

**ECON 222: Macroeconomic Theory I**  
Fall 2020

**Final Assignment**  
**DUE:** December 12, 2020  
**Time allowed:** 3 hours

**Submission instructions:** This Final Assignment will be completed online like a Quiz. You should work out the relevant answers to the questions below first. Then, when you are ready, complete the on-line version of the assignment in OnQ by choosing the correct responses. Note that the order in which answers appear online may not be the same as those below. Please submit your answers before the deadline.

**A: Independent multiple choice questions [25 marks]**

**B: Multi-part question on Long Run Growth [25 marks]**

Consider an economy that is described by a Solow (neoclassical) growth model. The savings rate is given by  $s$ , population growth by  $n$  and the rate of physical depreciation by  $d$ . Aggregate output,  $Y$ , is given by the aggregate production function

$$Y = AK^bN^{1-b} \quad (1)$$

where  $A$  denotes total factor productivity,  $K$  denotes the capital stock,  $N$  denotes the size of the work force and  $b < 1$  is a parameter. Assume that  $A$  and  $b$  are constant over time.

**B1. General case:** The change in the capital stock per worker,  $k = K/N$ , is given by

$$\Delta k = sy - (n + d)k \quad (2)$$

where output per worker,  $y = Y/N$ , is given by

$$y = Af(k) \quad (3)$$

Questions 26-29 relate to this information.

Q26: The function  $f(k)$  in this economy must be given by

- (a)  $f(k) = Ak^{\frac{1}{1-b}}$
- (b)  $f(k) = Ak^b$
- (c)  $f(k) = Ak^{\frac{1}{b}}$
- (d)  $f(k) = Ak^{1-b}$

Q27: The steady state capital per worker is given by

- (a)  $k^* = \left(\frac{n+d}{sA}\right)$
- (b)  $k^* = \left(\frac{n+d}{sA}\right)^{\frac{1}{1-b}}$
- (c)  $k^* = \left(\frac{sA}{n+d}\right)$
- (d)  $k^* = \left(\frac{sA}{n+d}\right)^{\frac{1}{1-b}}$

Q28: Steady state consumption per worker is given by

- (a)  $c^* = (1-s)A\left(\frac{sA}{n+d}\right)^{\frac{b}{1-b}}$
- (b)  $c^* = (1-s)A\left(\frac{n+d}{sA}\right)$
- (c)  $c^* = A\left(\frac{sA}{n+d}\right)$
- (d)  $c^* = A\left(\frac{n+d}{sA}\right)^{\frac{b}{1-b}}$

Q29: An increase in total factor productivity,  $A$  has the following impacts in the steady state:

- (a) Both output per worker and consumption per worker increase
- (b) Output per worker increases but consumption per worker decreases
- (c) Output per worker increases but the impact on consumption per worker is ambiguous
- (d) The impact on output per worker is ambiguous but consumption per worker increases.

**B2. Special cases:** Suppose  $A = 1$ ,  $b = 0.5$ ,  $d = 0.05$  and  $n = 0.05$ . Questions 30-33 relate to this information in addition to that above.

Q30: If  $s = 0.5$  what are the steady state values of  $y$  and  $c$ ?

- (a)  $y^* = 25; c^* = 12.5$
- (b)  $y^* = 10; c^* = 5$
- (c)  $y^* = 5; c^* = 2.5$
- (d)  $y^* = 25; c^* = 5$

Q31: If the savings rate decreases to  $s = 0.4$ , what are the implied steady state values of  $y$  and  $c$ ?

- (a)  $y^* = 4; c^* = 2.4$
- (b)  $y^* = 5; c^* = 2.5$
- (c)  $y^* = 16; c^* = 12.7$
- (d)  $y^* = 25; c^* = 15$

Q32: If the savings rate increases to  $s = 0.6$ , what are the implied steady state values of  $y$  and  $c$ ?

- (a)  $y^* = 36; c^* = 14.4$
- (b)  $y^* = 6; c^* = 2.4$

- (c)  $y^* = 5; c^* = 3$
- (d)  $y^* = 16; c^* = 9.6$

Q33: The "golden rule" level of the capital stock per worker is given by

- (a)  $k^{GR} = 9$
- (b)  $k^{GR} = 25$
- (c)  $k^{GR} = 16$
- (d)  $k^{GR} = 36$

### C: Multi-part question on short-run impacts of monetary policy [25 marks]

The economy of Kingstonia has the following characteristics:

$$\begin{aligned} C^d &= 40 + 0.8(Y - T) \\ I^d &= 80 - 250r \\ \frac{M^d}{P} &= 0.8Y - 250(r + \pi^e) \\ \pi^e &= 0 \end{aligned}$$

where  $Y$  is output,  $T$  is a lump-sum tax,  $G$  is government spending,  $r$  is the real rate of interest,  $P$  is the price level. Questions 34-41 relate to this information.

