The Microeconomic Foundations of Price Rigidity

Economists argue that a money supply change affects output in the short run because the price level does not adjust as fast as the money supply in the short run.

Some explanations given by economists for the reason why the price level does not adjust as fast as the money supply in the short run include

A. Imperfect Information

B. Sticky Prices

C. Sticky Wages

The Imperfect Information Theory

A. Key features of this model.

1. Prices are completely flexible.

2. Firms, however, have imperfect information on whether a shift in its demand curve is due to

   a. a change in M^S or

   b. a shift that is product specific (ex. increased consumer demand for that firm's product)

3. The response of the firm to its demand curve shift and the subsequent change in the firm's price, P_i, depends on the source of the shift.

   a. If a M^S change is the source, a firm does not adjust its output, Y_i, because the change in P_i is economy wide. (i.e., the price level, P, changes)

b. If the shift is product specific, the firm adjusts Y_i because the change in P_i is product specific. (i.e., P does not change)

4. Thus, a firm will increase Y_i if its relative price, $(P_i - P)$, rises. (This is the theory of supply.)

5. Specifically, this model assumes firms have a difficult time observing P so they must form expectations of P in order to interpret the source of a change in P_i.

6. The effect of this informational problem is that P will slowly adjust after a change in M^S if firms believe the source of the shift in its demand curve maybe product specific.

B. Derivation of the supply curve in a model with imperfect information

1. It is assumed there are n identical firms.

2. Firm i's (where $i \in [1,n]$) supply curve is given by

$$Y_i = h \times (P_i - P) + Y_i^* \tag{1}$$

where

Y_i is firm i's output.
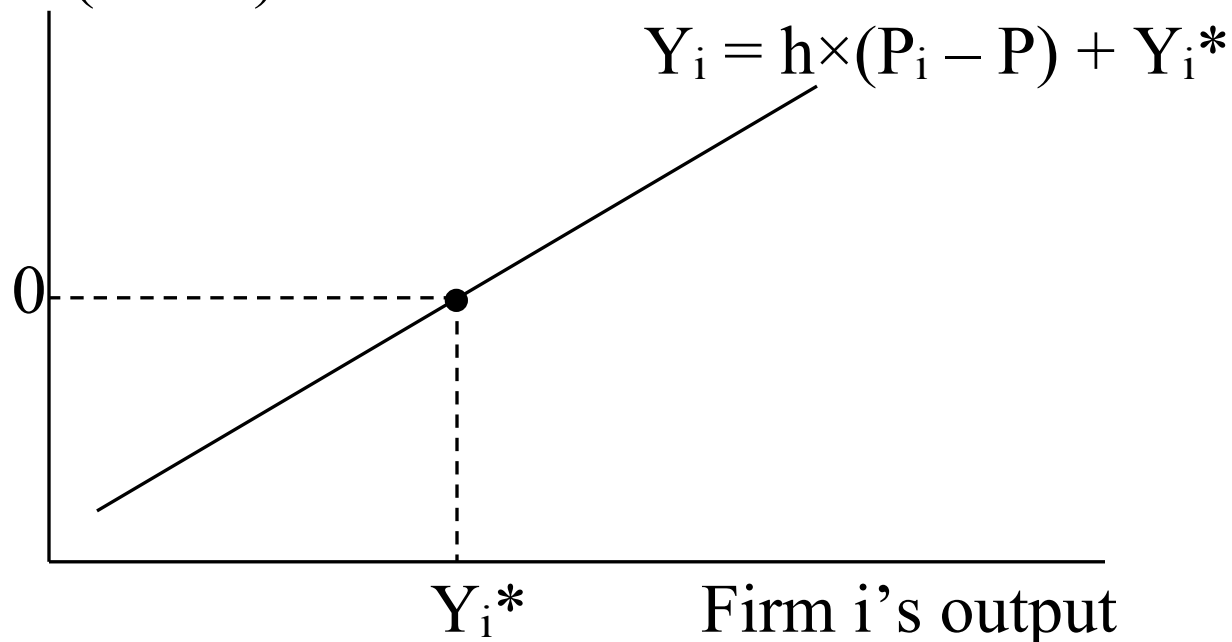
Y_i^* is firm i's potential output.

P_i is firm i's price.

P is the aggregate price level.

h is a constant coefficient such that $h > 0$.

