ECON4310 – Macroeconomic Theory

This is some important information about the written exam in ECON4310. Please read this carefully before you start answering the exam.

Date of exam: Friday, November 23, 2018

Time for exam: 09.00 a.m. – 12.00 noon

The problem set: The problem set consists of 3 exercises (A-C) with several subquestions. They count as indicated.

Sketches: You may use sketches on all questions. You are to use the sketching sheets handed to you. You can use more than one sketching sheet per question. See instructions for filling out sketching sheets on your desk. It is very important that you make sure to allocate time to fill in the headings (the code for each problem, candidate number, course code, date etc.) on the sheets that you will use to add to your answer. You will find the code for each problem under the problem text. You will NOT be given extra time to fill out the "general information" on the sketching sheets (task codes, candidate number etc.).

Access: You will not have access to your exam right after submission. The reason is that the sketches with equations and graphs must be scanned in to your exam. You will get access to your exam within 2-3 days.

Resources allowed: No written or printed resources - or calculator - is allowed (except if you have been granted use of a dictionary from the Faculty of Social Sciences).

Grading: The grades given: A-F, with A as the best and E as the weakest passing grade. F is fail.

Grades are given: Friday 14 December 2018.

2

Short Questions (40 Points)

Answer each of the following short questions. You will only get points for correct answer with an explanation.

Exercise A.1: (20 Points) Ricardian Equivalence

You are advisor to the Swedish king in 1618, right at the onset of the 30-year war in Eu-rope between protestant forces, led by Sweden, and catholic forces, led by the German emperor. The cost, per capita, of the war for the next thirty years, is 10, 000 kroner. The king has come up with three policies to finance the war:

a Finance the war with immediate taxes of 10, 000 kroner.
b Issue government debt, and repay that debt, including interest, in the 30 year period after the war (1648-1678).
c Issue government debt and simply pay the interest on that government debt forever, without ever redeeming the debt itself.

Assume that the interest rate for a 30 year period is r = 100% (so that 1 + r = 2).

Now consider Snorre Viking, a Swedish fisherman that lives from 1618 to 1678, that is, for 2 periods lasting 30 years each. By selling his fish he earns 15, 000 kroner in the first period of his life and 30, 000 kroner in the second period of his life (he gets better catching fish with experience). Snorre has utility function

$$log(c_1) + log(c_2)$$

1 **A1.1** (6 points)

Assume that Snorre can borrow and lend freely in the financial market. How does Snorre rank policies a., b. and c., that is, which one does he like best and which one is worst for him? Explain.

Fill in your answer here and/or on sketching paper

Format

Words: 0

Maximum marks: 6

2 **A1.2** (7 points)

Now suppose that Snorre cannot borrow any longer. How does Snorre rank policies a., b. and c., that

is, which one does he like best and which one is worst for him? Explain.

Fill in your answer here and/or on sketching paper

Format

Words: 0

Maximum marks: 7

3 **A1.3** (7 points)

Finally, suppose that Snorre eats so much healthy fish that he lives forever and that he can borrow. All other things remain the same. How does Snorre rank policies a., b. and c., that is, which one does he like best and which one is worst for him? Explain.

Fill in your answer here and/or on sketching paper

Format

Words: 0

Maximum marks: 7

4 **Exercise A.2: (10 Points) Permanent Technology shocks in Real business cycle model and**

Consumption Response

Consider a simple two-period model of labor supply, as we have seen in lectures, where we assume that utility is separable in consumption and labor supply:

$$\max_{\{c_0,c_1,h_0,h_1,a_1\}} \log c_0 - \phi\frac{h_0^{1+\theta}}{1+\theta} + \beta[\log c_1 - \phi\frac{h_1^{1+\theta}}{1+\theta}]$$

$$s.t.$$

$$c_0 + a_1 = w_0 h_0 + (1+r_0)a_0$$

$$c_1 = w_1 h_1 + (1+r_1)a_1$$

for given $a_0 = 0$. Assume r_0 , r_1 are exogenously given. We know the household has the following intertemporal labor supply condition:

$$\beta\frac{\phi h_1^{\theta}}{\phi h_0^{\theta}} = \frac{w_1}{(1+r_1)w_0},$$

and the solution for h_0 is given by:

$$\phi h_0^{1+\theta}\left[1+\left(\frac{w_1}{(1+r_1)w_0}\right)^{1+\frac{1}{\theta}}\beta^{-\frac{1}{\theta}}\right] = (1+\beta).$$

Suppose there is a permanent change to wages at the beginning of time 0: both wages in the first and second period increase by 10%. Then this household will take advantage of this opportunity and consume more in c_0 by 10%.

