

1 Multiple choice (30 points)

1. (6 points) The increase in use of ATMs decreases the currency/deposit ratio (cu). According to the Keynesian theory of sticky prices:
- (a) output increases and the interest rate goes down,
 - (b) output increases and the interest rate goes up,
 - (c) output decreases and the interest rate goes up.

ANSWER: A

2. (6 points) In the standard IS-LM model, an increase in Government spending (G) without changing taxes has
- (a) a positive effect on equilibrium consumption,
 - (b) a negative effect on equilibrium consumption,
 - (c) an ambiguous effect on equilibrium consumption.

ANSWER: C. The increase in G shifts the IS-LM upwards and to the right, which makes both output and the interest rate higher in equilibrium. However, the final effect on consumption is ambiguous since consumption depends positively on output and negatively on the interest rate.

3. (6 points) According to the misperception theory, an expected increase in money supply
- (a) increases output and increases interest rate,
 - (b) increases output and decreases interest rate,
 - (c) has an effect on neither output nor interest rates.

ANSWER: C.

4. (6 points) Consider a fractional reserve banking system with a legally required reserve-deposit ratio of m . Suppose that an individual deposits ID dollars in one bank. Then, the economy-wide change in total deposits
- (a) will be at most ID / m ,
 - (b) will be equal to ID / m ,
 - (c) will be equal to $m \cdot ID$.

ANSWER. A. The total change in deposits is equal to ID/m if nobody wants to hold currency and banks lend to their limit. If these two assumptions are relaxed, the increase in deposits is lower. So, in general, the increase in total deposits is at most ID/m .

5. (6 points) According to the Taylor rule, a positive output gap (i.e. real GDP above potential real GDP) will most likely result in
- (a) the Fed adjusting its estimate of potential real GDP,
 - (b) the Fed decreasing the nominal federal funds rate,
 - (c) the Fed increasing the nominal federal funds rate.

ANSWER. C. The Fed will increase the nominal FFR to bring back output to its potential level.

2 IS-LM with Liquidity Trap (35 points)

Consider the following IS-LM model with prices fixed at $P = 1$ (we are in the short run):

$$\begin{aligned} \frac{M^d}{P} &= Y - r \\ C &= 1 + 0.5Y \\ I &= 1 - 0.5r \\ G &= \bar{G} \\ Y &= C + I + G \\ \frac{M^s}{P} &= \frac{\bar{M}}{P} \\ \frac{M^d}{P} &\leq \frac{M^s}{P}, \text{ with } \frac{M^d}{P} = \frac{M^s}{P} \text{ if } r > 0 \\ r &= i - \pi^e \\ \pi^e &= 0 \end{aligned}$$

1. (7 points) Explain the minimum value that the real interest rate, r , can take.

We know the nominal interest rate has to be positive. This implies that the real interest rate must satisfy the non negativity constraint $r \geq 0$.

2. (7 points) Derive the IS curve.

Using the goods market equilibrium condition we have that the IS curve is

$$r = 4 - Y + 2\bar{G}$$

3. (7 points) Write down the LM curve.

Using the Money market equilibrium condition we have

$$r = \begin{cases} 0 & \text{if } Y \leq \bar{M} \\ Y - \bar{M} & \text{otherwise} \end{cases}$$

4. (7 points) What are the equilibrium interest rate and output level in the economy? What is the condition for the equilibrium interest rate to be positive?

The interest rate will be positive if

$$\bar{M} < 4 + 2\bar{G}$$

The equilibrium interest rate in this case will be

$$\begin{aligned} r^* &= 2 + \bar{G} - \frac{\bar{M}}{2} \\ Y^* &= 2 + \frac{\bar{M}}{2} + \bar{G} \end{aligned}$$

Otherwise we'll have

$$r^* = 0 \text{ and } Y^* = 4 + 2\bar{G}$$

5. (7 points) Suppose that the economy described above is going through a recession and the government is trying to stimulate the economy. When will monetary policy be effective in stimulating the economy? Explain why under certain conditions monetary policy fails to be effective as a policy instrument.

Monetary policy will be effective as long as the money supply is low and maintains the interest rate positive. In particular the condition is $\bar{M} < 4 + 2\bar{G}$. If money supply is higher than this value, then monetary policy becomes an ineffective channel for economic stimulus. The reason for this is that monetary policy is effective only when it is able to lower the interest rate in order to increase investment, however this channel is killed once the interest rate constraint binds.

3 AS-AD (35 points)

[Supply side] Consider a labor market characterized by the following production and labor supply functions:

$$\begin{aligned} F(N) &= 20N - N^2 \\ N^s &= \frac{1}{2} \frac{w}{p} \end{aligned}$$

1. (3 points) Using the fact that the marginal product of labor $MPN = 20 - 2N$, obtain and graph the labor demand function.