3. Graph of firm i's supply curve

Firm i's relative
 price $(P_i - P)$

$$Y_i = h \times (P_i - P) + Y_i{}^*$$

0

$Y_i{}^*$ Firm i's output

4. Suppose firm i does not have perfect information on P but instead has to make a guess. Their expected value of P is P^e. Thus, firm i's supply curve now is given by

$$Y_i = h \times (P_i - P^e) + Y_i{}^* \qquad (2)$$

5. Let's assume firm i's expectation of P evolves in the following manner

$$P^e = P^f + b \times (P_i - P^f) \qquad (3)$$

where P^f is firm i's forecast of P at the start of the year (before P_i changes), while *b* is a constant coefficient such that $0 \leq b \leq 1$

6. The value of *b* in (3) indicates firm i's belief of the source of a change in P_i.

   a. If b = 1, firm i is certain that an increase in P_i is due to an increase in P.

   b. If b = 0, firm i is certain that an increase in P_i is due to a product specific shock.

7. By substituting (3) into (2), we get firm i's supply curve

$$Y_i = h \times [(P_i - P^f) - b \times (P_i - P^f)] + Y_i*$$

which when simplified becomes

$$Y_i = h \times (1 - b) \times (P_i - P^f) + Y_i* \qquad (4)$$

8. If we add up the supply curves for all n firms in the economy, the aggregate supply curve (AS) is

$$Y = n \times h \times (1 - b) \times (P - P^f) + Y* \qquad (5)$$

where Y is actual aggregate output and Y* is potential aggregate output.

9. In the case where all firms have perfect information on P (b = 1), the AS is vertical. Thus, a change in M^S causes P to completely adjust and has no effect on Y.

10. When firms have imperfect information on P, the AS is upward slopping as shown in the graph below.
$(Y = n{\times}h{\times}(1{-}b){\times}(P{-}P^f)+Y^*)$

P

AS

Y
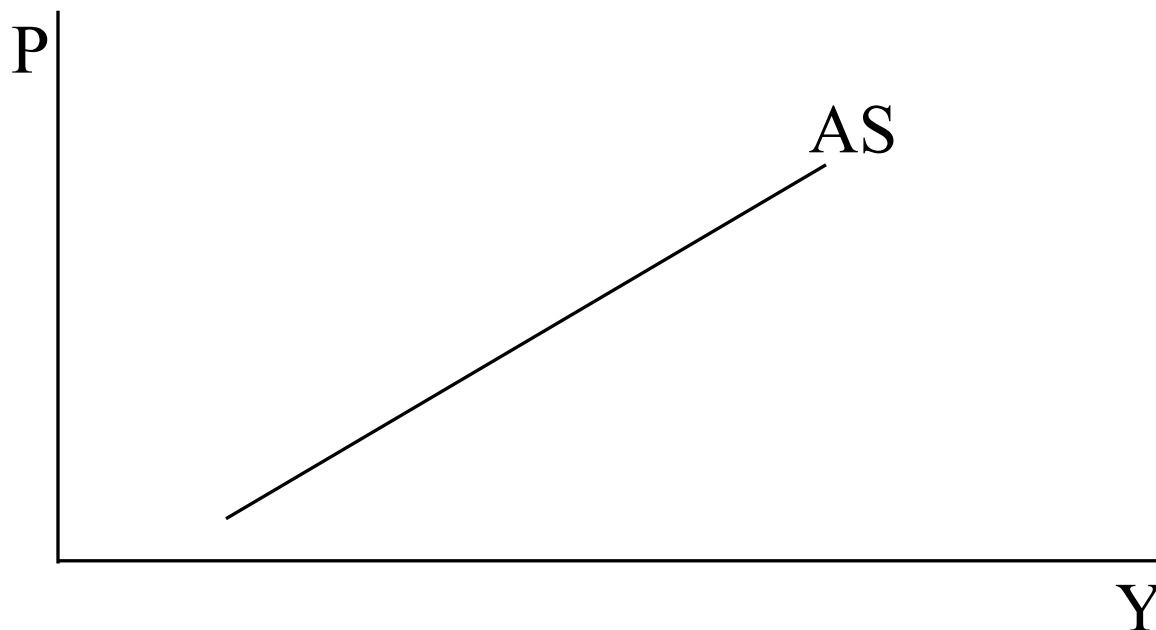
C. The appearance of price rigidity

1. Suppose the aggregate demand curve (AD) is given by

$$Y = k_0 + k_1{\times}(M^S - P)$$

where k_0 and k_1 are constant coefficients.

