EC313-Fall 2011
Problem Set 3

(Updated 5 October 2011)

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When you write up your answers, your goals should be to (1) be correct, and (2) convince your reader that your answer is correct. It is always helpful if your work is legible and if all steps are presented, possibly with a line of explanation.

In the case of empirical exercises, your goal should be to provide enough information to allow a reader to replicate your answer. This requires a description of data and data sources as well as a description of your analysis of the data.

Answers which do not achieve these goals will not be awarded full credit.

Problems

1. The object of this exercise is to try replicate figure 16 from 'Storms of my Grandchildren'.

   Download the Mauna Loa annual mean CO_2 data from

   `ftp://ftp.cmdl.noaa.gov/ccg/co2/trends/co2_annmean_mlo.txt`

   These data are described on the NOAA Mauna Loa page,

   `http://www.esrl.noaa.gov/gmd/ccgg/trends/#mlo_growth`

   Also download emissions data from

   `http://cdiac.ornl.gov/ftp/ndp006/ndp006.dat`

   These data are described at

   `http://cdiac.ornl.gov/ndps/ndp006.html`

   and a detailed description of the data set is at

   `http://cdiac.ornl.gov/ftp/ndp006/ndp006.txt`

   (a) Use these data to calculate the fraction of emissions that remains in the atmosphere in each year. Mauna Loa gives the concentration of CO_2 in the atmosphere. Your first step is to convert this concentration data into weight. The second step is to make sure that you have the same units of weight in both data sets. The next is to calculate the relevant ratio fore each year and plot the resulting time series.

   (b) You have just calculated the share of CO_2 emissions that remains in the atmosphere. In one or two sentences (only) explain why is this an important number to know.

2. These questions ask you to do some elementary calculations to relate the weight of fuel, emissions,CO_2 concentrations and climate change. You will probably need to refer to the 'useful numbers' given in lecture.

   (a) From Hansen figure 22, estimate the change in atmospheric CO_2 concentrations that would result from burning all coal reserves.

(b) Using Nordhaus' rule of thumb for the relationship between atmospheric CO_2 and climate change, estimate the change in world average temperature in 100 years that would result from burning the world's coal supply tomorrow.

(c) Using figure 25 in Hansen, estimate how much coal we will burn over the next 100 years if the rate of consumption stays constant at 2010 levels.

(d) Again using Nordhaus' rule of thumb, what is the likely impact on climate in 100 years of this slower consumption of coal? (To do this calculation, you can suppose that the impact on climate in 2111 of emissions in 2011 is the same as for emissions in 2110.)

3. This question asks you to think about the estimation of the cost of climate change conducted in Nordhaus and Mendelsohn (1995) that we discussed in class.

(a) Using the notation from lecture, suppose that

$$R = A_0 + A_1 T + A_2 T^2 + A_3 S + \epsilon$$

where R is unit land rent, T is a scalar mean annual temperature, A_1 and A_2 are the parameters we care about, S is the farmer's skill, and ϵ is unobserved determinants of land rent.

Suppose that skillful farmers choose places with the best climate, but that we don't observe the skill of a farmer. We do know, however, that skill depends on climate according to $S = B_0 T - B_1 T^2$ for $B_0 > 0$ and $B_1 > 0$.

Suppose we estimate the model

$$R = \hat{A}_0 + \hat{A}_1 T + \hat{A}_2 T^2 + \epsilon.$$

Will our estimated coefficients of $\hat{A}_1$ and $\hat{A}_2$ measure what we want them too? Explain briefly.

(b) Does this approach overestimate or underestimate the effects of climate on agricultural land rents?