The Macroeconomic Policy Model

This lecture provides an expanded framework for determining the inflation rate in a model where the Fed follows a simple nominal interest rate rule.

Price Adjustment

A. The Phillips curve relationship

1. Recall, the algebraic description of the Phillips curve

$$\pi = \pi^e + f[(Y_{-1} - Y^*)/Y^*]. \qquad (1)$$

   a. The current inflation rate, π, rises as the expected inflation rate, π^e, increases.

   b. π rises as the % deviation of output from its potential, $(Y_{-1} - Y^*)/Y^*$, increases. Recall, that current output, Y, does not influence π because prices are fixed in the short run.

2. To simplify (1), we will assume f = f(), where *f* is a constant coefficient such that f > 0. Therefore, we can rewrite (1) as follows

$$\pi = \pi^{e} + f\times[(Y_{-1} - Y^{*})/Y^{*}]. \qquad (2)$$

3. A key property from (2) is that there is no long-run trade off between inflation and output. This proposition is called the natural rate property.

4. Several theories, such as the imperfect information theory and the staggered wage setting model, can explain the positive relationship between output and inflation shown in (2).

B. In the Phillips curve equation, (2), the economic environment affects the responsiveness of $(Y_{-1} - Y^*)/Y^*$ to π (this is measured by the value of *f*) and the formation of π^e.

1. The degree of wage indexing in the economy is one factor that influences the value of *f*.

   a. Suppose wage contracts are indexed such that wages automatically rise by a fraction a_i of the increase in π.

   b. To see the impact of wage indexing on *f*, suppose there is an increase in Y that initially raises wage inflation by 1%.

   c. The rise in wage inflation causes marginal cost to increase by 1%, which pushes up price inflation by 1%.

   d. The rise in price inflation will cause wages to increase by another a_i%, which further forces up price inflation by a_i%.

e. This process will continue as wages and prices rise by another a_i^2%. This process, called a wage-price spiral, will eventually settle down as long as wage indexing is not 100%. (That is, $a_i < 1$.)

f. The total effect of wage indexing on price inflation is

$$1 + a_i + a_i^2 + a_i^3 + \ldots = 1/(1 - a_i).$$

g. Ex., Suppose wages rise by 1% due to an increase in Y and $a_i = 0.5$. Thus, price inflation rises by 2%,

$$[1/(1 - 0.5)] \times 0.01 = 0.02.$$

h. Therefore, the higher the value of a_i, the more responsive π is to $(Y_{-1} - Y^*)/Y^*$. This is reflected in the Phillips curve equation, (2), with a larger value of *f*.

2. The forecasted length and severity of a business cycle is another factor that influences the value of *f*.

   a. If workers expect a recession to be long, expectations of future average wages will be smaller than if workers expected the recession to be short. As a result, workers will be more willing to accept lower wages.

   b. The lower wages resulting from an expectation of a long recession will cause a large decline in the marginal cost, which leads to a large reduction in price inflation.

   c. Thus, an expectation of a long business cycle means π is more responsive to $(Y_{-1} - Y^*)/Y^*$ than if the recession is expected to be short. This is reflected in the Phillips curve equation, (2), with a larger value of *f*.

C. The most difficult component of the Phillips curve to measure is the expected inflation rate, π^e.

1. There are two important factors to consider when measuring π^e.

   a. Forward-looking forecasts of future prices and wages influence the process of current wage setting and, thus, affect the expected inflation term.

   b. Staggered contracts and backward-looking wage behavior influence the expected inflation term because they contain inertia that cannot be changed immediately.

2. Since any model of expected inflation must be consistent with the actual behavior of inflation over time, any expected inflation model must be endogenous to the type of policy present in the economy.

3. For example, if inflation tends to have momentum or if inflation tends to be temporary, any model of expected inflation must account for this behavior.
4. The simplest model of expected inflation says $\pi^e = \pi_{-1}$, but this model is far from satisfactory.
    a. Ex., Suppose the monetary policy tries to keep $Y > Y^*$ permanently.
    b. If this is the model of expected inflation, it would appear the Fed's policy to keep $Y > Y^*$ would be feasible.
    c. In reality, such a policy would encourage individuals to adjust their formation of inflation expectations so that $Y = Y^*$ in the long run.
    d. While more complicated models of expected inflation might perform better, a very important point should be made: no model of expected inflation is universally applicable.

