Macroeconomics Comprehensive Examination: August 2009

Instructions. There are two parts to this exam. Part A consists of three short answer questions, each are worth 10 points. Part B consists of three multi-part questions: each multi-part question is worth 50 points. The exam is designed to take three hours to complete and the total points on the exam are 180, so that there is one point per minute. Budget your time carefully. Your exam number (e.g. E3) and question number (e.g. QB2) should appear on the top of every page of your answers.

A. Short Answer Questions (30 minutes: 30 points)

Instructions. Each of the following statements contains one or more assertions that are either True, False or Uncertain. Classify each assertion as either True, False or Uncertain and **defend** your choice. Be as specific (this means support your words with at least the outline of a model) as possible in defending your choice as your success is largely determined by how well you defend your choice. Each statement is worth 10 points for a total of 30 points.

1. In the household dynamic optimization problem, the labor supply decision is independent of the portfolio decision.

2. In macroeconomic models with sticky nominal wages, the real wage must be procyclical.

3. In a dynamic game without commitment between the government and the public, as the length of the punishment phase increases, the set of Pareto efficient allocations gets larger.

B. Multipart Questions (2.5 hours: 150 points)

Instructions. Do all of the multi-part questions below. Each question is worth 50 points in total, but the subcomponents are not weighted equally.

Question 1.

Consider an overlapping generations model, with an infinite horizon and two period lived agents. There is no population growth. The number of agents born in each generation is 1.

Agents work and produce output in youth and consume in old age. Agents are endowed with a unit of time in youth and a production function such that working n units of time produces $y = n$ units of the single consumption good. Agents' utility is increasing and concave in consumption and is decreasing and convex in hours worked. There is a fixed stock of fiat money. [Up to this point, this is the standard production economy from class notes.]

Each period the government levies a lump-sum tax on young workers of τ. The per capita tax of τ is used to produce G units of the consumption good, per capita. The old age consumption of agent is the sum of their private consumption plus γG, where γ is a preference parameter.

1. Find the difference equation in n_t for $t = 1, 2, 3, ...$, where n_t is the level of employment of a representative generation t agent, which characterizes the equilibrium of this economy. What happens to this difference equation as G increases? What happens when $\gamma = 1$?[20 points]

2. Suppose there are two regions in this economy. The population share of agents in region 1 is $\phi^1 \in (0, 1)$. A lump-sum tax of τ is imposed on all agents in the economy. Suppose that the central government spends all the tax proceeds only on region 1 agents. Find the steady state of this economy assuming $\gamma = 1$. Across steady states, show that an increase in G will reduce employment in region 1 and increase employment in region 2. [25 points]

3. If G is random, how would you define a SREE for this two-region economy? [5 points]

Question 2.

Consider the following infinite horizon problem with money and capital. The representative household has preferences

$$\sum_{t=0}^{\infty} \beta^t u(c_t)$$

where u is strictly increasing, concave, and differentiable and $\beta < 1$. Households own a technology to produce $y_t = K_t^{\alpha}$. Capital depreciates at rate δ. Households can purchase capital, but they must use money for a fraction $\gamma \leq 1$ of the purchase (this is similar to a margin requirement in finance). That is $\gamma P_t K_{t+1} \leq M_t$ where P_t is the price level (number of dollars it takes to buy a good) and M_t is the household's beginning of period t money holdings. Agents receive nominal income $P_t y_t$ as well as a lump sum money transfer $P_t \tau_t$and have nominal consumption expenditure of $P_t c_t$. The money supply M_t^s evolves according to

$$P_t \tau_t = M_{t+1}^s - M_t^s. \tag{1}$$

where $M_{t+1}^s = (1+\mu) M_t^s$ and μ is the money growth rate.

1. State the household's decision problem. [5 points]

2. Define a competitive equilibrium. [7.5 points]

3. Under what conditions does a steady state competitive equilibrium with a binding margin requirement exist where real allocations are independent of time but the price level P_t rises over time at rate μ? [20 points]

4. How does the steady state capital stock vary with respect to money growth μ and margin requirement γ? [17.5 points]

Question 3.

Consider the following 2 period model. Agents begin the first period with one of two earnings levels y_n, $n \in \{H, L\}$ with $y_H > y_L$. Next period's earnings $y_{n'}$ are uncertain but persistent. Specifically, $\pi_{n,n'} = prob\{y_{n'}|y_n\}$ is the probability that an agent with current income y_n has income $y_{n'}$ next period, $n, n' \in \{H, L\}$. An intermediary offers agents the possibility to borrow or lend in the first period in order to smooth intertemporal consumption. In particular, an agent of type n can borrow a quantity of goods $a'_n < 0$ in the first period at price $q(a'_n, n) < 1$ with the promise to pay back provided they do not default. In the event of default, they needn't pay a'_n back but they suffer a loss proportional to their second period income $y_{n'}(1-\tau)$, where $\tau \in (0, 1)$. Banks must make zero present discounted profits on each type n dependent contract they offer with discount rate $1/(1 + r)$.

1. Formulate a household of type n's problem. [10 points]

2. State the intermediary's zero profit condition. [5 points]

3. If a type n agent begins period 2 with borrowings a'_n, when will that agent default? Which type of agent is more likely to default? Hint: you might want to characterize the default decision in terms of thresholds defining $\overline{a}_n$ as the level of borrowings where the agent is indifferent between paying back and defaulting. [15 points]

4. What is the equilibrium price function $q(a'_n, n)$? [5 points]

5. If the intermediary cannot observe the agent's type, what incentive compatibility conditions must be satisfied to get the two types to reveal their type truthfully? What implications does this have for borrowing constraints? [15 points]