ANSWER:

$$\begin{aligned}\frac{w}{p} &= 20 - 2N \\ N^d &= 10 - \frac{1}{2} \frac{w}{p}\end{aligned}$$

2. (3 points) Graph the labor supply function and solve for equilibrium (find $\left(\frac{w}{p}\right)^*$ and N^*) in the labor market.

ANSWER:

$$\begin{aligned}10 - \frac{1}{2} \frac{w}{p} &= \frac{1}{2} \frac{w}{p} \\ \left(\frac{w}{p}\right)^* &= 10 \\ N^* &= 5\end{aligned}$$

3. (5 points) Take prices p as given. Consider the case in which the government introduces a minimum nominal wage $\bar{w} = 50$. Explain in words the qualitative effects of this policy on equilibrium wages and employment as a function of p . (Hint: consider three cases $p \geq 5$, $\frac{5}{2} < p < 5$ and $p \leq \frac{5}{2}$).

ANSWER:

The policy will not affect the labor market equilibrium as long as $\left(\frac{w}{p}\right)^* = 10 \geq \frac{\bar{w}}{p} = \frac{50}{p}$. That is, as long as $p \geq 5$.

When $\frac{5}{2} < p < 5$ the implied minimum real wage will bind. There is excess supply and the number of workers is determined on the demand side.

If $p \leq \frac{5}{2}$ no workers get hired since the marginal cost is higher than the MPN .

4. (5 points) Solve for the real wage and number of workers, taking prices as given. Make sure you consider the three cases $p \geq 5$, $\frac{5}{2} < p < 5$ and $p \leq \frac{5}{2}$.

ANSWER:

If $p \geq 5$

$$\begin{aligned}\left(\frac{w}{p}\right)^* &= 10 \\ N^* &= 5\end{aligned}$$

If $\frac{5}{2} < p < 5$ the real wage will be at the minimum $\frac{50}{p}$ and the number of workers is given by $N = 10 - \frac{1}{2} \frac{\bar{w}}{p} = 10 - \frac{25}{p}$

If $p \leq \frac{5}{2}$, no workers get hired.

5. (4 points) Solve for the aggregate supply function and graph it.

ANSWER:

$$y^s = \begin{cases} 0 & \text{if } p \leq \frac{5}{2} \\ 100 - \frac{625}{p^2} & \text{if } \frac{5}{2} < p < 5 \\ 75 & \text{if } p \geq 5 \end{cases}$$

[Demand side] Consider the demand side characterized by the following consumption, investment and real money balances demand functions. Also, government expenditures are $g = 50$.

$$\begin{aligned} c &= 25 + \frac{y}{2} \\ i &= 25 - \frac{r}{2} \\ \frac{M^d}{p} &= 100 - \frac{r}{2} + \frac{y}{2} \end{aligned}$$

6. (4 points) Obtain the IS and LM relations as a function of money supply M^s .

ANSWER:

$$\begin{aligned} y &= c + i + g \\ &= 25 + \frac{y}{2} + 25 - \frac{r}{2} + 50 \\ &= 100 + \frac{y}{2} - \frac{r}{2} \end{aligned}$$

$$\text{IS: } r = 200 - y$$

$$\begin{aligned} \frac{M^s}{p} &= 100 - \frac{r}{2} + \frac{y}{2} \\ \text{LM: } r &= 200 - 2\frac{M^s}{p} + y \end{aligned}$$

7. (3 points) Obtain the aggregate demand function.

ANSWER:

$$\begin{aligned} 200 - y &= 200 - 2\frac{M^s}{p} + y \\ \frac{M^s}{p} &= y \text{ or } p = \frac{M^s}{y} \end{aligned}$$

[Equilibrium]

8. (4 points) For $M^s = 150$, solve for equilibrium output and prices. What is the effect on output of an expansionary monetary policy?

ANSWER:

If the equilibrium is in the intermediate region, then

$$100 - \frac{625}{\left(\frac{M^s}{y}\right)^2} = y$$

$$100 - \frac{625}{M^{s2}}y^2 = y$$

$$0 = \frac{625}{M^{s2}}y^2 + y - 100$$

The solution is:

$$y^* = 44.64$$

$$p^* = 3.36$$

Expansionary monetary policy increases output.

9. (4 points) For $M^s = 450$, solve for equilibrium output and prices. What is the effect on output of an expansionary monetary policy?

ANSWER:

If the equilibrium is in the intermediate region, then it must solve

$$0 = \frac{625}{M^{s2}}y^2 + y - 100$$

but the solution is greater than 75, therefore the solution is not in the intermediate region.

It must be then $y^* = 75$ and $p^* = M^s/y^* = 450/75 = 6$.

Expansionary monetary policy has no effect on output and increases prices.