D. A graphical representation of price adjustment

1. The price adjustment (PA) line shows the relationship between π and $(Y–Y^*)/Y^*$.
2. Since π in the Phillips curve equation depends on $(Y_{-1}–Y^*)/Y^*$ and NOT on $(Y–Y^*)/Y^*$, the PA line is perfectly horizontal at the current inflation rate, π'.

3. Factors that will shift the PA line up (down) include
   a. $(Y_{-1}–Y^*)/Y^*$ rises (falls).
   b. A rise (fall) in π^e.

Summarizing the IS Curve

A. As we have shown in previous lectures, spending decisions on C, I and (X – IM) depend on the real interest rate, r, and not the nominal interest rate, R.

   1. Recall that the relationship between the nominal and real interest rates is as follows

$$R = r + \pi^e. \tag{3}$$

   2. If we assume $\pi = \pi^e$, the relationship in (3) becomes

$$R = r + \pi. \tag{4}$$

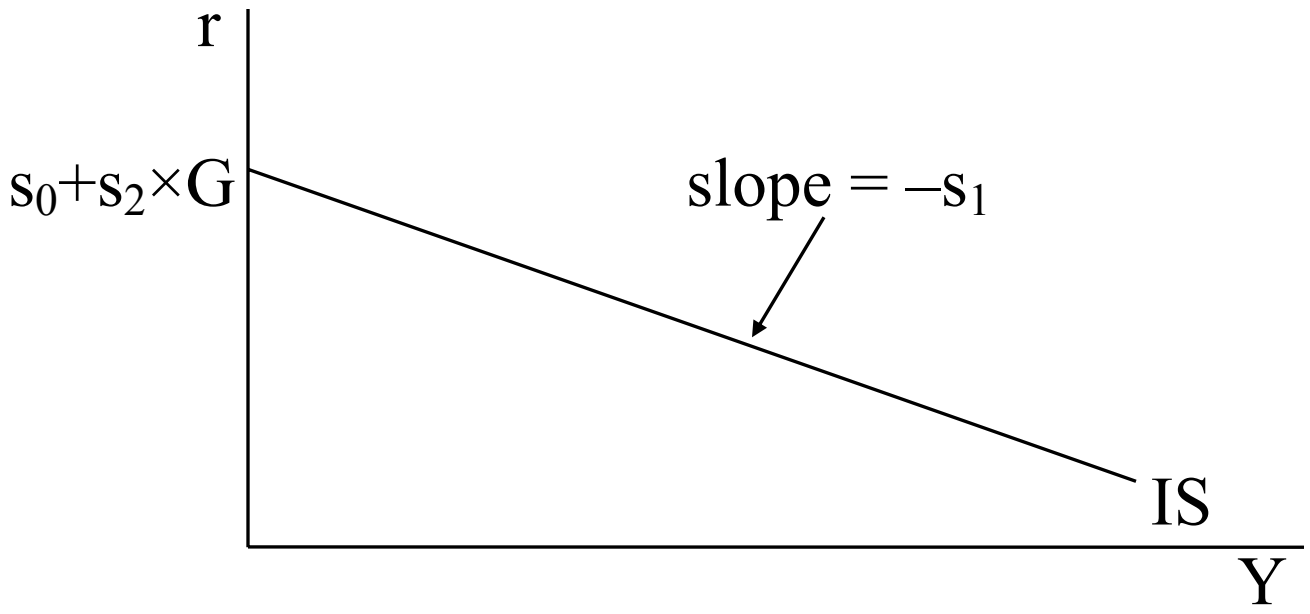
B. Since the components of Y actually depend on r and not R, the IS curve can be written in the following form

$$r = s_0 - s_1 \times Y + s_2 \times G, \tag{5}$$

   where s_0, s_1, and s_2 are constant coefficients.

   1. s_1 is the slope of the IS curve.

