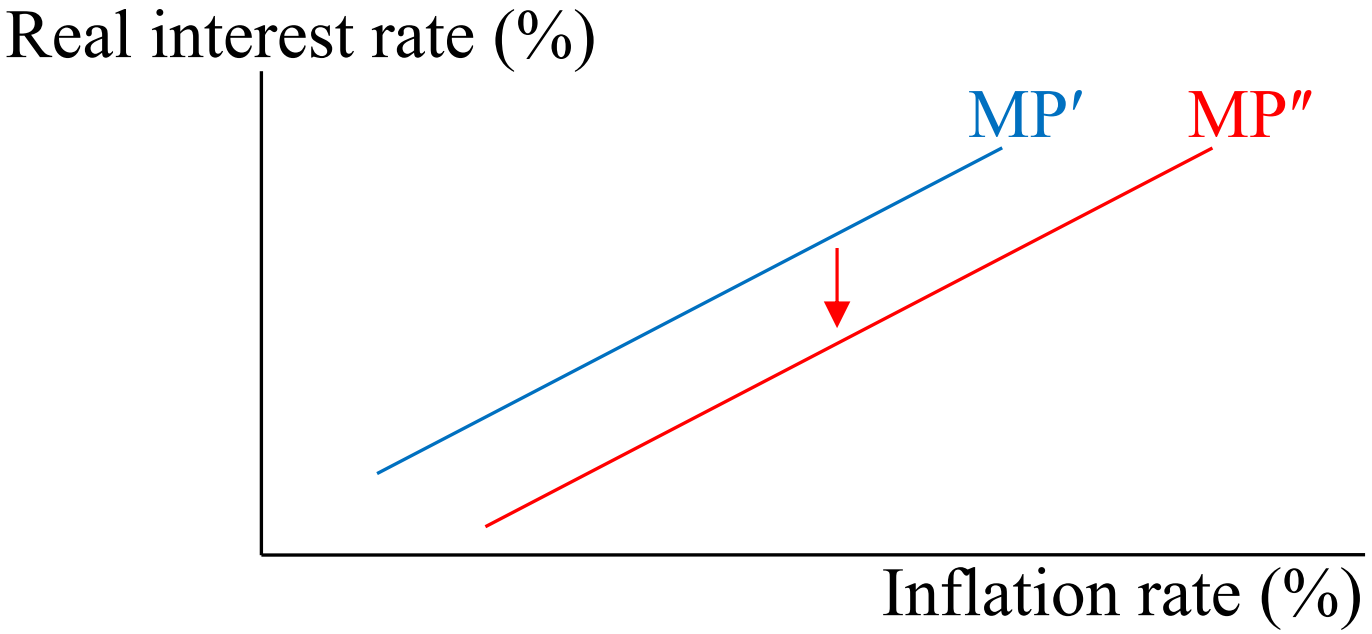
1. Consider the case where $\bar{r} = 2$, $\theta = 0.5$, and $\pi^* = 2$

$$r = 2 + 0.5 \times (\pi - 2).$$



2. As the inflation rate rises from 1% to 2% and then 3%, the central bank responds by raising the real interest rate from 1.5% to 2.0% and then 2.5% (point A to B and then C).

D. Factors that Cause the MP Curve to Shift Down



1. An increase in the target inflation rate
   a. $\pi^{*}\uparrow \rightarrow r\downarrow$
2. A decrease in the autonomous real interest rate
   a. A fall in the real interest rate at potential output or an autonomous easing of monetary policy
   b. $\bar{r}\downarrow \rightarrow r\downarrow$

The Aggregate Demand Curve

A. Aggregate demand is the total output demanded at different inflation rates.

B. Deriving the AD Curve

1. The IS curve shows the relationship between aggregate output and the real interest rate when the goods market is in equilibrium

$$Y = \frac{\bar{C} + \bar{I} + \bar{G} + \overline{NX} - d \times \bar{f} - MPC \times \bar{T}}{1 - MPC} - \frac{d + x}{1 - MPC} \times r. \qquad (4)$$