**C1:** Monetary policy in a closed economy.

In answering Questions 34-36, assume that Kingstonia is a closed economy.

Q34: Suppose initially that  $T = G = 50$ , the money supply,  $M = 1125$  and  $P = 3$ . What are the equilibrium values of  $Y$  and  $r$ ?

- (a)  $Y^* = 505; r^* = 0.116$
- (b)  $Y^* = 475; r^* = 0.02$
- (c)  $Y^* = 500; r^* = 0.1$
- (d)  $Y^* = 512; r^* = 0.138$

Q35: Now suppose due to unsuccessful innovation outcomes the expected future marginal product of capital declines and the investment curve shifts to the left. The new investment follows  $I^d = 50 - 250r$ . What are the short-run equilibrium values of  $Y$  and  $r$ ?

- (a)  $Y^* = 505; r^* = 0.116$
- (b)  $Y^* = 500; r^* = 0.1$
- (c)  $Y^* = 475; r^* = 0.02$
- (d)  $Y^* = 512; r^* = 0.138$

Q36: Suppose the central bank can perfectly predict the consequences of the shock described

in Q35 and can react immediately when it occurs. What should it do to avoid experiencing a short-run contraction and price decline?

- (a) Decrease money supply by 90.
- (b) Increase money supply by 90.
- (c) Use a contractionary monetary policy.
- (d) Increase the policy interest rate.

**C2:** Monetary policy in a small open economy with flexible exchange rate.

Now suppose Kingstonia trades with one large open economy. The behaviour of Kingstonia can still be represented by the equations in part C1. Plus its net exports follows

$$NX = 50 - 0.1Y - 0.5e$$

where  $e$  is the real exchange rate. Questions 37-39 relate to this information.

Q37: Which of the following expressions describes the AD curve for this economy?

- (a)  $P = \frac{1.5M}{1.2Y+170+0.5e}$
- (b)  $P = \frac{M}{1.2Y+170-0.8T+G}$
- (c)  $P = \frac{1.5M}{1.1Y-170-0.8T+G-0.5e}$
- (d)  $P = \frac{M}{1.1Y-170+0.8T-G+0.5e}$

Q38: Suppose  $e = 10$ ,  $T = G = 50$ ,  $M = 1125$  and  $r_{For} = 0.1$ . What are the implied levels of income and the price level?

- (a)  $Y^* = 500; P^* = 3$
- (b)  $Y^* = 505; P^* = 2.957$
- (b)  $Y^* = 475; P^* = 3.237$
- (c)  $Y^* = 512; P^* = 2.898$

Q39: Now suppose the central bank increases nominal money supply to 1155 while  $T = G = 50$ , and  $r_{For} = 0.1$ . Using the price level you calculated in Q38, what are the short-run equilibrium values of  $Y$  and the real exchange rate  $e$ ?

- (a)  $Y^* = 500; e^* = 10$
- (b)  $Y^* = 505; e^* = 7$
- (c)  $Y^* = 475; e^* = 25$
- (d)  $Y^* = 512.5; e^* = 2.5$

**C3:** Monetary policy in a small open economy with fixed exchange rate.

Now suppose that because the exchange rate kept fluctuating continuously, the government of the small open economy Kingstonia described in C2 above decides to adopt a fixed nom-

inal exchange rate. Assume that the economy is initially at the general equilibrium given in C2 Q38 above, where  $T = G = 50$ ,  $M = 1125$  and  $r_{For} = 0.1$ . Assume that the value of the nominal exchange rate is set to  $e_{nom} = 10$ , so that it is initially equal to the real exchange rate  $e$ . Questions 40-41 relate to this information.

Q40: Suppose again the central bank increases nominal money supply to 1155 while  $T = G = 50$ , and  $r_{For} = 0.1$ . Which of the following statement is wrong?

- (a) The domestic real interest rate starts to become smaller than  $r_{For}$  and domestic assets become less desirable.
- (b) The fixed exchange rate is now undervalued.
- (c) The domestic central bank needs to use its foreign reserves to buy back its own currency in foreign exchange markets to maintain its nominal exchange rate.
- (d) Eventually the monetary expansion must be reversed.

