EC314-Fall 2010
Problem Set 1

Matt Turner

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. **Please STAPLE pages together so that we do not lose them.** *(This problem set updated: 18 August 2010)*.

Problems Textbook p26, problems p.26, #1,2,3,4,5,6.

MT1. An infinitely long lasting economy requires G units of gasoline in each year, and would like to to acquire this gasoline in a way that minimizes the discount present value of atmospheric carbon emissions. The economy must choose the share s of gasoline that is to be produced corn (ethanol) and the share $(1-s)$ produced from petroleum.

Suppose that each unit of gasoline produced from petroleum results in one unit of carbon emissions, and one unit of gasoline produced from corn results in $\alpha \in (0,1)$ units of carbon. (Actually, the range of numbers I've seen for this is $\alpha \in [.5,.8]$.) Also suppose that gasoline from corn and from petroleum are indistinguishable from each other, and that, apart from the social cost associated with carbon emissions, both types of gasoline are costless.

In order to grow corn for a unit of gasoline we must cut down forest land that would otherwise sequester 10 units of carbon. That is, in order to grow corn for G units of gasoline each year, at time zero we must cut down at $t = 0$ forests that sequester $10G$ of carbon.

(a) What share of ethanol minimizes the discount present value of carbon? To answer:
- find annual carbon emissions per unit of gasoline as s varies,
- find carbon emissions at $t = 0$ as a result of deforestation as s varies,
- calculate the sum of annual carbon emissions and initial carbon emissions over $t =$ 0,1,2,.... Get a nice closed form expression for this sum using what you've learned about evaluating infinite discounted sums. Let δ denote the social discount factor here. Note that δ has a bit of an awkward interpretation here: it is something like your preference to delay carbon emissions.
- Finally, optimize your nice closed form expression by choice of s.

(b) What criteria did you use to assess the optimal fuel policy? Describe two problems with this criteria?