2. The MP curve shows the relationship between the real interest rate, which is indirectly set by the central bank, and the inflation rate

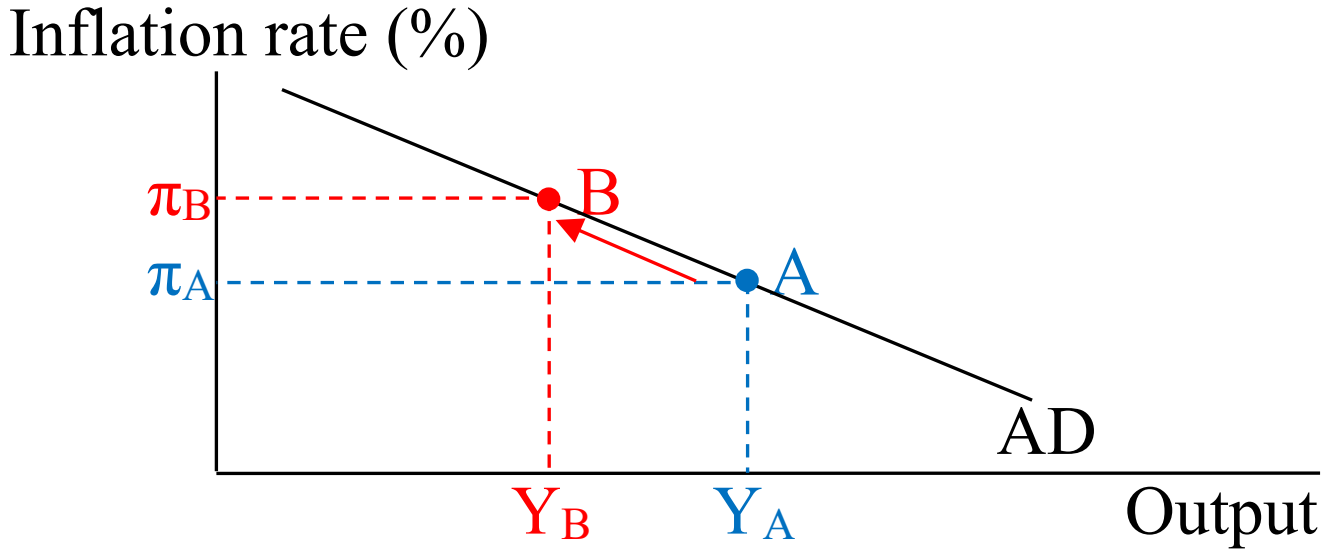
$$r = \bar{r} + \theta \times (\pi - \pi^*). \qquad (5)$$

3. The AD curve equation is obtained by combining the IS and MP curves,

$$Y = \frac{\bar{C} + \bar{I} + \bar{G} + \overline{NX} - d \times \bar{f} - MPC \times \bar{T} - (d+x) \times (\bar{r} - \theta \times \pi^*)}{1 - MPC} - \frac{(d+x) \times \theta}{1 - MPC} \times \pi.$$

   a. The equation for the AD curve reveals the negative relationship between output and the inflation rate.

4. The AD curve graph: Higher inflation is represented by an upward movement along the AD curve.
   [$\pi\uparrow \rightarrow R\uparrow \rightarrow r\uparrow \rightarrow (I\downarrow \ \& \ NX\downarrow) \rightarrow Y\downarrow$]