True or false?

Fill in your answer here and/or on sketching paper

Format | B I U x_2 x^2 | I_x | | | | | | | Ω | | | Σ | ABC | |

Words: 0

Maximum marks: 10

5 Exercise A.3: (10 Points) Consumption and Saving with Worker Heterogeneity

Consider households' optimal intertemporal consumption choice in a two-period model. Suppose there are two types of workers in the economy, type A with constant wages w_a over time and type B with constant wages w_B, with $w_B = (1+10\%)w_A$. Both of them begin with 0 initial assets. Households have preferences $U = \sum_{t=0}^{1}\beta^t u(c_t)$where $\beta \in (0,1)$ is the discount factor and the momentary utility function is

$$u(c_t) = \frac{c_t^{1-\theta}-1}{1-\theta}, \theta > 1.$$

Also, assume the risk-free interest rate *r* is constant. Assume $\beta(1+r) < 1.$

Denote the optimal consumption for type-A household as $(c_0^A, c_1^A), and (c_0^B, c_1^B)$ for type-B household. The we know type-B workers will have relatively lower consumptions in the first period, i.e., $c_0^B < (1+10\%)c_0^A$.

True or false?

Fill in your answer here and/or on sketching paper

Format | B I U x_2 x^2 | I_x | | | Ω | | | Σ | ABC | |

Words: 0

Maximum marks: 10

3

A Four Period Model

For the entire question, the interest rate is *r = 0*. First consider a household that lives for four periods. It has utility function

$$log(c_1) + log(c_2) + log(c_3) + log(c_4)$$

and income in the four periods of $y_1 = 10,000, y_2 = 10,000, y_3 = 50,000 \; and \; y_4 = 10,000$

1 (5 Points)

Compute the optimal consumption choices (c_1, c_2, c_3, c_4)

Fill in your answer here and/or on sketching paper

Format

Words: 0

Maximum marks: 5

2 (10 Points)

Suppose the household cannot borrow. Now what are the optimal consumption choices?

Now consider two members of the same dynasty that both live for two periods. Children have utility function

$$log(c_3) \; + \; log(c_4)$$

and parents have the utility function

$$log(c_1) + log(c_2) + V(b)$$

where b are the bequests left to the children and $V(b)$ is the maximal utility children can obtain when given bequests b. Income of parents is $(y_1, y_2) = (10,000, 10,000)$and that of children is $(y_3, y_4) = (50,000, 10,000)$.

Fill in your answer here and/or on sketching paper

Format | B I U x₂ x² | Tx | | Ω | Σ |

Words: 0

Maximum marks: 10

3 (10 Points)

Solve the maximization problem of the children to obtain V(b), that is, solve

$$V(b) = \max_{c_3, c_4} \log(c_3) + \log(c_4)$$
$$s.t.$$
$$c_3 + c_4 = 60,000 + b$$

Fill in your answer here and/or on sketching paper

Format | B I U x₂ x² | Tx | | Ω | Σ |

Words: 0

Maximum marks: 10

4 (15 Points)

Use your answer from the previous question to solve the parents' maximization problem. *Allow bequests to be negative.*

Fill in your answer here and/or on sketching paper

Format | B I U x_2 x^2 | I_x | | | | | | Ω | | | ∑ | ABC | |

Words: 0

Maximum marks: 15

5 (10 points)

Repeat question B.4, but now assume that bequests cannot be negative (that is, assume a constraint of the form $b \geq 0$). You don't have to do any calculations, but you have to explain your anwer.

Fill in your answer here and/or on sketching paper

Format | B I U x_2 x^2 | I_x | | | | | | Ω | | | ∑ | ABC | |

Words: 0

Maximum marks: 10

6 (10 Points)

Bequests still cannot be negative. Now suppose the government increases taxes in period 2 by 5,000 and gives back 5,000 in subsidies in period 3. What is the optimal consumption allocation now. Again you don’t have to do any calculations, but you have to explain your answer.