2. Graph of the IS curve: $r = s_0 - s_1 \times Y + s_2 \times G$.



C. If r* is defined as the real interest rate when Y = Y*, r* is calculated from (5) such that

$$r^* = s_0 - s_1 \times Y^* + s_2 \times G. \qquad (6)$$

D. If we subtract (6) from (5), we can express the IS curve in terms of Y – Y*

$$r - r^* = - s_1 \times (Y - Y^*). \qquad (7)$$

E. If the right side of (7) is multiplied and divided by Y*, the IS curve can be expressed in terms of (Y – Y*)/Y*

$$r - r^* = -\sigma \times [(Y - Y^*)]/Y^*, \qquad (8)$$

where $\sigma = s_1 \times Y^*$.

Combining Price Adjustment with Aggregate Demand

A. Deriving the Macroeconomic Policy (MP) curve

1. Recall, the Taylor rule

$$R = \pi + \beta_\pi \times (\pi - \pi^*) + \beta_Y \times [(Y - Y^*)/Y^*] + r^{e}*, \qquad (9)$$

where π^* is the Fed's target inflation rate and $r^{e}*$ is the Fed's belief of the value of the real interest rate when $Y = Y^*$.

2. If we substitute (4) into (9), the monetary policy rule becomes

$$r + \pi = \pi + \beta_\pi \times (\pi - \pi^*) + \beta_Y \times [(Y - Y^*)/Y^*] + r^{e}*,$$

and when it is simplified it becomes

$$r = \beta_\pi \times (\pi - \pi^*) + \beta_Y \times [(Y - Y^*)/Y^*] + r^{e}*. \qquad (10)$$

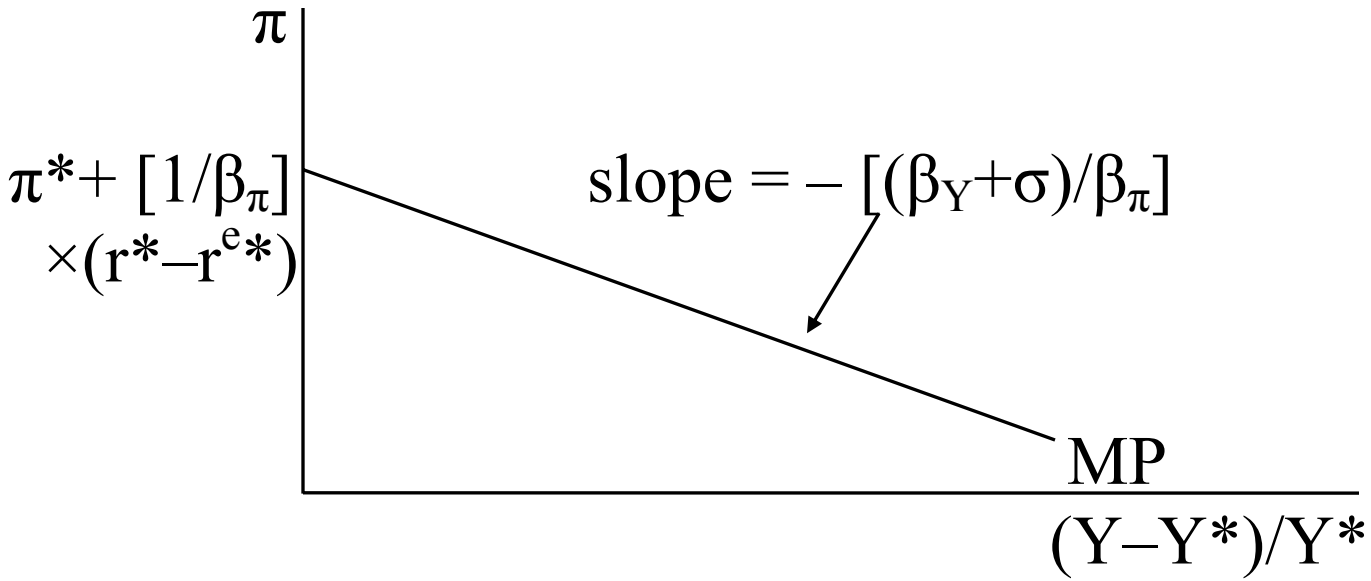
3. The equation for the MP curve is derived by substituting the value of r in (8) into (10)

$$r^* = \beta_\pi \times (\pi - \pi^*) + (\beta_Y + \sigma) \times [(Y - Y^*)/Y^*] + r^{e}*. \qquad (11)$$

