Final Exam

(December 16, 2022, **1 hour 15 minutes**)

Macroeconomics (Fall 2022)

Professor: Wonmun Shin

 * *Write up your answers as **clearly**, **precisely**, and **concisely** as possible. Your grade will be reduced if your answer is unreasonably difficult to follow.*
 * *Label the axes and curves when you draw graphs.*

1. **(Total 50 points)** Consider the **CLASSICAL GENERAL EQUILIBRIUM MODEL** with government spending discussed in class. Remember that we assumed that government spending was useless (in the sense of not being productive nor affecting utility) but it nevertheless affected aggregate demand.

(a) **(5 points)** Assume that government purchases consumption goods (G_t) and there is no government transfer (v_t). If the government can collect taxes (T_t), issue government bonds ($\triangle B_t^G$) and print money $\left(\frac{\triangle M_t^s}{P_t} \right)$, what is the government budget constraint? Note that the government bond is one-period bond, so it should pay the interest on the bond holding from the previous period (B_{t-1}^G). The interest rate is not time-varying, say r.

(b) **(2 points)** If the government does not have access to issuing bonds or printing money, what is the government budget constraint?

Imagine that the only tax available to the government is a **LUMP-SUM** tax (T).

(c) **(10 points)** Suppose that the government increases spending (G) **TEMPORARILY**. What are the effects on GDP (Y), real interest rate (r), price level (P), consumption (C) and investment (I)? Explain using diagram(s).

(d) **(10 points)** Suppose that the government increases spending (G) **PERMANENTLY**. What are the effects on GDP (Y), real interest rate (r), price level (P), consumption (C) and investment (I)? Explain using diagram(s).

(e) **(3 points)** In the light of your answer to (d), when government spending is useless, is it a good idea to expand the size of government, **in terms of welfare**? Why or why not?

Imagine now that, on top of affecting aggregate demand, government spending affects the marginal product of private capital (MP_K). For example, more roads make cars more productive. But it does not affect during the period in which the spending is made. For example, it takes time to build roads.

Also, let us assume that the government spending does not affect the aggregate supply (that is, G does not affect technology A of production function).

(f) **(10 points)** If the government increases this type of spending **TEMPORARILY**, what are the effects on GDP (Y), real interest rate (r), price level (P), consumption (C) and investment (I)? Are they different from your answer for (c)? Why or why not?

(g) **(10 points)** If the government increases this type of spending **PERMANENTLY**, what are the effects on GDP (Y), real interest rate (r), price level (P), consumption (C) and investment (I)? Are they different from your answer for (d)? Why or why not?

2. **(Total 35 points)** A **CAPITAL GAIN TAX** is a tax on the difference between the purchase price of a machine and the sale price of that machine. Suppose that, at time t, firms can purchase a machine at price P_t. One period later, the machine generates some marginal product $(MP_{K,t+1}$ which exhibits diminishing returns). The firm then sells the depreciated machine at price $P_{t+1} > P_t$. Imagine that the depreciation rate is δ $(0 < \delta < 1)$. At the end of the process, the firm has to pay capital gain taxes by the amount $\tau (P_{t+1} - P_t)$ **per (depreciated) machine** (where τ is the capital gain tax rate, and $0 < \tau < 1$). The nominal interest rate a bank imposes on the one-period borrowing is i.

(a) **(5 points)** Imagine that the firm borrows money from a bank to purchase machines and repays one period later. Then what is the firm's financing cost to purchase machine at time t? (Express the total cost of purchasing 1 unit of machine in terms of P_t and i.)

(b) **(5 points)** Considering the capital gain tax, express the total benefit of purchasing 1 unit of machine at time t in terms of δ, $MP_{K,t+1}$, P_t, P_{t+1}, and τ.

(c) **(15 points)** How does the desired capital stock (K_t^*) relate to the following variables? (For example, when $MP_{K,t+1}$ increases, does K_t^* go up or down?)
[*Useful note* : $\pi = \frac{P_{t+1}-P_t}{P_t}$, $1 + \pi = \frac{P_{t+1}}{P_t}$, $1 + r = \frac{1+i}{1+\pi}$]

    i. Marginal product of capital $(MP_{K,t+1})$

    ii. Depreciation rate (δ)

    iii. Capital gain tax rate (τ)

    iv. Inflation rate (π)

    v. Real interest rate (r)

(d) **(5 points)** Draw a graph that represents how the investment demanded (I_t) is related to the real interest rate (r) on the $I - r$ plane. How would a reduction in the capital gain tax rate (τ) affect the investment function? Explain graphically.

(e) **(5 points)** Consider the **CLASSICAL GENERAL EQUILIBRIUM MODEL**. What would be the effect of an increase in the capital gain tax rate (τ) on output (Y), real interest rate (r), and the price level (P)?

3. **(Total 15 points)** Paul Volker said *"The only thing useful banks have invented in 20 years is the ATM"*. We can interpret the introduction of ATM as a decrease in "cost of going to bank". In order to analyze the effect of the introduction of ATM, we can use the Baumol-Tobin model telling that the demand for real money balance (M^d/P) depends on nominal interest rate (i), income (Y) and transaction cost (ψ):

$$M^d = P \cdot L\left(i, Y, \psi\right) = P\sqrt{\frac{\psi Y}{2i}}$$

In the case of money supply, we assume that the money supply (M^s) is exogenously determined by Bank of Korea (BOK):

$$M^s = M$$

(a) **(5 points)** From the **CLASSICAL** perspective, what are the effects of the introduction of ATM on output (Y), real interest rate (r), and price level (P)?

(b) **(5 points)** From the **KEYNESIAN** perspective, what are the effects of the introduction of ATM on output (Y), real interest rate (r), and price level (P)? (*Hint : In the Keynesian view, the short-run effect and the long-run effect are separately analyzed.*)

(c) **(5 points)** Suppose that the BOK believes the **KEYNESIAN** theory is true in the short run, and the BOK wants to stabilize the real interest rate in the short run. In order to cancel out the impact of the introduction of ATM on r, how should the BOK respond?

(End of Exam, Total 3 Pages)