QUEEN'S UNIVERSITY FINAL EXAMINATION
FACULTY OF < Arts and Science >
DEPARTMENT OF < Economics >

ECON222 001-002, Professors: Mike Kennedy and Mohsen Bakhshi-Moghaddam
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INSTRUCTIONS TO STUDENTS:
This examination is <3> HOURS in length.
There are five sections to this examination.

The following aids are allowed:
Lecture slides
Textbooks: ***Macroeconomics***
(ABCK: Pearson, 2018)

GOOD LUCK!

PLEASE NOTE:
Proctors are unable to respond to queries about the interpretation of exam questions.
Do your best to answer exam questions as written.

B: The Solow growth model with effective labour and government spending

Consider the following production function:

$$Y_t = K_t^{\alpha}(A_t N_t)^{\beta} G_t^{1-\alpha-\beta}$$

where Y_t denotes output, K_t the capital stock, N_t the labour input and A_t is the technological progress variable. In this model A_t is labour augmenting because it affects aggregate output by increasing the effectiveness of labour. Note that $A_t N_t$ is commonly referred as "effective labour." G_t is government spending, and it is included on the assumption that it makes private capital K_t and N_t more productive. Also, assume that the government runs a balanced budget, that is:

$$T_t = G_t = \tau Y_t$$

where τ is a tax rate on output. Consumers save a constant fraction s of disposable income. The growth rates in N_t and A_t are equal to n, and m, respectively. The depreciation rate equals d. Finally, the capital stock, K_t, evolves according to:

$$K_{t+1} = I_t + (1-d)K_t.$$

21. Let $y_t = \frac{Y_t}{A_t N_t}$ and $k_t = \frac{K_t}{A_t N_t}$. Also, the balanced budget can be written as $g_t = \tau y_t$ in terms of effective labour. What is the intensive form of the production function in terms of effective labour?

a) $y_t = (k_t \tau)^{\frac{1}{\alpha+\beta}}$

b) $y_t = k_t^{\alpha} g_t^{\beta}$

c) $y_t = k_t^{\frac{\alpha}{\alpha+\beta}} \tau^{\frac{1-\alpha-\beta}{\alpha+\beta}}$

d) $y_t = k_t^{\frac{1}{\alpha+\beta}} \tau^{\frac{1-\alpha-\beta}{\alpha+\beta}}$

22. Using the above law of motion of capital, what is the steady state condition for this economy? Note that the goods market is in equilibrium and that saving is $s(1-\tau)Y_t$.

a) $k(m+n+d) = s(1-\tau)k^{\frac{1}{\alpha+\beta}} \tau^{\frac{1-\alpha-\beta}{\alpha+\beta}}$

b) $k(m+n+d) = s(1-\tau)k^{\frac{\alpha}{\alpha+\beta}} \tau^{\frac{1-\alpha-\beta}{\alpha+\beta}}$

c) $k(n+d) = s(1-\tau)k^{\frac{1}{\alpha+\beta}} \tau^{\frac{1-\alpha-\beta}{\alpha+\beta}}$

d) $k(m+n+d) = s(1-\tau)k^{\alpha} g^{\beta}$

23. What is the steady state level of capital per effective labour, k^*?

a) $k^* = \left[\frac{s(1-\tau)\tau^{\frac{1-\alpha-\beta}{\alpha+\beta}}}{m+n+d}\right]^{\frac{\alpha+\beta}{\beta}}$

b) $k^* = \left[\frac{s(1-\tau)\tau^{\frac{1-\alpha-\beta}{\alpha+\beta}}}{m+n+d}\right]^{\frac{\alpha+\beta}{\alpha+\beta-1}}$

c) $k^* = \left[\frac{s(1-\tau)\tau^{\frac{1-\alpha-\beta}{\alpha+\beta}}}{n+d}\right]^{\frac{\alpha+\beta}{\alpha+\beta-1}}$

d) $k^* = \left[\frac{s(1-\tau)g^{\beta}}{m+n+d}\right]^{\frac{1}{1-\alpha}}$

24) What is the steady state level of consumption per effective labour, c^*? Note that the government spending is present in this model and affects c^*.

a) $c^* = {k^*}^{\frac{1}{\alpha+\beta}}\tau^{\frac{1-\alpha-\beta}{\alpha+\beta}} - (m+n+d)k^*$

b) $c^* = (1-\tau){k^*}^{\frac{1}{\alpha+\beta}}\tau^{\frac{1-\alpha-\beta}{\alpha+\beta}} - (m+n+d)k^*$

c) $c^* = {k^*}^{\frac{\alpha}{\alpha+\beta}}\tau^{\frac{1-\alpha-\beta}{\alpha+\beta}} - (m+n+d)k^*$

d) $c^* = (1-\tau){k^*}^{\frac{\alpha}{\alpha+\beta}}\tau^{\frac{1-\alpha-\beta}{\alpha+\beta}} - (m+n+d)k^*$

25) What is the saving rate that can help this economy to achieve the Golden rule level of capital per effective labour, k_G, in the steady state?

a) $s = 0.5$

b) $s = \frac{\alpha}{\alpha+\beta}$

c) $s = \frac{1}{\alpha+\beta}$

d) $s = \frac{\tau}{\alpha+\beta}$

C: Asset Market

Suppose that the real money demand function is as follows:

$$\frac{M^d}{P} = 400 + 0.5Y - 400i$$

where *Y* is real output, *P* is the price level, *i* is the nominal interest rate on nonmonetary assets and monetary assets earn no interest.