2. Suppose M^S increases from $M^{S\prime}$ to $M^{S\prime\prime}$. This increase is shown in an AD/AS graph by shifting the AD up by the change in M^S ($M^{S\prime\prime} - M^{S\prime} = P_C - P_A$). The presence of imperfect information, however, means that P rises only to P_B. This value is smaller than the new long-run level of P, which is P_C.
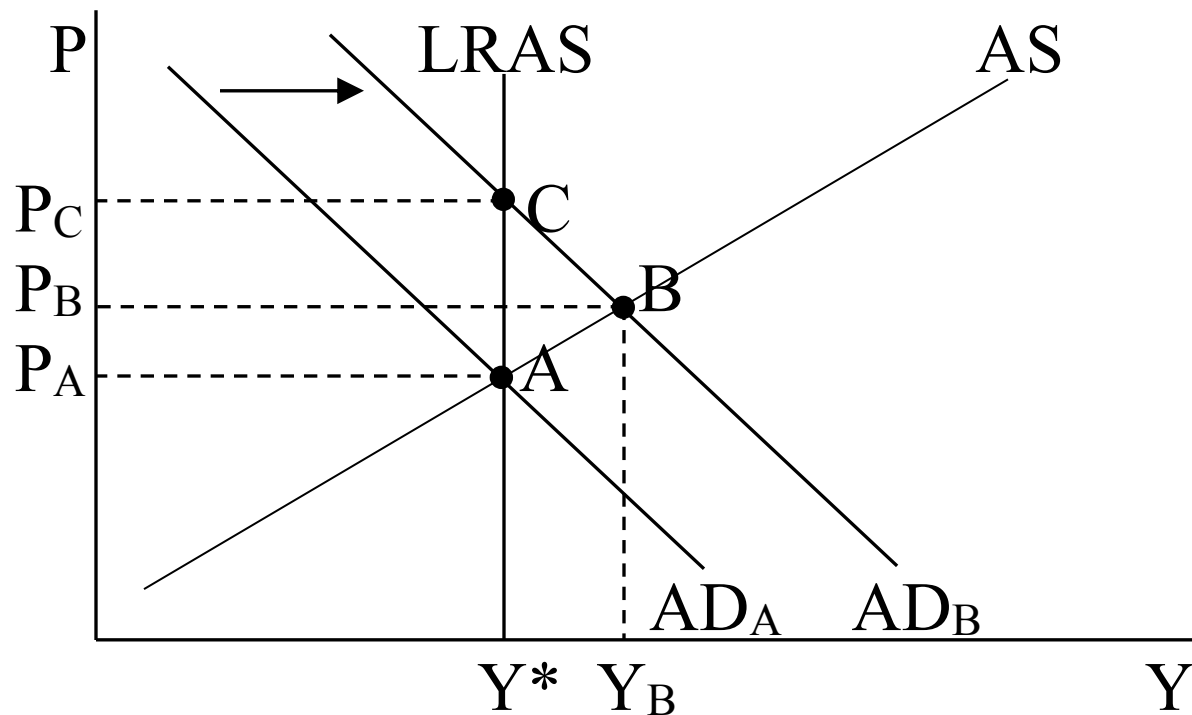

3. In the case where all firms have perfect information ($b = 1$), the AS curve is vertical. Thus, an increase in M^S causes P to rise from P_A to P_C while Y remains at Y*.

D. Anticipated vs. unanticipated money supply increases

1. An anticipated increase in the money supply

a. A M^S increase shifts the AD curve from AD_A to AD_B.

b. Since people have perfect information about the rise in M^S, the AS curve is vertical ($b = 1$).