4. By rearranging the terms in (11), the MP equation becomes

$$\pi = \pi^* - [(\beta_Y+\sigma)/\beta_\pi]\times[(Y-Y^*)/Y^*]+ [1/\beta_\pi]\times(r^*-r^{e*}). \qquad (12)$$

5. Graph of the MP curve in (12)



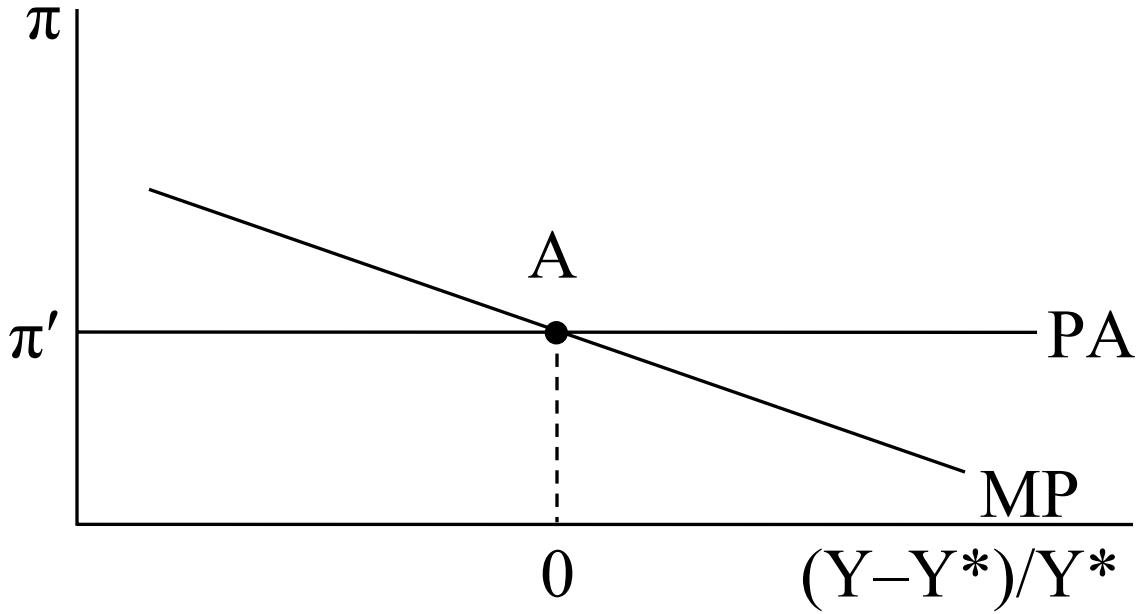
6. Factors that shift the MP curve

   a. An increase in π^* shifts the MP curve rightward.

   b. An increase r^* without an equal increase in r^{e*} causes the MP curve to shift rightward. (Ex., A permanent increase in G causes r^* to rise.)

