Department of economics
Queen's University

ECON320: Macroeconomic Theory II
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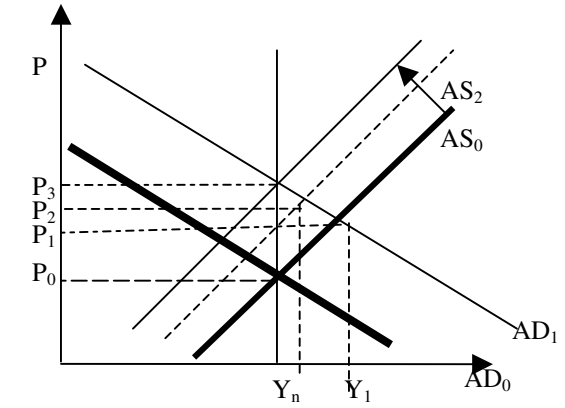
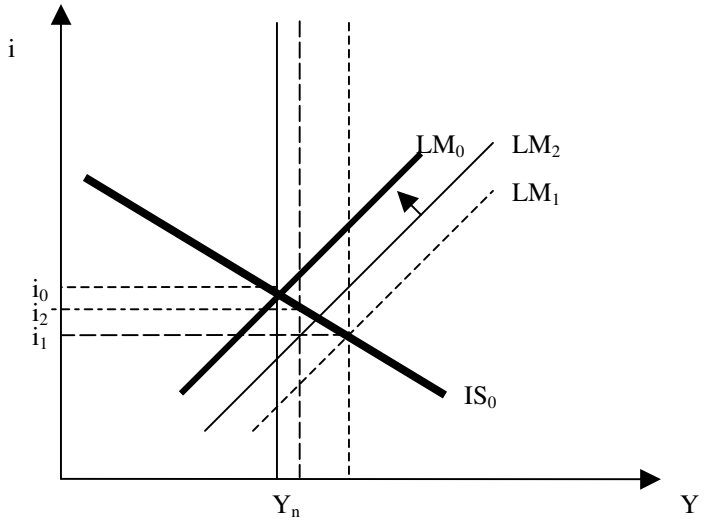
Assignment # 2- Answer Guide
Due Date Wednesday, April 6, 2005

Section A (40 percent):Read each of the following statements and indicate whether they are True, False or uncertain. Briefly explain your answer. NO MARKS WILL BE GIVEN FOR UNSUPPORTED ANSWERS

A1. Unemployment cannot be maintained below its natural rate using expansionary fiscal policy.
TRUE/UNCERTAIN- While this may be possible in the short-run, it seems unlikely that it could be possible in the long run. In the Keynesian-classical synthesis model, for example, an expansionary fiscal policy (where we mean by an increase in public consumption) increases the nominal price level and therefore erodes the value of real balances (i.e. the LM curve shifts to the left). As real balances fall, aggregate demand falls thereby offsetting the fiscal expansion. In the long run, real equilibrium in the labour market implies that the long run aggregate supply curve must be vertical, so this process will continue until the economy reverts to its initial output level, but with higher nominal prices. If the government tried to continually raise public consumption in order to maintain unemployment at a low level by offsetting the adjustment process, households would eventually realize this expectations of inflation. This would became built into nominal contracts, so that even the short-run aggregate supply curve would became (close to) vertical.

