Noah Williams
Department of Economics
University of Wisconsin

Economics 702
Macroeconomics
Spring 2019

Midterm Examination

Instructions: This is a 75 minute examination worth 100 total points. **ANSWER ALL THREE** of following questions. Point values for each question are marked.

In order to get full credit, you must give a clear, concise, and correct answer, including all necessary calculations. Notes and books will not be permitted. Explain your answers clearly and use graphs when helpful.

1. **(30 points)** Consider a static model where each leisure hour has a productivity of θ, so that the household problem is:

$$\max_{c,l} U(c, \theta l) \quad \text{s.t. } c = w(h - l) + \pi$$

where w is the wage, h is total hours available, and π is unearned income.

(a) How does an increase in leisure productivity θ affect labor supply? Consider the effects on both intensive (changes for those already working) and extensive (whether to work at all) margins.

(b) Suppose that there is also a representative firm that maximizes profits with a constant returns to scale production function $F(K, N)$, and that capital is in fixed supply $\bar{K}$. How does an increase in the leisure productivity θ affect equilibrium employment, consumption, and wages?

2. **(40 points)** This problem works with the dynamic model like we used in class to study optimal allocations, but now we focus on a sub-optimal one. We add a government that funds government spending G_t via proportional taxes. Households have preferences:

$$\sum_{t=0}^{\infty} \beta^t U(C_t).$$

Households own firms and pay a wealth tax τ on accumulated capital, thus they face the sequence of constraints:

$$K_{t+1} = (1 - \tau)[(1 - \delta)K_t] + F(K_t) - C_t$$

(a) Derive the Euler equation which governs the optimal allocation for consumption. That is: write the Lagrangian incorporating the constraints, find the optimality conditions for C_t and K_{t+1} for an arbitrary date t, and combine them to get the Euler equation.

(b) Suppose the government balances its budget so $\tau(1 - \delta)K_t = G_t$, making the resource constraint:

$$K_{t+1} = (1 - \delta)K_t + F(K_t) - C_t - G_t$$

Use this equation to get the dynamics of capital $\Delta K_t = K_{t+1} - K_t$, and the Euler equation from part (a) to get the dynamics of consumption ΔC_t. Sketch the phase diagram.

(c) Suppose that the economy starts in a steady state where capital, consumption, and government spending are constant. Then there is an unanticipated, once-and-for-all permanent increase in government spending to a new higher constant level, financed by an increase in the tax rate τ. What happens to consumption and capital, both on impact and over time?

3. **(30 points)** This problem considers a variation on the basic Solow model with no productivity growth. Suppose that consumers spend more income when capital is higher, so consumption is given by $C = (1-s)Y + hK$, where $s, h > 0$ are both constants. Output is produced via a Cobb-Douglas production function $Y = K^{\alpha}N^{1-\alpha}$ and the population grows at the constant rate n.

   (a) Determine the steady state per-worker quantities of capital, output, and consumption.

   (b) Suppose that the economy is in the steady state and there is an increase in h. What are the effects on the per-worker levels of capital, output, and consumption, both at the time of the change and in the long-run?