Final Exam Review Questions
EC 308: Macroeconomics

Fall 2022

The final exam is on Tuesday, December 6 from 10 AM - 1 PM in Harbert 328 unless stated otherwise. The exam is cumulative in principle. Here are the problem-solving questions you may want to focus on.

1 Recall that leisure time in our model of the representative consumer is intended to capture any time spent not working in the market, including production at home such as yard work and caring for children. Suppose that the government was to provide free daycare for children and, for the purpose of analyzing the effects of this, assume that this has no effect on the market real wage w, taxes T, and dividend income π. Determine the effects of the daycare program on consumption, leisure, and hours worked for the consumer. Draw graphs to illustrate your answer.

2 Consider the closed-economy one-period (CEOP) macroeconomic model we learned in class. In this model, the representative household chooses consumption C and leisure l that maximizes the utility (given by the function) $U(C, l)$, subject to its budget constraint $C = w(h - l) + \pi - T$, where w is the real wage, π is the firm's profit, and T is the lump-sum tax. Remember that the household also faces time constraint $h = l + N^s$, where h is the total time available to the household and N^s is the household's labor supply. The representative firm uses a production function $Y = zF(K, N^d)$ to optimally choose labor demand N^d that will maximize its profit (π). The government has to satisfy its budget constraint $G = T$. At the competitive equilibrium, quantity demanded must equal quantity supplied in labor markets — such that $N^s = N^d$ — and the output market — such that $Y = C + G$.

1. Using the information given, derive the production possibilities frontier (PPF) as we did in class. Start with the firm's production function. Then use some of the equilibrium conditions provided above to derive the PPF that expresses consumption C as a function of leisure. Must show detailed work to get full credit.
2. Draw the above PPF in a graph in the space below. Then, show competitive equilibrium by drawing the household's indifference curve in the same diagram. Also, draw the consumer's budget constraint correctly. You must label all the axes, points, and curves correctly to get full credit.
3. Define the competitive equilibrium as you learned in class. What are the exogenous variables, and which are the endogenous ones?
4. Show the point where we have competitive equilibrium. Explain your intuition on why we have $MRT_{l,c} = MP_N = MRS_{l,c} = w$ at competitive equilibrium.
5. Is the competitive equilibrium Pareto Optimum? Why?

3 As learned in class, let's now consider the simplified closed-economy one-period (CEOP) model. The representative household chooses consumption C and leisure l that maximizes the utility function $U(C, l)$, subject to its budget constraint. Let's assume that labor is the only input to production so that the representative firm's production function becomes $Y = zF(N^d) = zN^d$. The firm optimally chooses labor demand N^d that will maximize its profit (π). The government has to satisfy its budget constraint $G = T$. At the competitive equilibrium, quantity demanded must equal quantity supplied in labor markets — such that $N^s = N^d$ — and in the output market — such that $Y = C + G$. Now assume that there is distortionary proportional tax t on labor income. Consequently, the consumer's budget constraint becomes $C = w(1-t)(h-l) + \pi$, where w is the real wage, t is the proportional tax, and π is the firm's profit. Notice that there is no lump-sum tax (T) in this model. The Household's time constraint is $h = l + N^s$, where h is the total time available to the household and N^s is the time the household spends supplying labor.

(a) Derive the production possibilities frontier (PPF). To do this, start with the firm's production function $Y = zN^d$. Then use the equilibrium conditions that $Y = C + G$ and $N^s = N^d = h - l$ to substitute for Y and N^d, respectively, in the production function. Finally, express consumption as a function of leisure. That is, C should be the only variable on the left-hand side of the PPF equation. Please show your work in detail to get full credit. No need to draw the graph.

(b) Show that the firm will earn zero profit ($\pi = 0$) at equilibrium. Remember that $\pi = Y - wN^d$ is the firm's profit function here. Use the fact that $Y = zN^d$ to substitute for Y in the profit function. Then argue a relationship between w and z at equilibrium(hint: whether $w > z$, $w < z$, or $w = z$). Once you know the relationship between w and z at equilibrium, then show that firm earns zero profit at equilibrium. No need to draw the graph.

(c) Update the consumer's budget constraint considering firm's zero profit. In other words, given consumer's budget constraint is $C = w(1-t)(h-l) + \pi$, show how it looks when profits are zero ($\pi = 0$). No need to draw graph.

(d) In the diagram below, label the budget constraint and the PPF you just derived above. Which point represents the competitive equilibrium? Which one represents the Pareto Optimum? In *no more than two sentences*, explain why competitive equilibrium and the Pareto optimum are different in *this* case.

(e) Based on the diagram in part (d), determine what happens to consumption (C), leisure (l), wage (w), labor supply (N^s), GDP (Y), and consumer's welfare as a result of a distortionary proportional tax on wage income. You need to give reasons/intuition behind your answers for full credit.