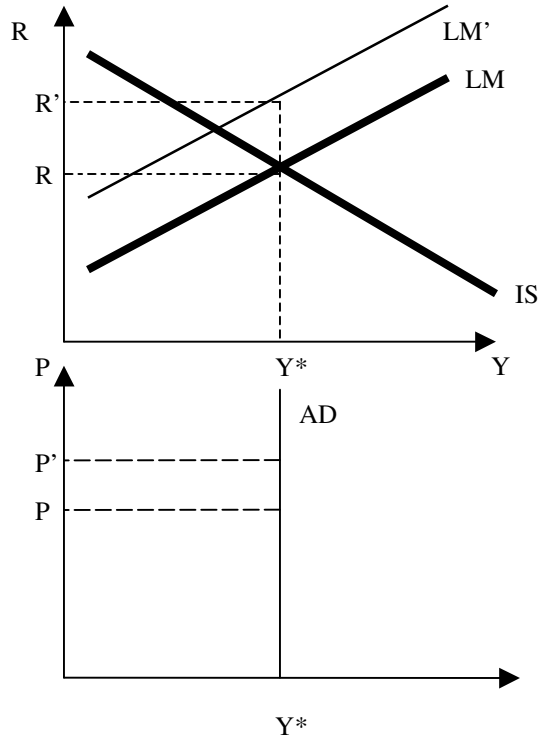
A2. In the AD-AS framework, the implication that an increase in the money supply stimulates the economy in the short run, stems from the assumption that the price expectation of the workers and firms adjust only slowly.
TRUE . In response to a monetary stimulus, the AD curve shifts right. This drives up prices on impact and expands output. Under the assumption of adaptive expectations, firms and workers do not immediately adjust upwards their inflationary expectation, so the AS curve does not shift immediately. In the following period, agents adjusts upwards their inflationary expectations, but only to the extent implied by the past price increase. Although, as this process continues and the AS curve shift up, output eventually returns to its natural level, output remains above that level in the short run. If, instead, workers and firms were able to predict the eventual consequences of an increase in the money supply on prices, and adjust their expectations accordingly, the AS curve would shift to its long run level immediately rather than gradually and output would remain at its natural rate.





A4. Suppose the bank of Canada has some target interest rate R*, and that it adjusts the money supply, M, so as to keep R=R*. With this policy, the AD curve is vertical.

TRUE- In the absence of the interest rate target, an increase in prices, P, would cause the LM curve to shift in as real money balances decline. This would cause aggregate demand to decline. However, if monetary policy is designed to maintain a constant interest rate, the money supply would have to be increased so that the LM curve remains in its original position. As a result, the increase in prices would have no impact on aggregate demand implying that the AD curve would indeed be vertical.



Section B (60 percent)

B1. Suppose that, in the short run, the economy can be approximately described by the following IS-LM system:

$$C = 120 + .6(Y - T)$$
$$I = 50 + .2Y - 200i$$
$$G = 250$$
$$T = 200$$
$$M^d = P(2Y - 8000i)$$
$$M = 1600$$

All variables (expect P) are in units of constant dollars.

(a) **Identify the variables that are exogenous and those which are endogenous**.
Exogenous: T,G,M,P
Endogenous : C, I, Y, i, M^d

(b) Find the IS-LM equilibrium in this economy when the price level P=1. Repeat when P=2.

(1) p=1:
The IS curve is given by

$$Y = C + I + G$$
$$Y = 120 + .6(Y - 200) + 50 + .2Y - 2000\,i + 250$$
$$.2Y = 300 - 2000\,i$$
$$Y = 1500 - 10{,}000\,i$$

The LM curve is given by

$$2Y - 8000i = 1600$$
$$Y = 800 + 4000i$$

Equating the two we get

$$800 + 4000i = 1500 - 10{,}000i$$
$$14{,}000i = 700$$
$$i^* = 0.05 \Rightarrow Y^* = 1000$$

(2) P = 2: the IS curve is unchanged, but the LM curve becomes

$$4Y - 16000i = 1600$$
$$Y = 400 + 4000i$$

Equating yields

$$400 + 4000i = 1500 - 10{,}000i$$
$$14{,}000i = 1100$$
$$i^* = 0.08$$

And

Y*=700

(c) Derive the AD curve for this economy. What would be the horizontal shift in the AD curve if taxes fell to t=100?

The AD curve is given by the intersection of the IS curve above and the general LM curve

$$P(2Y - 8000i) = 1600$$
$$Y = \frac{800}{P} + 4000i$$

The IS curve can be expressed as

$$i = \frac{1500 - Y}{10{,}000}$$

Substituting yields

$$Y = \frac{800}{P} + .4(1500 - Y)$$
$$1.4Y = 600 + \frac{800}{P}$$
$$Y = 428.57 + \frac{571.43}{P}$$

If taxes fell to T=100, the IS curve becomes

$$Y = 120 + .6(Y - 100) + 50 + .2Y - 2000i + 250$$
$$.2Y = 360 - 2000i$$
$$Y = 1800 - 10{,}000i$$

Solving for i we get

$$i = \frac{1800 - Y}{10{,}000}$$

Substituting into the LM curve yields

$$Y = \frac{800}{P} + .4(1800 - Y)$$
$$1.4Y = 720 + \frac{800}{P}$$
$$Y = 514.29 + \frac{571.43}{P}$$

Thus, the horizontal shift in the AD curve (the change in Y for a given P) is 514.29 - 428.57 = 85.72

(d) In general (i.e. when the structural parameters of the model could take on values other than those given above), under that two conditions will the AD curve be vertical? One condition relates to the IS curve and one to the LM curve. In each case, explain the economic interpretation.

