Georgia Institute of Technology
Advanced Macroeconomics, Econ 3120
Spring 2008
Midtrm Exam
Full points: 100
Time 2 hours and 30 mintues

Name:_____

Student ID: _____

Instructions:

This is a closed book and closed notes exam, however, you may use your own electronic calculators. Sharing calculators during the exam without permission is illegal.

Write down your name and student ID number on the exam.

Please work out the problems in the space provided below each question. If you prefer, you may use your own paper. Please circle your answer at the end.

Receiving and providing help during exam is against the university's Code.

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1. The product market of an economy is characterized by

$$C = 1000 + 0.75(Y - T)$$
$$T = 2200, \quad G = 2500, \quad I = 1200, \quad NX = -250$$

(a) [5 points] If the unplanned business inventory investment of this economy at the current level of real output equals 200, find the current level of output.

This is a reduced model–a model in which all but the households' consumption are independent of target variable Y.

$$AE = 1000 + 2500 + 1200 - 250 - 0.75 \times 2200 = 2800.$$

$$Y = \frac{AE + I_u}{mps} = \frac{2800 + 200}{0.25} = 12000.$$

(b) [10 points] If the marginal propensity to consume for this economy increases from 0.75 to 0.9, find the level of income at which unplanned inventory investment again equal to 200.

Here change in mpc will also change AE, new AE equals

$$AE = 1000 + 2500 + 1200 - 250 - 0.9 \times 2200 = 2470.$$

$$Y = \frac{AE + I_u}{mps} = \frac{2470 + 200}{0.1} = 26700.$$

See the power of higher mpc in changing the target variable Y.

2. The product market of an economy is characterized by

$$C = 500 - 10r + 0.8(Y - T)$$
$$T = -300 + 0.2Y$$
$$I = 100 - 40r + 0.04Y$$
$$NX = 50 - 0.08Y$$
$$G = 1000.$$

(a.) [10 points] Finding the equation for planned aggregate equation and find the equation for IS.

IS is an instrument along which $Y = PAE$. IS can be derived for any specification, I told you. All you need to find PAE and equate to Y.

$PAE = C + I_p + G + NX$
$PAE = 500 - 10r + 0.8(Y + 300 - 0.2Y) + 100 - 40r_{+}0.04Y + 1000 + 50 - 0.08Y$
$PAE = 500 + 1150 - 50r + 0.8(Y + 300 - 0.2Y) + 0.04Y - 0.08Y$
$PAE = 1650 - 50r + 240 + 0.8(Y - 0.2Y) - 0.04Y$
$PAE = 1890 - 50r + 0.64Y - 0.04Y$
$PAE = 1890 - 50r + 0.6Y$
slope of PAE equals 0.6
MLR equals one minus slope = 0.4
MLR formula you have in which investment does not depend on Y
in this case MLR $= 1 - mpc(1-t) + \eta - 0.04 = 1 - 0.8 \times 08 + 0.08 - 0.04 = 0.4$
$IS \quad Y = 1890 - 50r + 0.6Y$
$Y = \dfrac{1890 - 50r}{0.4} = 4725 - 125r.$
$r = 37.8 - 0.008Y$

(b) [10 points] Now in the money market, the equation for LM is given by

$$LM: \quad \left(\frac{M}{P}\right) = 0.2Y - 50r$$
$$M = 3000,$$

Find the expression for AD.

$$\frac{3000}{P} = 0.2Y - 50(37.8 - 0.008Y)$$
$$\frac{3000}{P} = 0.2Y - 1890 + 0.4Y$$
$$0.6Y = 1890 + \frac{3000}{P}$$
$$AD: \quad Y = 3150 + \frac{5000}{P}$$

(c) [10 points] Now take the equation for AD derived in part (b) and the given Lucas rational expectation short-run aggregate supply

$$Y = Y_n + h(P - P^e)$$
where potential real income $Y_n = 4000$
expected price $P^e = 2$
parameter $h = 2$.

Find the equilibrium price. Note that here you may need to solve a quadratic equation in P and short-run equilibrium real output. Note that output is measure in million.

$$3150 + \frac{5000}{P} = 4000 + 2(P - 2)$$
$$3150 + \frac{5000}{P} = 3996 + 2P$$
$$\frac{5000}{P} = 846 + 2P$$
$$5000 = 846P + 2P^2$$
$$2500 = 423P + P^2$$
$$P^2 + 423P - 2500 = 0$$
$$P = \frac{-423 + \sqrt{178929 + 10000}}{2}$$
$$P = \frac{-423 + 434.66}{2} = 5.83$$
$$Y = 4000 + 2(5.83 - 2) = 4007.66$$

Note that output is measured in millions

your short-run output is about 8 million more than potential.

(d) [10 points] If the short-run equilibrium output that you in part (c) is different from the potential output, discuss the steps of adjustments as per Friedman imperfect information model and also as per Lucas rational expectation model that will bring the output to potential output (long-run results). Use supporting diagrams and explain using diagrams.

Now see the problem set I gave you.

Page # 207 of the handout.