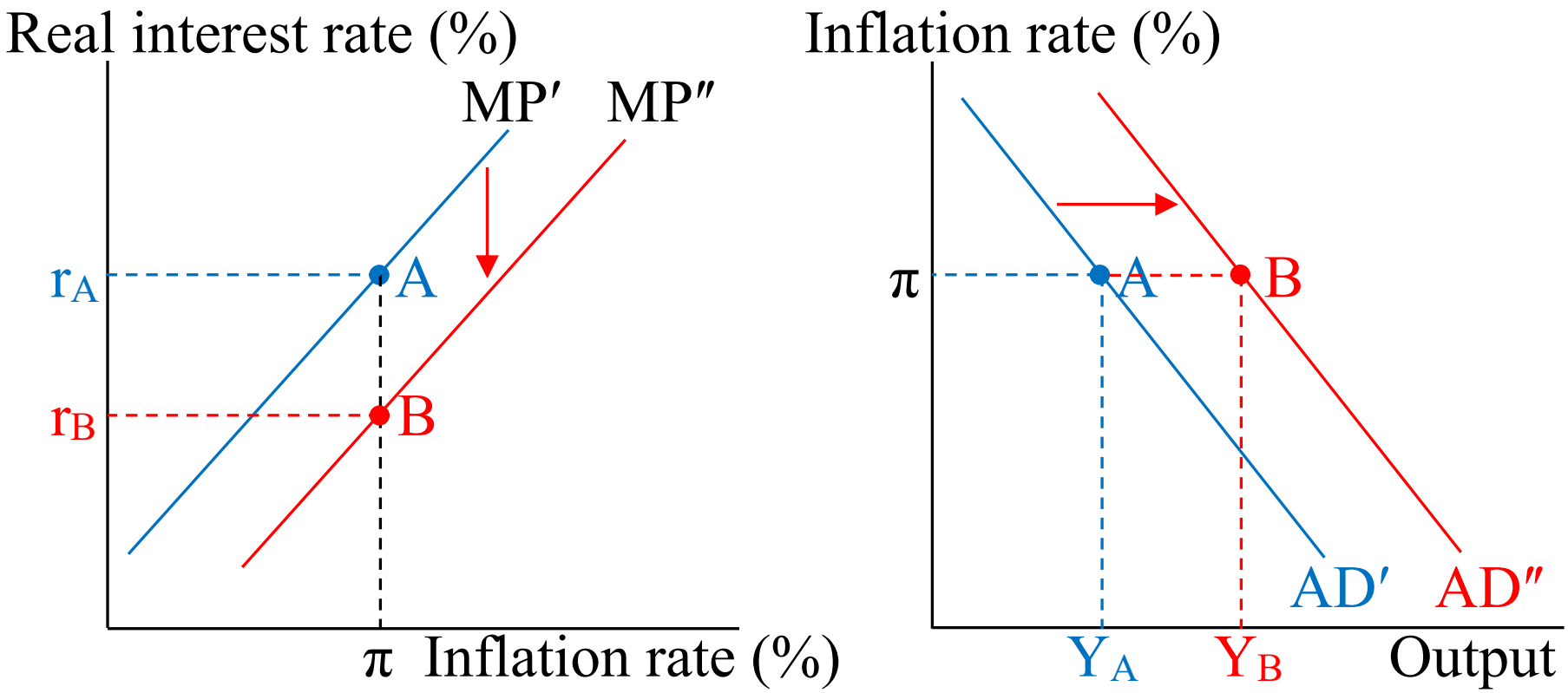


C. Factors that Shift the AD Curve

1. Factors that shift the MP curve down and AD curve right

   a. A decrease in the autonomous real interest rate ($\bar{r}$)
   [$\bar{r}\downarrow \rightarrow r\downarrow \rightarrow (I\uparrow \ \& \ NX\uparrow) \rightarrow Y\uparrow$]

   b. An increase in the target inflation rate (π^*)
   [$\pi^*\uparrow \rightarrow r\downarrow \rightarrow (I\uparrow \ \& \ NX\uparrow) \rightarrow Y\uparrow$]



2. Factors that shift both the IS and AD curves to the right

   a. An increase in autonomous consumption ($\bar{C}$) [$\bar{C}\uparrow \rightarrow Y\uparrow$]