The AD curve is vertical if either:

(1) The IS curve is vertical: in this case investment is insensitive to interest rates. Consequently, although an increase in the price level, reduces real balances and causes the LM curve to shift left, this has no consequences for real GDP.

(2) The LM curve is horizontal: in this case there is no adjustment in the interest rate in response to the fall in real balances that is caused by a rise in prices. Consequently, even if investment is sensitive to interest rate changes, there is no impact on real GDP.

B2. In this problem we look at how the recovery of an economy from an oil price shock is affected by the model used for inflationary expectations. Suppose the economy starts off in period t=0 with output at potential: $Y_0 = Y^* = 4000$, $\pi_0 = \pi_o^e = 0$, and $P_0 = 1$. Also the money supply is assumed fixed at $M_0 = 600$. Aggregate demand is given by

$$Y_t = 2{,}067 + 3.221\frac{M_t}{P_t}$$

Price adjustment is given by

$$\pi_t = .25\left(\frac{Y_{t-1} - Y^*}{Y^*}\right) + \pi_t^e + Z_t$$

In year t =1, the price shock effect is Z = .025, and then returns to zero thereafter.
For the first three parts of this question assume that M_t remains fixed.

(a) Calculate the path of inflation, the price level and out put in years 1 through 6 under the assumptions that (i) $\pi_t^e = .4\pi_{t-1} + .2\pi_{t-2}$ and (ii) $\pi_t^e = \pi_{t-1}$. In performing your calculations compute $P_t = (1 + \pi_{t-1})P_{t-1}$.

(i)

T	P_t	Y_t	π^e_t	π_t
1	1	4000	0	0.025
2	1.025	3952	0.010	0.010
3	1.035	3934	0.009	0.006
4	1.041	3923	0.004	0
5	1.041	3923	0.001	-0.004
6	1.037	3931	-0.002	-0.007

(ii)

T	P_t	Y_t	π^e_t	π_t
1	1	4000	0	0.025
2	1.025	3952	0.025	0.025
3	1.051	3906	0.025	0.022
4	1.074	3866	0.022	0.016
5	1.091	3838	0.016	0.008

6	**1.100**	**3824**	**0.008**	**-0.002**

(b) In each case, how long does it take inflation to first return to zero? Analyze the factors that cause inflation to fall in each case.

In case (i), inflation first returns to zero by period 4, whereas in case (ii) it does not return to zero until period 6. The main reason is that in case (ii) inflationary expectations are more persistent. This implies that once inflation enters the system, the higher expectations that it creates fuels further high inflation via Phillips curve mechanism. Although in both cases this results in a fall in aggregate demand below potential output which has a negative effect on inflation, the high expectations dominate this effect for longer in case (ii).

(c) In which case is the fall in output greater? How do you explain this result?

The fall in output is greater in case (ii). There are two reasons for this: firstly inflation in period 3 remains higher in case (ii) than in case (i), because of the bigger effect on expectations. This leads to higher prices and hence lower output. Secondly, inflation persists longer in case (ii), so output continues to fall for longer than in case (i).

Now suppose the aim of the central bank is to keep inflation equal to zero in every year possible by manipulating the money stock.

(d) If the oil price shock was unexpected, why can't anything be done about inflation in Year 1? Suppose $\pi_t^e=0$ in every period. What values of M_t would be chosen by the central bank in years 2 to 6?

The central bank wants to set M_2 so that $\pi_3=0$. Given $\pi_3^e=0$, this must imply setting it so that $Y_2=4000$. By period 2, the price level will have risen to 1.025, hence M_2 must satisfy

$$4000 = 2{,}067 + 3.221\frac{M_2}{1.025}$$

$$M_2 = \frac{1.025}{3.221}\times 1933 = 615$$

With zero expected inflation and inflation in period 2 given by 0, the price level in period 3 rises to $P_3 = 1.025$. It follows that M_3 must satisfy

$$4000 = 2{,}067 + 3.221\frac{M_3}{1.025}$$

$$M_3 = \frac{1.025}{3.221}\times 1933 = 615$$

Note that, since inflation from period 2 on is now zero price stay at 1.025 and this same condition must be satisfied every period, and so $M_4 = M_5 = M_6 = 615$ also. In other words, the money supply experiences increase in two steps in period 2 and 3 in order to maintain zero inflation from period 2 on. Note that output remains stable at 4000 as a result of this policy.