1.

according to Friedman, $P \uparrow$ implies $w \downarrow$

for a given W, firms respond by hiring more labors

this action of firms pushes the nominal wage W up

labors do not see price increase, see real wage increase

this make them supply more quantity of labor

recall Friedman's labor supply depends on *expected price level*

in the short run labor market is not cleared

when worker catch on price increase, their real wage goes back to original

in the long-run when expectation gets accurate, all markets cleared

economy moves to long-run results

Lucas expectation, when price goes up, workers update

their expectation almost instantaneously

3. [5 points] (a) The inflation rate of this year and the previous year are respectively 4% and 3%. The price markup rate equals 0.02 and the value of catchall variable Z=0.10. If the parameter α in augmented Phillips curve equals 3, find the current unemployment rate of this economy.

$$\pi_t - \pi_{t-1} = (\mu + Z) - \alpha U_t$$
$$0.04 - 0.03 = 0.02 + 0.1 - 3U_t$$
$$U_t = \frac{0.11}{3} = 0.037.$$

(b) [5 points] For the above information, find the economy's natural rate of unemployment. Is the economy operating better than normal, discuss.

$$\pi_t - \pi_{t-1} = -\alpha(U_t - U_n)$$
$$0.04 - 0.03 = -3(U_t - U_n)$$
$$U_t - U_n = -\frac{0.01}{3} = -0.0033$$
$$U_n = U_t + 0.0033 = 0.037 + 0.0033 = 0.04$$
the actual unemployment rate is less than natural rate
therefore, economy is performing better than normal.

4. [10 points] Starting at the long-run equilibrium solution, suppose the government of this economy undertakes an expansionary fiscal policy taking the economy off this long-run equilibrium solution. With supporting diagrams, discuss the process of bringing back the equilibrium to potential real output but at different equilibrium price using Frieman's Imperfect Information model's concepts.

This same as 2(d), I cannot draw the diagrams here.

$G \uparrow \Longrightarrow AD \uparrow$
$AD \uparrow \Longrightarrow P \uparrow Y \uparrow$
according to Friedman, $P \uparrow$ implies $w \downarrow$
for a given W, firms respond by hiring more labors
this action of firms pushes the nominal wage W up
labors do not see price increase, see real wage increase
this make them supply more quantity of labor
recall Friedman's labor supply depends on *expected price level*
in the short run labor market is not cleared
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5. Consider the Cobb-Douglass production function

$$Y = A \cdot K^{\beta} L^{1-\beta}$$
where the technology parameter $A = 1$.

(a) [10 points] For a saving rate of 20%, labor-force growth rate of 4%, and depreciation rate of 5%, workout the steady-state equation. For $\beta = 0.3$, and if the steady-state real output Y^* equals 10000 units, find the steady-state capital for this economy.

This answer I gave you in the problem set. All I changed from α to β.

Problem number 9 page 63 of the handout

(a)

$$Y = A \cdot K^{\beta} L^{1-\beta}$$
$$y = \frac{Y}{L}, \quad \kappa = \frac{K}{L}$$
$$\frac{Y}{L} = y = A \cdot \left(\frac{K}{L}\right)^{\beta} \tag{1}$$
$$\frac{y}{\kappa} = A \cdot \kappa^{\beta-1}$$

at steady state

$$s\left(\frac{y^*}{\kappa^*}\right) = s\delta + n$$
$$0.2\left(\frac{y^*}{\kappa^*}\right) = 0.2 \times 0.05 + 0.04 = 0.05$$
$$\frac{y^*}{\kappa^*} = \frac{0.05}{.2} = 0.25$$
$$\frac{Y^*}{K^*} = \frac{0.05}{.2} = 0.25$$

I told you $y/\kappa = Y/K$

$$K^* = \frac{Y^*}{0.25} = \frac{1000}{0.25} = 4000.$$

(b) [5 points] Now due to technological innovation, the technology parameter increases from 1 to 1.2. find the new steady-state capital requirement.

$$sA \cdot \kappa^{*(\beta-1)} = s\delta + n$$
$$\kappa^{*(\beta-1)} = \frac{s\delta + n}{sA}$$
$$\kappa^* = \left(\frac{0.2 \times 0.05 + 0.04}{0.2 \times 1.2}\right)^{\frac{1}{0.3-1}}$$
$$\kappa^* = \left(\frac{0.2 \times 0.05 + 0.04}{0.2 \times 1.2}\right)^{\frac{1}{0.3-1}}$$
$$\kappa^* = (0.208)^{\frac{1}{0.3-1}} = (0.208)^{-1.43} = 9.44$$
$$y^* = 1.2 \cdot (0.208)^{\frac{0.3}{0.3-1}}$$
$$y^* = 1.2 \cdot (0.208)^{-0.43} = 2.36$$
$$\frac{y^*}{\kappa^*} = \frac{Y^*}{K^*} = \frac{2.36}{9.44} = 0.249$$
$$K^* = \frac{1000}{0.249} = 4016$$

This problem is exactly similar to 9 on the last problem set which is still online– Solow growth model. I told you to go through it again again.

6. [5 points] (Modigliani life-cycle theory) Suppose you started your job at age 25 and would retire at the age of 65. You expect to life expectancy is 85 years. Your life long real labor income is \$70,000 per year and you have no other assets to support you. Find your average real consumption per year. How much you need to save, to maintain the same standard of living over your entire retirement life.

$$C = \frac{40}{60} \times 70000 = \$46666.67.$$

$$\text{your retirement saving} = 46666.67 \times 20 = \$933333.33.$$

7. [5 points] The price of bread is \$2. The nominal annual interest rate is 12%. Instead of consuming the bread, you invest \$2. If next year expected price of the bread is \$2.1, how many bread you expect to get a year from now.

This one is Irving Fisher's equation.

$$\text{Expected inflation rate } \pi^e_{t+e} = \frac{2.1 - 2}{2} = 0.05$$

$$r_t = i_t - \pi^e_{t+1} = 0.12 - 0.05 = 0.07$$

Your bread will grow by 0.07 bread. Therefore, your expected number of bread will be 1.07.