26. Assume that Y = 2000, $\boldsymbol{r}$ = **0.0**6 and π^e = **0.0**4 and that the asset market is in equilibrium. What are the velocity of money and the value of k in the quantity theory of money, respectively?

a) V=0.68 and k=1.47
b) V=1.80 and k=0.56
c) V=1.47 and k=0.68
d) V=0.56 and k=1.80

27. Assume that the quantity theory of money holds and that velocity is constant at the level you found in the previous question. In this economy, the central bank fixes the nominal money supply (M^s) at 1500. With output fixed at its full-employment level (Y = 2000) and assuming that prices are flexible, what will be the price level? What happens to the price level if the nominal money supply rises by 20%?

a) P=1.10; the price level increases proportionally to the increase in the money supply (a 20% increase).
b) P=1.10; the price level increases by more than 20% in response to the increase in the money supply due to the multiplier effect.
c) P= 1.35; the price level increases proportionally to the increase in the money supply (a 20% increase).
d) P=1.35; the price level increases by more than 20% in response to the increase in the money supply due to the multiplier effect.

28. The rate of inflation in this economy is defined as the growth rate of the nominal money supply minus an adjustment for the growth rate of real money demand arising from growth in real output. Assume that the values for $\frac{M^d}{P}$ and Y are those in question 26 and that the initial money supply is 1500. Also, assume that real income is expected to grow by 10% over the next year, and the interest rate remains constant. What should be the new money supply if the central bank pursues an inflation target of 2% inflation for next year.

a) $M^s = 1500$
b) $M^s = 1650.50$
c) $M^s = 1620.75$
d) $M^s = 1640.25$

29. Now, assume that the central bank follows a money supply rule, setting the money supply according to:

$$M^s = 200 + 0.5Y - 5000\pi$$

Also, assume that the real money demand equation has not changed. Given that π^e = $\boldsymbol{\pi}$ = **0.0**2, $\boldsymbol{Y}$ = 3**000** and $\boldsymbol{r}$ = **0.04**, what is the price level in this economy?

a) 1.10
b) 1.17
c) 0.853
d) 0.750

30. Now, suppose that real money demand is given by:

$$\frac{M^d}{P} = \frac{Y^\sigma}{(r + \pi^e)^\varphi}$$

What are the elasticities of real money demand with respect to real income and the nominal interest rate, respectively?

a) $\sigma \; and \; \varphi$
b) $\sigma \; and \; -\varphi$
c) $-\sigma \; and \; \varphi$
d) $\sigma \; and \; -\frac{1}{\varphi}$

D: The *IS-LM* model in a closed economy

Below are the equations for a closed economy, where the definitions of the variables and the equations are familiar to you from the lectures, assignments and the textbook.

$C^d = 28 + 0.6(Y - T) - 200r$ (1)

$I^d = 24 - 150r$ (2)

$M/P = 18 + 0.5Y - 350(r + \pi^e)$ (3)

$Y = C^d + I^d + G$ (4)

31. Start by using the above equations to derive the aggregate demand (AD) curve for this economy. Assume that the level of taxes (T) is 20 and that the government is running a fiscal deficit of 5; the real money supply (M/P) is 45 and expected inflation (π^e) is 0.02. Based on your AD curve, which of the following is the level of output (Y):

a) 105
b) 110
c) 100
d) 95

32. Now suppose that, in the short run, expected inflation increases from 0.02 to 0.03. What happens to Y in the short run and why?

a) Y falls to 105.666… because the nominal interest rate has risen
b) Y increases to 115.444… because nominal interest has fallen
c) Y increases to 113.888… because the real interest rate has fallen
d) Y remains unchanged at the level found in question 1 because the real interest rate has not changed

33. Assume that the results that you found in question 32 represent the economy's short-run equilibrium and that the level of output you found in question 31 is the economy's long-run equilibrium level of output. Assume also that the short-run price level was one (P = 1) and that the central bank keeps the nominal money stock unchanged. Based on your AD curve, in the long run, by how much does the price level change and why?

a) The price level rises to 1.084… because there was initially excess demand
b) The price level remains unchanged because money is neutral in the long run
c) The price level falls to 0.916 because the rise in expected inflation lowers demand
d) The price level rises to 1.01 in line with the rise in expected inflation by 0.01