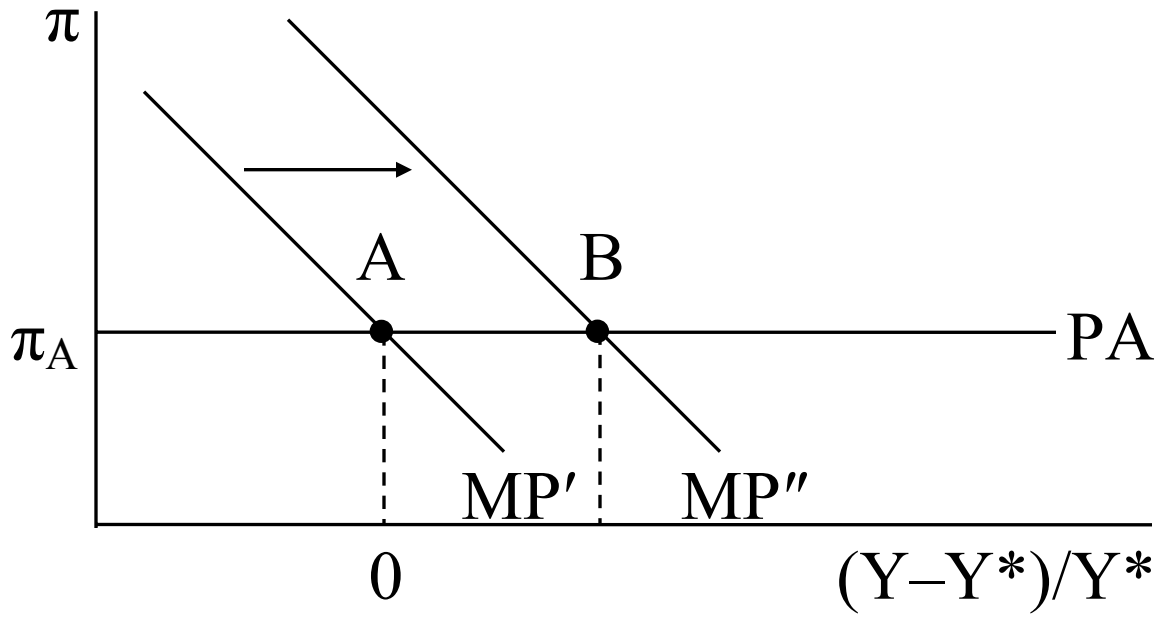
B. Combining the PA and MP curves

1. The equilibrium π and (Y–Y*)/Y* are determined by the intersection of the PA and MP curves.

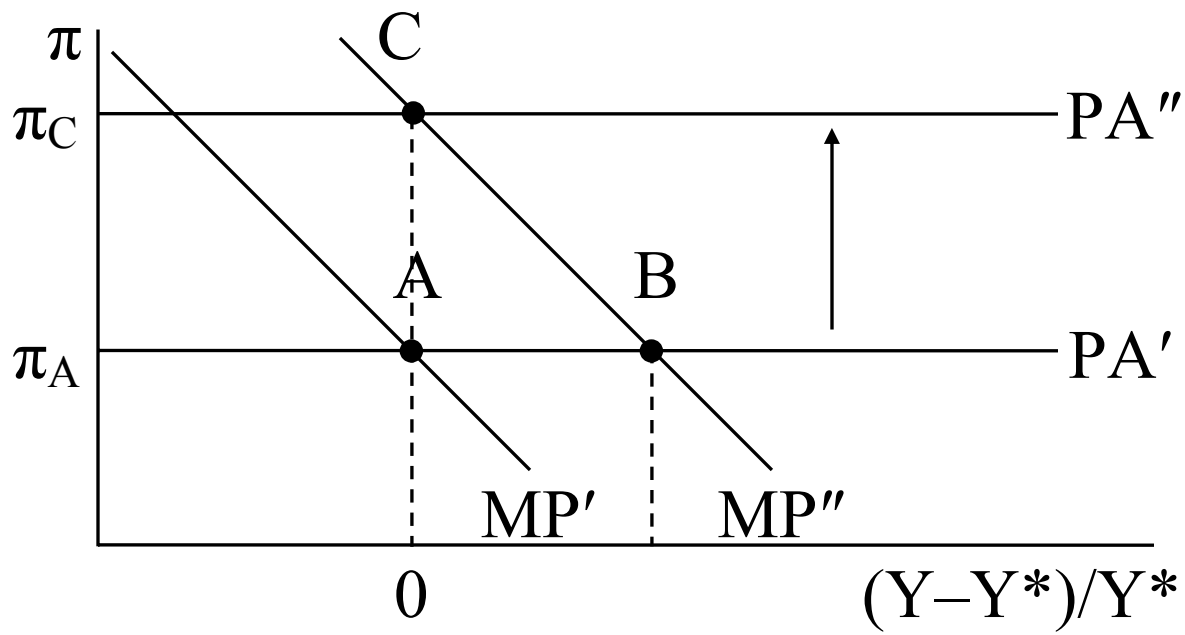


2. Suppose G increases permanently. This change causes r* to rise. If the Fed does not change r^{e}*, then this increase in r* causes the MP curve to shift rightward.

   a. In the short run, the MP curve shifts from MP′ to MP″, which causes Y to increase but π remains unchanged at π_A.

