EC1340 – Fall 2018
Midterm
10:30-11:50am, October 23, 2018
Matt Turner

You will have 80 minutes to complete this exam. No notes or books are allowed but you may use a calculator. Cell phones and any device with a wireless connection must be off. Anyone still working on their exam after time is called will be subject to an automatic 10 point penalty.

When you write up your answers, your goal should be to (1) be correct, and (2) convince your reader that your answer is correct. Answers which do not achieve these goals will not be awarded full credit. To accomplish the second objective, it is helpful if your work is legible and if all steps are presented, possibly with a line of explanation. Total points =100/Share of total grade =25% .

This exam has TWO pages.

1. (30 points in total) The most recent IPCC report, "Global Warming of 1.5C" makes the case that climate change will begin to have important economic impacts starting in about 30 years. This problem asks you to think about the mitigation costs we should be willing to accept now in order to avoid climate damage in 30 years.

   Let $t = 0,1,2,...$ index years. Suppose that one ton of CO_2 emissions today causes 0\$ of damage for $t < 30$ and 100\$ of damage for $t \geq 30$. Let M denote the amount spent on mitigation at $t = 0$. If the interest rate is r how much will a planner who maximizes the discount present value of consumption be willing to spend on abatement to reduce future damage to zero.

2. (30 points in total) Dell, Jones and Olken derive the following relationship between economic growth rates and climate,

   $$g_{it} = g_i + (\beta + \gamma)T_{it} - \beta T_{it-1},$$

   and estimate

   $$g_{it} = B_0 + (-0.9)T_{it} + (-0.4)T_{it-1} + \epsilon_{it}$$

   for a sample of poor countries (this is from Table 3, Column 2).

   Consider a series of annual temperature shocks, $(T_{i0},T_{i1},T_{i2},T_{i3},T_{i4},T_{i5}) = (0,0,1/2,1/2,1,1)$ and a country for which $g_{i0} = 0$, $Y_{i0} = 1$ and $L_{it} = 1$ for all t.

   (a) (25) Using estimates above, evaluate and plot the path of $1 + g_{it}$ and Y_{it} for $t = 0,...,5$ for i a poor country.

   (b) (5) On the basis of your work above, what do the results above suggest is the effect of this particular path of climate change.

   Hint: Don't forget that g_{it} is a percentage.

3. (22 points in total) Consider the 'savings problem' that we discussed in class. That is,

$$\max_{s,c_1} \frac{c_1^{1-\eta}}{1-\eta} + \frac{1}{1+\rho}\frac{c_2^{1-\eta}}{1-\eta}$$
$$\text{s.t. } W = c_1 + s$$
$$c_2 = (1+r)s$$

where c_t is consumption in period t, s is savings, W is initial income, $\rho > 0$ is the pure rate of time preference, $0 < \eta < 1$ is inequality or risk aversion, and $r > \rho$ is the rate of return to capital. Define $g = c_2/c_1 - 1$ to be the rate of consumption growth.

(a) (15) Derive derive the equation, $\eta g + \rho = r$, that we talked about in class. *Hints: (1) solve the constraints so that you can write c_2 as a function of c_1, (2) organize your first order condition so that you recognize the expression for c_2 from part (1) and substitute, (3) solve for the ratio of c_2/c_1 and substitute with the expression for g (4) take logarithms and recall that $ln(1+x) \sim x$ for x small.*

(b) (5) Restate the equation $\eta g + \rho = r$ in words.

(c) (2) In a few sentences, explain why this relationship is important to an analysis of the problem of climate change?

4. (18 points in total) We discussed each of the following three papers in class

(a) *Adapting to Climatic Challenges: A Progress Report on Studies of the Historical Evolution of Wheat Production*, unpublished working paper by Olmstead and Rhode, 2011.

(b) *Civil conflicts are associated with the global climate*, published in Nature by Hsiang, Meng and Cane, 2011.

(c) *Global climate change, war and population decline in recent human history*, published in the Proceedings of the National Academy of Science (PNAS), by Zhang et al., 2007

For each paper provide a one or two sentence description of; (1) the data on which the paper is based (2 points per paper),(2) the conclusion that the paper reaches (2 points per paper), and (3) why this conclusion is relevant to the economics of climate change.(2 points per paper).

A good answer need not be longer than three or four sentences.