4 In the CEOP model, what are the macroeconomic effects of a fall in oil prices? Note that this event is equivalent to an increase in the total factor productivity, z. Draw a graph to illustrate. Do not forget to talk about SE and IE.

5 What does the First Welfare Theorem say? Why is competitive equilibrium not usually socially efficient (Pareto Optimum)?

6 A household's income in the current period is $y = 95$, and income in the future period is $y' = 115$. The household pays lump-sum taxes $t = 15$ in the current period and $t' = 10$ in the future period. The real interest rate r is 0.05, or 5%, per period.

1. Determine the household's lifetime wealth.
2. Suppose that a household's preferences are such that it wants to have equal consumption in both periods, meaning $c = c'$. Using your solution from Part (1) along with the lifetime budget constraint, determine what this representative household's optimal current-period and future-period consumption are. What is the optimal saving? Round up your answers to the second decimal. Is the household a lender or a borrower? Why?
3. Now suppose that instead of $y = 95$, the household has $y = 140$. Again, determine optimal consumption in the current and future period and optimal saving assuming the same preferences as in part (2). Round up your answers to the second decimal. Is the household a lender or a borrower? Explain how things change compared to Part (2).
4. Go back to $y = 95$. Now, suppose the real interest rate increased to $r = 0.1$ or 10%. Determine the household's lifetime wealth, optimal current-period consumption, optimal future-period consumption, and optimal saving using the assumption that the household's preferences are such that it wants to have equal consumption in both periods ($c = c'$). Round up your answers to the second decimal. Explain how things changed compared to Part (2).
5. Now let $y = 140$ and the interest rate is $r = 0.1$. Determine the household's lifetime wealth, optimal current-period consumption, optimal future-period consumption, and optimal saving using the assumption that the household's preferences are such that it wants to have equal consumption in both periods ($c = c'$). Round up your answers to the second decimal. Explain how things changed compared to Part (3).

6. In about two sentences, explain how c, c', and s changed after an increase in the real interest rate across Part (4) and Part (5). (Hint: think about whether the household is a borrower or a lender. Also, think about how the income and substitution effects behave given this household's preferences ($c = c'$).)

7 Assume that the Ricardian Equivalence theorem holds. With the help of a graph, show how government borrowing affects private savings.

8 What is the Ricardian Equivalence Theorem? Illustrate it with the help of a graph. What assumptions is it based on? Do they hold in real life?

9 Consider the dynamic model we learned in class. Illustrate the Permanent Income Hypothesis, as we did in class. Be sure to draw the graph.

10 In the two-period model, how does an increase in interest rate affect the borrower consumer? Analyse the effect on c, c', and s. You must analyze the SE and IE to get full credit.

11 In the two-period model, how does an increase in interest rate affect the lender consumer? Analyse the effect on c, c', and s. You must analyze the SE and IE to get full credit.

12 In the dynamic model (the two-period model) learned in class, we assumed that individuals who are born in the current period live for sure until the next period. Now assume that in fact, people could die before the next period. If people knew that the chance that they will be alive in the next period is just 50 percent, how would this affect their consumption-savings decisions? In other words, how would this affect c, c', and s in the model you learned in class?

13 Let's explore the implications of Ricardian Equivalence using some numbers. Suppose the real interest rate r is 5% or 0.05. The government is facing an exogenous amount of spending $G = 9$ this period and $G' = 11.55$ in the future period. For simplicity, let's assume that this economy has one representative household (that is, $N = 1$) that pays lump-sum tax $t = 10$ in the current period and a lump-sum tax $t' = 10.5$ in the future period. Given these numbers, please answer the following questions.

1. Show that the government's inter-temporal budget constraint(aka the government's present value budget constraint) holds. Hint: the government's inter-temporal budget constraint looks like this

$$\frac{1}{N}\left(G + \frac{G'}{1+r}\right) = t + \frac{t'}{1+r}$$

2. Suppose that the household's preferences are such that it wants to have equal consumption in both periods, meaning $c = c'$. Suppose $y = 100$, $y' = 105$, and solve for c and c' for the representative household. Is the household a borrower or a lender? How much is it borrowing/lending?

3. Suppose the government decides to give a huge tax cut today so that t decreases from 10 to 7. Since the government must balance its inter-temporal budget constraint, it will have to raise taxes tomorrow (raise t') to pay back the debts it incurs today. In this case, how much will the future tax, t' be?

4. Compute c and c' for this representative household as the current tax goes down to $t = 7$ and t' equals the value that you calculated in Part (3). Does the Ricardian Equivalence theorem hold in this case? How much is the household borrowing/saving now? Explain briefly.