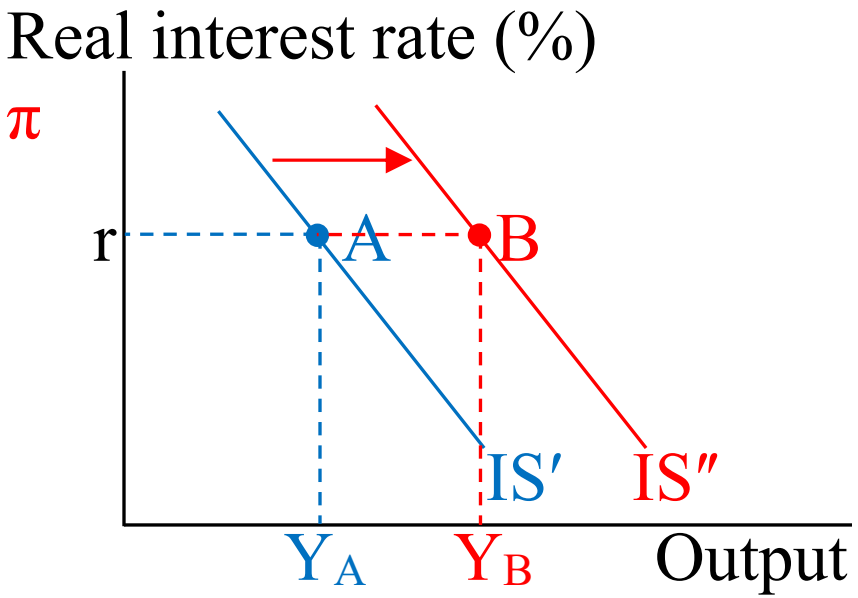
   b. An increase in autonomous investment ($\bar{I}$) [$\bar{I}\uparrow \rightarrow Y\uparrow$]

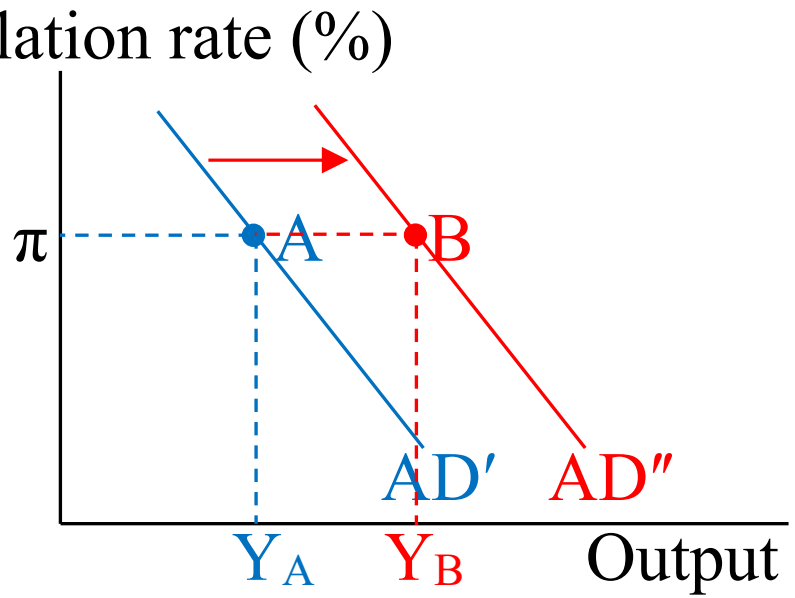
   c. An increase in government spending ($\bar{G}$) [$\bar{G}\uparrow \rightarrow Y\uparrow$]

   d. A decrease in taxes ($\bar{T}$) [$T\downarrow \rightarrow Y^{D}\uparrow \rightarrow C\uparrow \rightarrow Y\uparrow$]

   e. An increase in auto. net exports ($\overline{NX}$) [$\overline{NX}\uparrow \rightarrow Y\uparrow$]

   f. A decrease in financial frictions ($\bar{f}$) [$\bar{f}\downarrow \rightarrow I\uparrow \rightarrow Y\uparrow$]