34. Start again at the conditions that you found in question 31. Now assume that the government wants to balance its fiscal budget. In particular it lowers spending (G) to be in line with its level of taxation. Based on your model, what happens to the short-run level of output (Y) and the real interest rate (r)?

a) Y increases to 115 as the real interest rate falls to 0.05206
b) Y declines by 5 to 105, the amount by which G has fallen, and the real interest rate drops to 0.053
c) Y declines to 104.44… and the real rate of interest drops to 0.05206…
d) Y remains unchanged as the reduction on G crowds in consumption and investment and the real rate of interest remains unchanged

35. Assume that the answers to Y and r that you found in question 34 represent a short-run equilibrium and that, again, the level of output you found in question 31 is the economy's long-run equilibrium level of output. What happens to P and r in the long run and why?

a) The initial excess supply with M unchanged lowers the price level to 0.9. This shifts the LM curve to the right and lowers the real interest rate to 0.0457…
b) The initial excess supply with M unchanged causes the price level to rise to 1.1 and this causes the real money supply to fall raising interest rates to 0.0625
c) Because money is neutral in the long run, the price level, real interest rates and real output remain unchanged
d) With the initial level of excess demand the price level rises to 1.125 and interest rates increase to 0.074

E: The *IS*-*LM* model in an open economy

Below are the equations for a small open economy, where the definitions of the variables and the equations are familiar to you from the lectures, assignments and the textbook. This economy takes the world rate of interest (r^w) as fixed.

$$C^d = 31 + 0.6(Y - T) - 250r^w \quad (1)$$

$$I^d = 30 - 150r^w \quad (2)$$

$$NX^d = 30 - 0.2Y - 5e \quad (3)$$

$M/P = 16 + 0.5Y - 350r^{w}$ (4)

Assume that the nominal exchange rate (e_{nom}) is flexible and that the world rate of interest is 0.06 or 6%. As well the foreign and domestic price level are both equal to one; $P = P_{For} = 1$.

Start by deriving the IS curve for this economy with the real exchange rate (e) on the left-hand side. Next write the LM curve with output (Y) on the left-hand side. Writing these relationships will help you to answer the following questions:

36. You are given the following information: M/P = 60; G = 30; and T = 25. Find first the level of output and the real exchange rate for this economy. Which of the following are the correct values of each variable:

a) Y = 125 and e = 0.9
b) Y = 130 and e = 0.9
c) Y = 125 and e = 0.8
d) Y = 130 and e =0.8

37. As noted above, the domestic and foreign price level are the same, implying that their ratio (P/P_{For}) is also one. Now suppose that the government wants to reduce its deficit. Economists in the Department of Finance use the above model to estimate the effect on the economy of lowering government spending by 1 (i.e., G is now 29). Which among the following represents what happens to Y, e, e_{nom} and NX^{d} in the short run:

a) Y = 130, e = 0.6, e_{nom} = 0.6 and NX^{d} = 1.5
b) Y = 129, e = 0.6, e_{nom} = 0.6 and NX^{d} = –1.0
c) Y = 130, e = 0.6, e_{nom} = 0.6 and NX^{d} = 1.0
d) Y = 125, e = 0.8, e_{nom} = 0.8 and NX^{d} = 1.5

38. Going back to the model in question 36 above, now assume that the Economists in the Department of Finance want to see the effect of an increase in taxation by 1 (i.e., T is now 26). Which among the following represents what happens to Y, e, e_{nom} and NX^{d} in the short run:

a) Y = 125, e = 0.82, e_{nom} = 0.82 and NX^{d} = 1.5
b) Y = 130, e = 0.68, e_{nom} = 0.68 and NX^{d} = 0.6
c) Y = 125, e = 0.88, e_{nom} = 0.88 and NX^{d} = 1.5
d) Y = 130, e = 0.72, e_{nom} = 0.72 and NX^{d} = 1.0

39. Go back again to the model in question 36. Now assume that the government decides to peg the exchange rate (i.e., they adopt a fixed exchange rate regime). The nominal exchange rate is set equal to 0.65 (e_{nom} = 0.65). Use the model to calculate the short-run effect on Y and NX^{d}. Which among the following represents what happens to Y and NX^{d} in the short run:

a) Y = 131.25 and NX^{d} = 0.35
b) Y = 131.00 and NX^{d} = 0.25
c) Y = 132.00 and NX^{d} = 1.0
d) Y = 131.25 and NX^{d} = 1.0

40. Now use your model to calculate the long-run effect of the devaluation of the nominal exchange rate. Which of the following represents what has happened to Y, e and the domestic price level (P):

a) Y = 130, e = 0.65 and P = 1.11
b) Y = 132, e = 0.7 and P = 1.26
c) Y = 131.25, e = 0.8 and P = 1.23
d) Y = 130, e = 0.8 and P = 1.23