

Final Exam

(December 17, 2021, **1 hour 15 minutes**)

Macroeconomics (Fall 2021)

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 45 points)** Consider the **CLASSICAL** general equilibrium model with investment discussed in class. When a firm buys a new machine, it can incur some installation costs. In this problem, we are going to analyze the effect of introducing such costs in our model. Let us imagine that the firm (with a one-period time-to-build technology) has to pay a **REAL COST**, ϕ , in addition to the price of the machine, P_t , per each machine ($\phi > 0$ is a constant). The cost is paid in the same period in which the machine is purchased.

(a) **(5 points)** What is a **NOMINAL** installation cost? When there exists the installation cost, how much should a firm **ACTUALLY** pay to purchase 1 unit of machine at a period t ? Note that a firm borrows money from a bank to purchase machine. Then what is the firm's financing cost (for purchase and installation) when nominal interest rate is i ? (Express total cost of purchasing 1 unit of machine today in terms of P_t , i and ϕ).

(b) **(5 points)** According to the time-to-build technology, a capital good purchased at t becomes productive at $t + 1$. If a firm sells the marginal product of 1 unit of machine at the price of P_{t+1} at $t + 1$, what is the firm's gain from the extra production? Also, a firm re-sells the used machine (with depreciation rate δ) at P_{t+1} at $t + 1$. What is the firm's gain from the resale? Express total benefit of purchasing 1 unit of machine today in terms of δ , $MP_{K,t+1}$ and P_{t+1} .

(c) **(5 points)** Write down the optimal condition for desired level of capital (K) in terms of ϕ , δ , $MP_{K,t+1}$ and real interest rate r .

(d) **(5 points)** Draw a diagram that represents how the optimal K is determined. Is the desired capital stock for today (t), or for tomorrow ($t + 1$)? Explain, and clearly write down the time subscript of K for the label of the horizontal axis (Is it K_t or K_{t+1} ?).

(e) **(5 points)** How does the desired investment demand depend on the real interest rate (r), on the level of productivity (MP_K) and on the real installation cost (ϕ)? Explain graphically (*i.e.* using a diagram).

(f) **(5 points)** Suppose that the installation cost of new machine declines **TEMPORARILY** (that is, ϕ declines today but it will come back to the initial level tomorrow). What is the effect of this shock on output (Y), consumption (C), interest rate (r) and price level (P)? How does the quantity invested (I) change to the shock in the classical model? (Increase or decrease?)

(g) **(5 points)** Suppose instead that the installation cost of new machine declines **PERMANENTLY**. Does your answer to part (f) change? Why or why not?

(h) **(5 points)** Suppose instead that firms ANTICIPATE a reduction of the installation cost in the future (for example, firms know that the cost will decrease tomorrow). Does your answer to part (f) change? Why or why not?

(i) **(5 points)** Imagine now that the cost ϕ is an INCREASING FUNCTION of the desired amount of capital, say $\phi(K)$ with $\phi'(K) > 0$. If $K = 0$, then the cost is 0, and then, the cost increases with capital. Compared to the constant cost case, does the firm desire more capital, or less capital? Show graphically (*i.e.* using a diagram).

2. **(Total 35 points)** Imagine that a new oil field is discovered in the East Sea, which might lead to a fall in oil prices if the oil field is developed. We will consider two scenarios of how the news of a new oil field affects the economy; [**Scenario 1**] The oil price drop is going to boost supply — that is, for the same amount of inputs, we will get more output since fewer resources will have to be used to pay for oil; [**Scenario 2**] In the short run, the news could create deflationary pressures — that is, since the cost of one key input, energy, becomes lower, firms will charge lower prices overall.

[**Scenario 1**] Consider a CLASSICAL model (with both investment and consumption on the demand side). Suppose that people interpret that the news is a positive TEMPORARY shock on productivity, A . That is, the size of oil field is so small that A_t will increase but A_{t+1} and all future productivity are unaffected.

(a) **(5 points)** What would happen to output (Y), interest rate (r), and prices (P)? Use graph(s) and explain. Can this explain “*Goldilocks economy*”? (Note: A *Goldilocks economy* refers to the ideal state of an economy, with moderate economic growth and low inflation.)

(b) **(5 points)** Suppose that the BOK (a central bank) dislikes price instability, so it wants to change money supply in order to leave the price level unchanged. How does the money supply (M^s) need to change so as to achieve price stability? Use graphs and explain.

(c) **(5 points)** If people interpret that the news is a positive PERMANENT shock on productivity, A , (that is, the size of oil field is huge, so A_t , A_{t+1} , and all future productivity increase), what would happen to output (Y), interest rates (r) and prices (P)? Can this still explain “*Goldilocks economy*”?

[**Scenario 2**] Consider a KEYNESIAN model (IS-LM model). Suppose that people expect that inflation will be lower in the future due to lower prices in energy. To analyze this scenario, we are going to modify the simple Keynesian model by incorporating expectations of individuals. Note that the real interest rate is given (approximately) by:

$$i = r + \pi^e$$

where i is a nominal interest rate, r is a real interest rate and π^e is EXPECTED INFLATION (π^e is a constant). Recall that Keynesian assumes that money market always clears, and the equilibrium condition for money market is:

$$i = \frac{\psi Y}{2 \left(\frac{M}{P}\right)^2}$$

- (d) **(5 points)** Derive a MODIFIED LM equation (representing relationship between r and Y) using the above information.
- (e) **(5 points)** Draw a graph of the IS curve and the modified LM curve. What is difference with what we saw in the class?
- (f) **(5 points)** By interpreting the news of a new oil field as an EXOGENOUS decrease in expected inflation π^e , explain what effects this will have on the economy (Y and r) in the short run. Draw a graph and explain your answers.
- (g) **(5 points)** What could the BOK do to keep the previous level of output (before the news)? Draw a graph and explain your answers. What would happen to the real interest rate?

3. **(Total 20 points)** *Essay questions:* Write up your answers to the following questions, based on the models and the theories we have learned and what we have discussed in the class.

- (a) **(5 points)** Paul Volker said “*The only thing useful banks have invented in 20 years is the ATM*”. What are the effects of a decrease in “cost of going to the bank” (what in class we labeled with ψ) in the CLASSICAL model?
- (b) **(5 points)** What are the effects of a decrease in “cost of going to the bank” in the KEYNESIAN model?
- (c) **(5 points)** Ben Bernanke said “*Monetary policy cannot do much about long-run growth*”. If you were the classical economist, do you agree with him? Why or why not? If you were a Keynesian, do you agree with him? Why or why not?
- (d) **(5 points)** Some people think that a fiscal problem of government deficit causes inflation problem. In fact, Calvin Coolidge once said “*Inflation is repudiation*”. Explain why the fiscal problem can lead to inflation, using the government budget constraint we saw in class.

(End of Exam, Total 3 Pages)