

Suggested solution for Q.3 of Problem set 1

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Exercise 3 : Technology shocks in the AS-AD model

1.

We consider the two equations : WS and PS. From the assumption that $P^e = P$, we get

$$\begin{aligned} WS : \quad & \frac{W}{P} = A^e f(u) \\ PS : \quad & \frac{W}{P} = \frac{A}{1 + \mu} \end{aligned}$$

for graphical representation, see figure 1.

Thus unemployment rate can be obtained by combining the above two equations:

$$\frac{1}{1 + \mu} \frac{A}{A^e} = f(u)$$

Assume that the economy was in the equilibrium before the positive productivity shock hits and $A = A^e$. Hence we can define u_0 which satisfies $f(u_0) = (1 + \mu)^{-1}$.

Now suppose that the shock is realized once wage setters form their expectations on the size of the shock. We can have three scenarios:

(1) $A = A^e$

In this case, the expectations of wage setters are exactly right. Notice that both of A and A^e all are multiplied to $(1 + \mu)^{-1}$ and $f(u)$: If they are equal, the unemployment rate should be maintained to the previous level, u_0 . Real wage, however, increases since the productivity increases.

(2) $A > A^e$

Now the realization is greater than the expectation. Then we get

$$f(u) = \frac{1}{1 + \mu} \underbrace{\frac{A}{A^e}}_{>1} > \frac{1}{1 + \mu} = f(u_0)$$

since $f_u < 0$, $u < u_0$

Unemployment rate decreases(See figure 1 for graphical representation: WS shifts to WS' and PS shifts to PS') : Firms can hire more workers since the economy experiences more favorable productivity than expected(the required wage by wage setters is less than the suggested wage by firms(price setters)).

(3) $A < A^e$

Explanation is omitted, since exactly the opposite is true for this case: unemployment rate increases.

2.

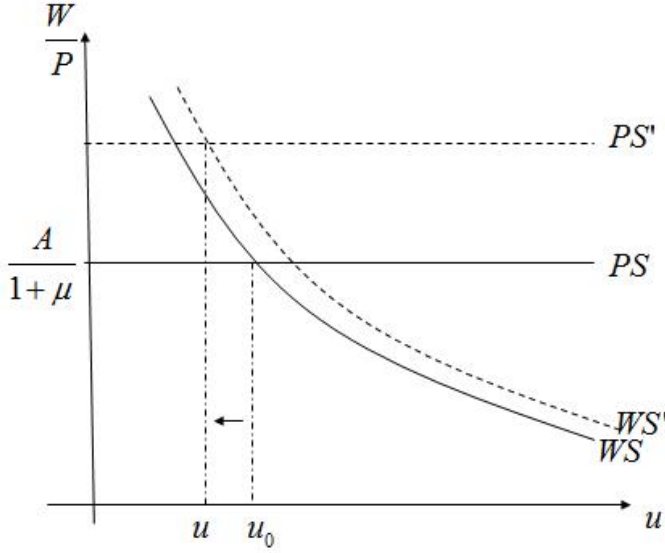


Figure 1: Graphical Representation of WS-PS

We have already obtained AS:

$$\frac{1}{1+\mu} \frac{A}{A^e} = f(u)$$

using $u = 1 - N$, we get

$$\frac{1}{1+\mu} \frac{A}{A^e} = f(1 - N) \quad (1)$$

Then what is the equilibrium condition of RBC model that resembles AS relationship? Recall the labor supply equation (intratemporal condition) is given by

$$-\frac{u_N}{u_c} = MPN \quad (2)$$

where u_x is the marginal utility with respect to variable x , N is the hours worked, c is consumption, and MPN is marginal productivity of labor.

In order to compare (1) and (2), suppose unexpected productivity shock hits the economy so that $A > A^e$. From the analysis in 1, this increases the numbers of workers employed. Similarly, sudden increase in the productivity makes MPN to increase, which raises the incentive to work for the workers in the RBC economy so that N increases.

3.

Using the production function, $P = P^e$, and $A = A^e$, we can rewrite AS and AD as follows.

$$\begin{aligned} AS &: \frac{1}{1+\mu} = f\left(1 - \frac{Y}{A}\right) \\ AD &: Y = y\left(\frac{M}{P}\right) \end{aligned}$$

Notice that AS does not contain the price level variable in it since we assume price flexibility so that P and P^e are canceled out. Thus, it should be a vertical line since P cannot affect AS. Meanwhile, AD curve is decreasing in P . Thus plot of AS – AD curves would be as in figure 2.

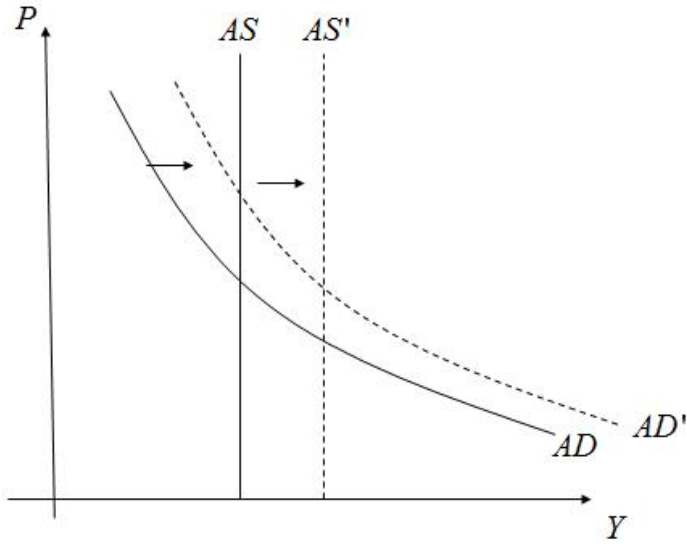


Figure 2: $AS - AD$

Suppose that A increases while it remains as $A = A^e$. One can observe that AD does not change while AS should change. One can easily find out that for fixed μ , Y should increase in order for RHS of AS not to be changed. Thus, for given P , AS should shift to the right (AS'). As a result, price level decreases while output increases.

4.

We know from 3 that price decreases as A increases. In order to keep price constant, the central bank should implement a policy that can raise price: It should increase money supply, M . Then AD curve will shift to the right (AD') so that it can achieve price stability while the economy can still enjoy the expansion.