Suppose an Economy is Described by the Following Information

$$Y = C + I + \bar{G} + NX$$

$$C = \bar{C} + MPC \times (Y - \bar{T})$$

$$I = \bar{I} - d \times (r + \bar{f})$$

$$NX = \overline{NX} - x \times r$$

$$R = \bar{r} + \pi + \theta \times (\pi - \pi^{*})$$

$$R = r + \pi.$$

Let $\bar{C} = 4.0$, $\bar{I} = 1.5$, $\bar{G} = 3.0$, $\overline{NX} = 1.0$, $\bar{T} = 3.0$, $MPC = 0.8$,

$d = 35$, $x = 15$, $\bar{f} = 0$, $\bar{r} = 0.03$, $\pi^{*} = 0.02$, and $\theta = 0.5$.

A. Derive the equation for the IS curve

$$Y = \bar{C} + MPC \times (Y - \bar{T}) + \bar{I} - d \times (r + \bar{f}) + \bar{G} + \overline{NX} - x \times r$$

$$Y = 4.0 + 0.8 \times (Y - 3.0) + 1.5 - 35 \times (r + 0) + 3.0 + 1.0 - 15 \times r$$

$$Y = [4.0 - 2.4 + 1.5 - 0 + 3.0 + 1.0] + 0.8 \times Y - (35 + 15) \times r$$

$$Y - 0.8 \times Y = 7.1 - 50 \times r$$

$$0.2 \times Y = 7.1 - 50 \times r$$

$$Y = 7.1/0.2 - (50/0.2) \times r$$

$$Y = 35.5 - 250 \times r$$

B. Derive the equation for the MP curve (assume $\pi^e = \pi$)

$$R = \bar{r} + \pi + \theta \times (\pi - \pi^*) \;\&\; R = r + \pi$$

$$r + \pi = \bar{r} + \pi + \theta \times (\pi - \pi^*)$$

$$r = 0.03 + 0.5 \times (\pi - 0.02)$$

$$r = 0.02 + 0.5 \times \pi$$

C. Derive the equation for the AD curve

Combine the equations for the IS and MP curves

$$Y = 35.5 - 250\times(0.02 + 0.5\times\pi)$$

$$Y = 35.5 - 5 - 125\times\pi$$

$$Y = 30.5 - 125\times\pi$$

D. Calculate output when $\pi = 4\%$

Using the equation for the AD curve

$$Y = 30.5 - 125\times\pi$$

$$Y = 30.5 - 125\times(0.04)$$

$$Y = 30.5 - 5$$

$$Y = 25.5$$

E. Calculate the real interest rate when $\pi = 4\%$.

$$r = 0.02 + 0.5 \times \pi$$

$$r = 0.02 + 0.5 \times 0.04$$

$$r = 0.02 + 0.02)$$

$$r = 0.04$$

F. Calculate the nominal interest rate when $\pi = 4\%$.

$$R = r + \pi$$

$$R = 0.04 + 0.04$$

$$R = 0.08$$

G. Calculate consumption when $\pi = 4\%$.

$$C = \bar{C} + MPC \times (Y - \bar{T})$$

$$C = 4.0 + 0.8 \times (25.5 - 3.0)$$

$$C = 4.0 + 18.0$$

$$C = 22.0$$

H. Calculate investment when $\pi = 4\%$.

$$I = \bar{I} - d \times (r + \bar{f})$$

$$I = 1.5 - 35 \times (0.04 + 0)$$

$$I = 1.5 - 1.4$$

$$I = 0.1$$

I. Calculate net exports when $\pi = 4\%$.

$$NX = \overline{NX} - x \times r$$

$$NX = 1.0 - 15 \times 0.04$$

$$NX = 0.4$$