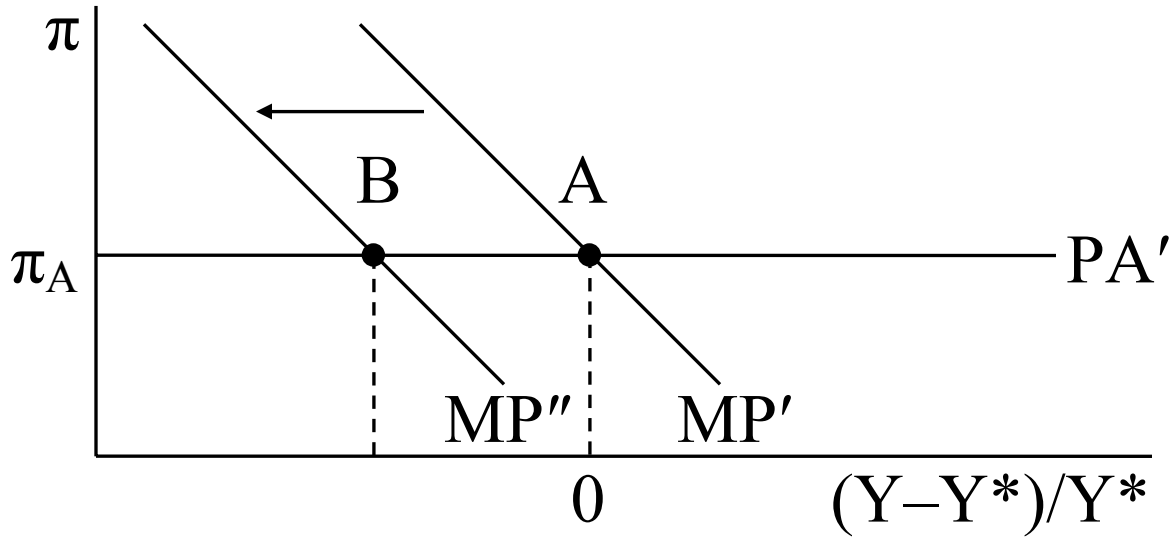


b. In the long run, the PA curve shifts from PA′ to PA″, which causes π to increase to π_C and Y to return to Y*.