(e) Now assume π^e_t is given alternately by (i) and (ii) in part (a). Repeat the calculations from part (d) in each case.

(i) Expected inflation in period 2 is (as in part (a)) $\pi^e_2 = 0.01$. Since $Y_1 = 4000$, it follows that inflation in period 2 is also (as in part (a)) $\pi_2 = 0.01$. This implies that expected inflation in period 3 will be $\pi^e_3 = 0.009$. The target period 2 output level must therefore satisfy

$$0 = .25\left(\frac{Y_2 - 4000}{4000}\right) + .01$$
$$Y_2 = 4000 - (.01 \times \frac{4000}{.25})$$
$$Y_2 = 3840$$

To attain this level, M_2 must satisfy

$$3840 = 2{,}067 + 3.221\frac{M_2}{1.025}$$
$$M_2 = \frac{1.025}{3.221} \times (3840 - 2067) = 564$$

Since $\pi_3 = 0$, expected inflation is given by $\pi^e_4 = .2(0.01) = 0.002$. The target period 3 output level must therefore satisfy

$$0 = .25\left(\frac{Y_3 - 4000}{4000}\right) + .002$$
$$Y_3 = 4000 - (.002 \times \frac{4000}{.25})$$
$$Y_3 = 3968$$

Since the price level expected in period 3 $P_3 = 1.035$, to obtain this output level, M_3 must satisfy

$$3968 = 2{,}067 + 3.221\frac{M_3}{1.035}$$
$$M_3 = \frac{1.035}{3.221} \times (3968 - 2067) = 611$$

Since $\pi_4 = \pi_3 = 0$, expected inflation is given by $\pi^e_5 = 0$. Hence, the target output level is $Y_4 = 4000$. To obtain this output level, M_4 must satisfy

$$4000 = 2{,}067 + 3.221\frac{M_4}{1.035}$$
$$M_4 = 621$$

After this, as in part (d) the money supply remains constant. Notice that, in this case, an initial monetary contraction is needed to keep inflation under control.

(ii) Expected inflation in period 2 is (as in part (a)) $\pi^e_2 = 0.025$. Since $Y_1 = 4000$, it follows that inflation in period 2 is also (as in part (a)) $\pi_2 = 0.025$. This implies that expected inflation in period 3 will be $\pi^e_3 = 0.025$. The target period 2 output level must therefore satisfy

$$0 = .25\left(\frac{Y_2 - 4000}{4000}\right) + .025$$

$$Y_2 = 4000 - (.025 \times \frac{4000}{.25})$$

$$Y_3 = 3600$$

To obtain this output level, M_2 must satisfy

$$3600 = 2{,}067 + 3.221\frac{M_2}{1.025}$$

$$M_2 = \frac{1.025}{3.221} \times (3600 - 2067) = 488$$

Since $\pi_3 = 0$, expected inflation is given by $\pi^e_4 = 0$. The target output level is $Y_3 = 4000$. Since the price level expected in period 3 $P_3 = 1.05$, to obtain this output level, M_3 must satisfy

$$4000 = 2{,}067 + 3.221\frac{M_3}{1.05}$$

$$M_3 = 630$$

After this, as in part (d) the money supply remains constant. Notice that, in this case, the required monetary contraction is initially much more severe in the short run than in (i). However, because expectations only depend on last period's inflation, the contraction in aggregate demand need not last as long as in case (i).

This question illustrates the importance of the sluggish adjustment of inflationary expectations for monetary policy. When expectations take time to adjust, the oil price shock causes a possible long recession in the absence of monetary policy adjustment (as in part (a)). The central bank may feel that it is better to have a short sharp contraction for a quarter or so, thereby "killing" inflationary expectations and allowing the economy to return to its potential output level more rapidly (a short, but deep recession rather than a long but shallower one). If inflationary expectations were zero(original Phillips curve) this would not be problem; a monetary expansion would immediately stabilize the economy (part (d)). This "monetary accommodation" is exactly what central banks did in response to the oil shocks of the 1970s, and it was a disaster because it fuelled inflationary expectations.