Q41: Compare flexible and fixed exchange rate regimes, which of the following statement is correct?

- (a) Under both regimes the central bank cannot use monetary policy to pursue macroeconomic stabilization goals.
- (b) Under a flexible exchange rate the central bank cannot use monetary policy to pursue macroeconomic stabilization goals.
- (c) Under a fixed exchange rate the central bank cannot use monetary policy to pursue macroeconomic stabilization goals.
- (d) Under a fixed exchange rate the central bank can achieve both free cross-border capital flows and independent monetary policy.

### **D: Impacts of COVID-19 in an open economy with fixed exchange rates [25 marks]**

This question studies the multiple impacts of the COVID-19 pandemic in the context of the open economy IS-LM-FE model with fixed nominal exchange rates. Start with an initial situation where the economy is in general equilibrium and use diagrams to think through each of the following impacts on output,  $Y$ , and the real exchange rate,  $e$ . In each situation, the central bank is assumed to adjust the money supply in response to other changes in order to maintain the fixed nominal exchange rate.

**D1: Uncertainty** An initial impact of the pandemic was an increase in uncertainty about the future reflected in greater volatility in stock-market returns. Questions 42 and 43 relate to this impact.

Q42. In the short run, this alone would be expected to result in

- (a) higher  $Y$ ; higher  $e$
- (b) higher  $Y$ ; lower  $e$
- (c) lower  $Y$ ; higher  $e$
- (d) lower  $Y$ ; lower  $e$

(e) no change in  $Y$  or  $e$

Q43. In the long run, in comparison with the initial general equilibrium situation, this alone would be expected to result in

- (a) no change in  $Y$ ; higher  $e$
- (b) no change in  $Y$ ; lower  $e$
- (c) lower  $Y$ ; higher  $e$
- (d) lower  $Y$ ; lower  $e$
- (e) no change in  $Y$  or  $e$

**D2: Lock-downs** The lock-downs resulted in restrictions on how much the economy could produce. Questions 44 and 45 relate to this impact.

Q44. In the short run, this alone would be expected to result in

- (a) higher  $Y$ ; higher  $e$
- (b) higher  $Y$ ; lower  $e$
- (c) lower  $Y$ ; higher  $e$
- (d) lower  $Y$ ; lower  $e$
- (e) no change in  $Y$  or  $e$

Q45. In the long run, in comparison with the initial general equilibrium situation, this alone would be expected to result in

- (a) no change in  $Y$ ; higher  $e$
- (b) no change in  $Y$ ; lower  $e$
- (c) lower  $Y$ ; higher  $e$
- (d) lower  $Y$ ; lower  $e$
- (e) no change in  $Y$  or  $e$

**D3: Government Transfers** Increased government transfers (e.g. CERB) increased the net disposable income to households from which they can spend or save. Questions 46 and 47 relate to this impact.

Q46. In the short run, this alone would be expected to result in

- (a) higher  $Y$ ; higher  $e$
- (b) higher  $Y$ ; lower  $e$
- (c) higher  $Y$ ; no change in  $e$
- (d) no change in  $Y$ ; lower  $e$
- (e) no change in  $Y$  or  $e$

Q47. In the long run, in comparison with the initial general equilibrium situation, this alone would be expected to result in

- (a) no change in  $Y$ ; higher  $e$
- (b) no change in  $Y$ ; lower  $e$
- (c) higher  $Y$ ; higher  $e$
- (d) higher  $Y$ ; lower  $e$

- (e) no change in  $Y$  or  $e$

**D4:Government debt** High expected government debt may induce households to spend less and save more of each dollar earned today. Questions 48 and 49 relate to this impact.

Q48. In the short run, this alone would be expected to result in

- (a) no change in  $Y$ ; higher  $e$
- (b) no change in  $Y$ ; lower  $e$
- (c) lower  $Y$ ; no change in  $e$
- (d) lower  $Y$ ; lower  $e$
- (e) no change in  $Y$  or  $e$

Q49. In the long run, in comparison with the initial general equilibrium situation, this alone would be expected to result in

- (a) no change in  $Y$ ; higher  $e$
- (b) no change in  $Y$ ; lower  $e$
- (c) lower  $Y$ ; higher  $e$
- (d) lower  $Y$ ; lower  $e$
- (e) no change in  $Y$  or  $e$