c. Graph

P | AS

P_B ----------------- B

P_A ----------------- A

→

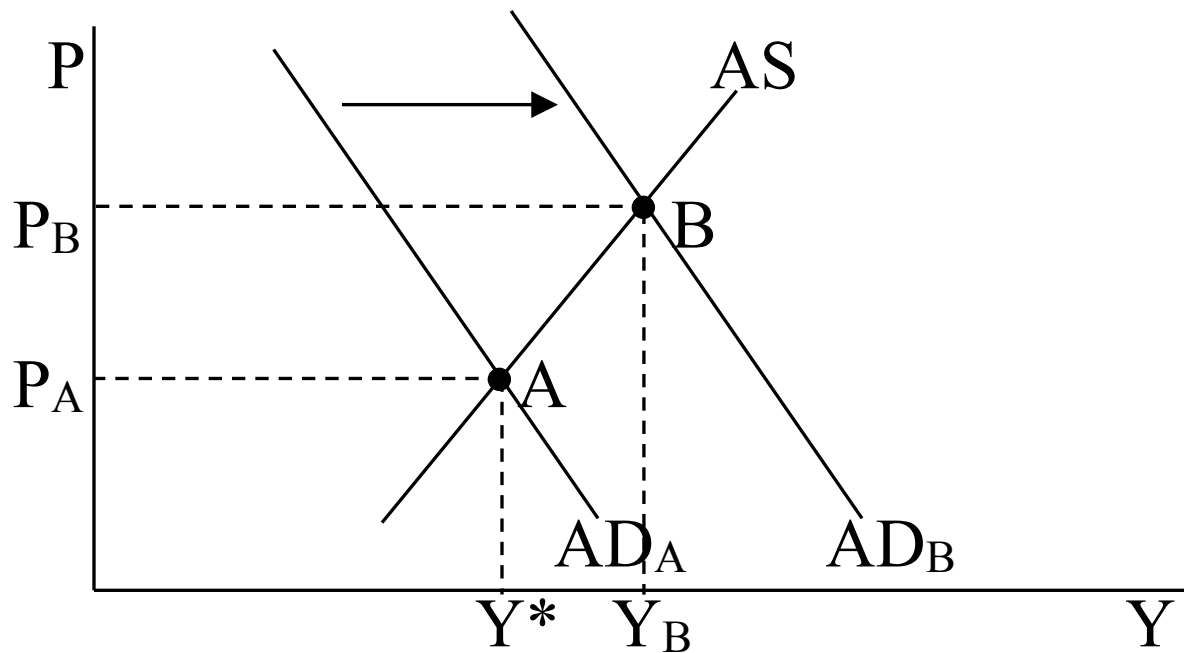AD_A AD_B

Y*   Aggregate output
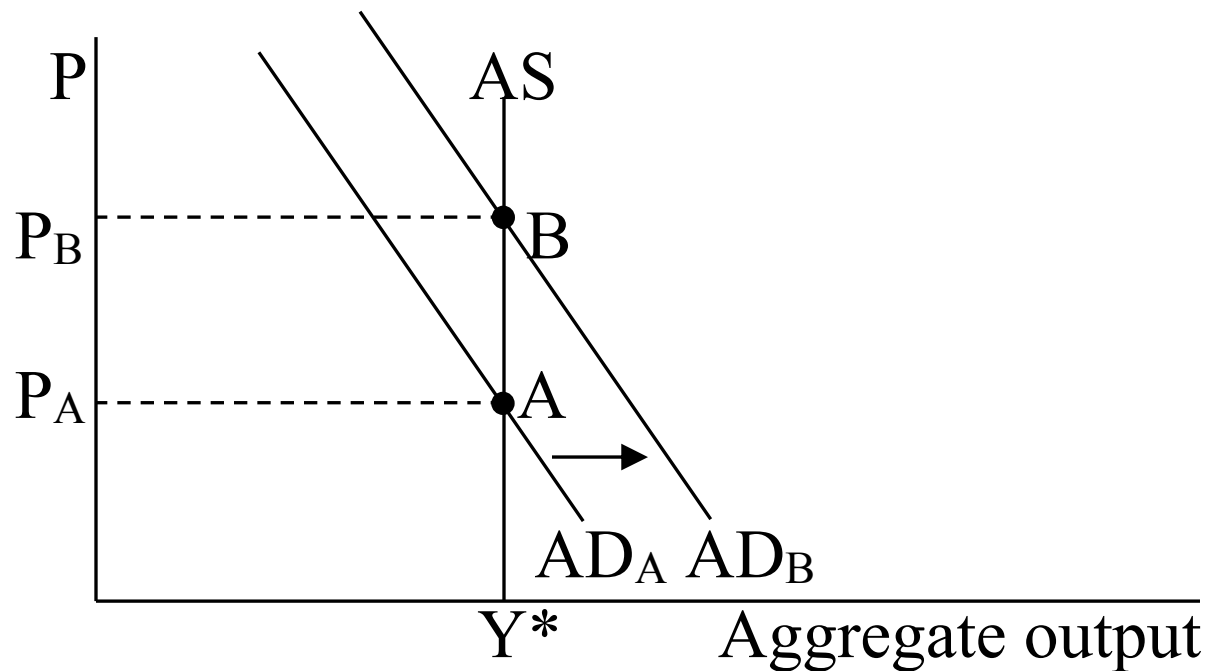
d. Thus, P is higher but Y is unchanged in the short run.

2. An unanticipated increase in the money supply

   a. A M^S increase shifts the AD curve from AD_A to AD_B.

   b. Since people have imperfect information about the rise in M^S, the AS curve is upward slopping as indicated by equation (5).

   c. Graph

   d. Thus, both P and Y are higher in the short run.