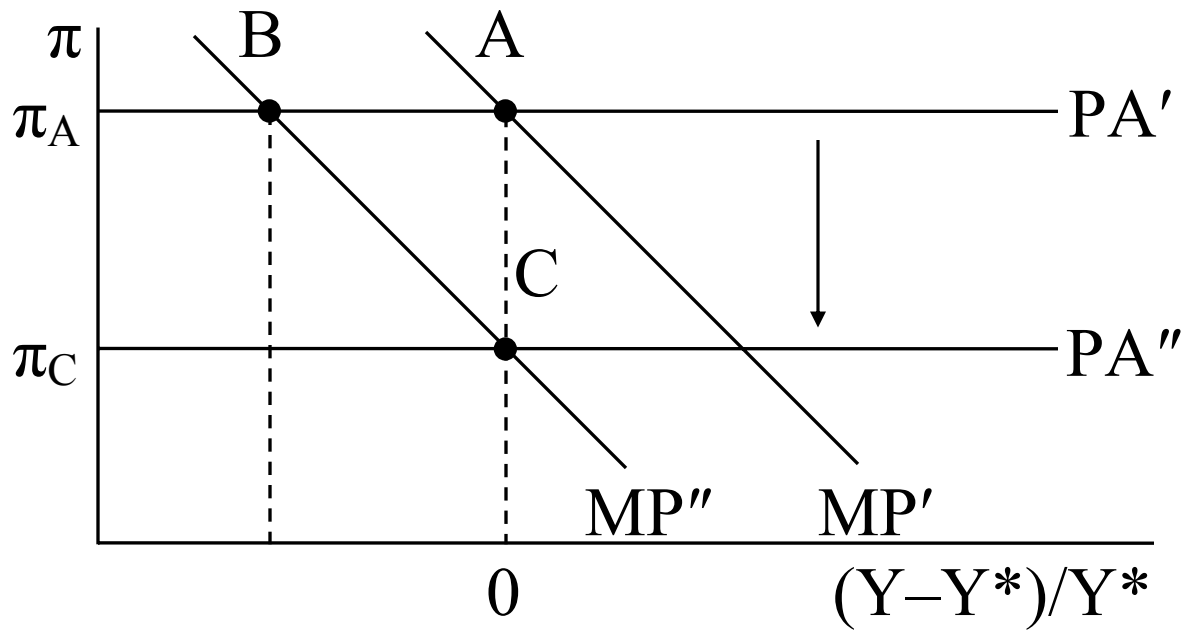


3. Suppose π^* declines permanently.

   a. In the short run, the MP curve shifts from MP′ to MP″, which causes Y to fall but π remains unchanged at π_A.

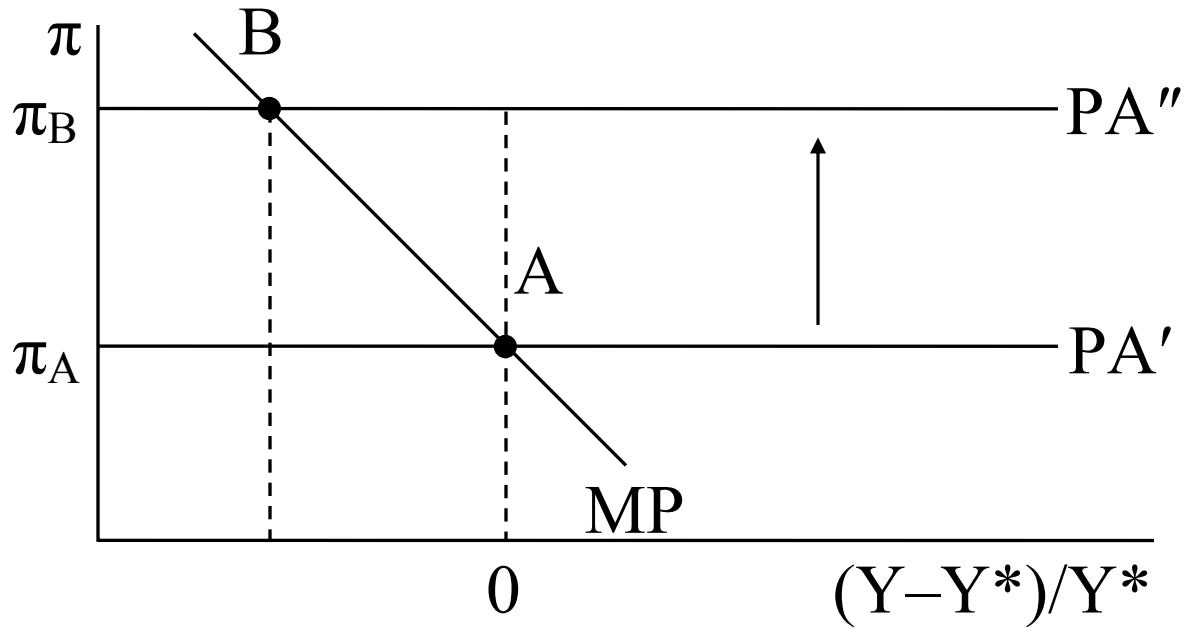


b. In the long run, the PA curve shifts from PA′ to PA″, which causes π to decline to π″ and Y to return to Y*.



4. Suppose π^e rises.

   a. In the short run, the PA curve shifts from PA′ to PA″, which causes Y to rise and π to fall to π_B.



b. In the long run, the PA curve shifts back to PA′ from PA″, which causes π and Y to return to π_A and Y*, respectively.