Fill in your answer here and/or on sketching paper

Format

Words: 0

Maximum marks: 10

4

A real business cycle model

Consider a representative household of a closed economy. The household has a planning horizon of two periods and is endowed with the following preferences over consumption, *c*,

$$U = u(c_1) + \beta E u(c_2(s_2)),$$

with the following marginal utility

$$u'(c) = c^{-\gamma}, \gamma \geq 1.$$

The variable s_2 denotes the state of the economy in the second period which follows the stochastic process

$$s_2 = \begin{cases} s_G, \text{ with prob. } p \\ s_B, \text{ with prob. } 1-p, \end{cases}$$

and the household conditions the consumption, $c_2(s_2)$, in the second period on the state, s_2. Assume the household's labor supply is exogenous and always equal to 1.

Labour market assumptions:

Assume that in each period and in each state of the economy, s_t, there is a linear (in labor n_t) production technology of the form

$$y_t(s_t) = A_t(s_t) n_t(s_t),$$

and the labor market is assumed to be perfect competitie. Assume tha labor productivity in the firs period is given by $A_1 = A$, and the labor productivity is higher in the good state of the second period,

$$A_2(s_G) = A + A(1-p)\epsilon > A_2(s_B) = A - Ap\epsilon, \quad \epsilon > 0, A > 0, 0 < p < 1,$$

than in the bad state of the second period. The wages are denoted as w_1, $w_2(s_G)$and $w_2(s_B)$.

Asset market assumptions:

Assume the household does have access to a risk-free asset, a_2, and the associated interest rate is denoted as r_2.

1 (5 Points)

Find the equilibrium wages, w_1, $w_2(s_G)$, and $w_2(s_B)$, and show that the expected wages in the second period is the same as wage in in the first period.

Fill in your answer here and/or on sketching paper

Format

Words: 0

Maximum marks: 5

2 (5 Points)

Write down the state-by-state budget constraints for the household.

Fill in your answer here and/or on sketching paper

Format

Words: 0

Maximum marks: 5

3 (10 Points)

Let $(\lambda_1, \lambda_2(s_G), \lambda_2(s_B))$ denote the Lagrange multipliers of the state-by-state budget constraints. State the representative agent's Lagrangian. (Note that the expected utility for the second period is the summation of utility across good and bad states, weighted by probability, i.e., $\mathbf{E}u(c_2(s_2)) = pu(c_2(s_G)) + (1-p)u(c_2(s_B)).$)

Fill in your answer here and/or on sketching paper

Format

Words: 0

Maximum marks: 10

4 (10 Points)

Derive the optimality conditions with respect to consumption, $(c_1, c_2(s_G), c_2(s_B))$ and savings, a_2 by using multipliers.

Fill in your answer here and/or on sketching paper

Format | B I U x_2 x^2 | I_x | | | | | | Ω | | | ∑ | ABC | |

Words: 0

Maximum marks: 10

5 (10 Points)

Derive the stochastic consumption Euler equation (it only involves with $c_1, c_2(s_2), \beta \; and \; r_2$ and No multipliers).

Fill in your answer here and/or on sketching paper

Format | B I U x_2 x^2 | I_x | | | | | | Ω | | | ∑ | ABC | |

Words: 0

Maximum marks: 10

6 (10 Points)

For *(f)* and *(g)*, assume that the asset a_2 is available in zero supply. What is the household's optimal choice of a_2 in the equilibrium? What are the household's optimal choices of consumption? Can the household fully smooth consumption? i.e., are $c_1, c_2(s_G)\ and\ c_2(s_B)$equal?

Fill in your answer here and/or on sketching paper

Format | B I U x_2 x^2 I_x | Ω | ∑ | ABC

Words: 0

Maximum marks: 10

7 (10 Points)

Is the equilibrium interest rate r_2 higher or lower than $r_{RN} \equiv \frac{1}{\beta} - 1$? Why? (Hint: do it step by step: (1) use the budget constraint to link consumption andwages; (2) use the Euler equation and the result, $u'(w_1) \leq \mathbf{E}[u'(w(s_2))]$,which comes from the Jensen's inequality.)

Fill in your answer here and/or on sketching paper

Format

Words: 0

Maximum marks: 10