Sticky Prices and Nominal Wage Contracts

A. Sticky prices

   1. Prices in the U.S. are set in U.S. dollars.

   2. Studies have shown that prices tend to be "stuck" at a particular U.S. dollar value for a long time.

   3. In some economies, prices are set in terms other than its domestic currency (ex. Chile sets prices in terms of the UF and not it currency: the peso). In these economies, price stickiness, as observed in the U.S., is not present.

   4. One source of price stickiness in the U.S. is that firms incur a cost to print new catalogs, price sheets, and menus every time they adjust their prices. These costs are called <u>menu costs</u>.

   5. Not every price is sticky. In some markets, prices change every few seconds. (ex., agriculture and industrial commodities)

B. Sticky wages

   1. Wages tend to be sticky because

      a. the wage bargain is made in monetary terms.

      b. it is complicated and costly to index wages based on some measure of the average wage rate.

   2. If wages are sticky, then prices are sticky.

      a. A profit-maximizing firm sets its price in relation to its marginal cost.

      b. Since wages are a key component of marginal cost, wage stickiness is transferred to prices through the marginal cost. As a result, prices become sticky.

C. Wage determination in the U.S.

    1. The length of a wage contract depends, in part, on whether there is a union or not.

        a. Union contracts tend to last for several years. (Three-year contracts are especially popular.)

        b. Non-union workers tend to receive salary and wage adjustments once a year. While there usually is not a formal contract, the wage rate is rarely changed before the next adjustment period.

    2. Wage contracts, whether formal or informal, tend to be staggered, which means that at any one time only a small number of workers are signing contracts.

3. Several factors influence the outcome of wage negotiations.

   a. One factor is the state of the labor market. That is, low unemployment favors the employee, while high unemployment favors the employer.

   b. Another factor is the wage rate paid to comparable workers at other companies and in other industries. This includes both recently signed wage contracts and expected wage contracts to be signed in the near future.

   c. A final factor is the expected inflation rate.

D. Why are wage contracts set for long periods without indexing them to P?

1. The time and resources for employees and employers to acquire information on labor market conditions is substantial.

2. In unionized industries, there is always possibility of a costly strike. In addition, it is expensive to prepare for that strike regardless of whether or not it occurs.

3. Since firms choose labor where $W/P=MP_L$, indexing the wage (W) to P would prevent W/P from falling. In the event there is a negative technology shock that shifts down the MP_L, the inability to adjust W/P forces the employer to push up the MP_L by decreasing their labor input.

4. Indexing contracts to P adds complexity to the contract, which could make it harder to sell to some union members.

5. Some workers object to indexing because it adds uncertainty to future wages, even though economists argue that the workers are better off with it.

A Model with Staggered Wage-Setting

A. Initial assumptions

   1. All wage contracts last 2 years.

   2. ½ of all contracts are signed at the start of even-numbered years and the other ½ are signed at the start of odd-numbered years.

   3. There is no indexing in the contract.

B. Notation

   1. The subscript –1 denotes the previous year while the subscript +1 denotes the next year.

2. X denotes the contract wage negotiated this year. (X_{-1} is the contact wage negotiated last year)

3. W denotes the average wage rate this year in the economy. In this model, W is given by

$$W = \tfrac{1}{2} \times (X + X_{-1}) \tag{6}$$

C. Determining the value of X

a. The negotiated value of X is influenced by

1. W and W_{+1}.

2. The effect of current and future expected unemployment. (U and U_{+1}, respectively)

b. An algebraic relationship for X is given by

$$X = \tfrac{1}{2} \times (W + W_{+1}) - (d/2) \times [(U - U^*) + (U_{+1} - U^*)] \tag{7}$$

where d is a constant coefficient and U^* is the natural rate of unemployment.

c. Let's rewrite (7) by substituting (6) for W and W_{+1}

$$X = \tfrac{1}{2}\times[\tfrac{1}{2}\times(X_{+1}+X)+\tfrac{1}{2}\times(X+X_{-1})] - (d/2)\times[(U-U^*)+(U_{+1}-U^*)]$$

d. Now, let's solve for X

$$X = \tfrac{1}{2}\times(X_{-1}+X_{+1})-d\times[(U-U^*)+(U_{+1}-U^*)] \qquad (8)$$

e. Equation (8) shows that X has a backward-looking component, X_{-1}, and a forward-looking component, X_{+1}.

1. X_{-1} reflects the influence of last year's contract and is what makes inflation persist from year to year.

2. X_{+1} reflects the influence of next year's contract and is what makes expectations about future monetary policy important.