Explanation of files for:
"Projections and uncertainties about climate change
in an era of minimal climate policies"
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Steps for Generating Outputs
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1. All the files listed below are provided to *AEJ: Economic Policy.* This document explains the steps needed to generate the uncertain runs for the study. Those who wish to go right to the DICE model runs can proceed to #4 below.

2. The first step is to generate the five quintiles for each of the five uncertain variables. This step uses EViews, but can be done on any statistical software. The five states of the world for each of the uncertain variables are generated by Monte Carlo methods.

Here are the steps for the current estimates. These are in program "prog-test-discrete-quintiles-081117.prg" These generate 10 million draws and then sort these into quintiles. They are then into an Excel spreadsheet ("quint-calib-121417.xlsx"), in different pages. These are adjusted to ensure that the median equals the mean and that standard deviations are equal to the a priori ones.

3. We calculated the GAMS quintiles in "quint-calib-121417.xlsx," page solvernew. This then produces the following in the GAMS programs listed in #5 below. These then are pasted into the GAMS program after the comment "* Quintiles for the five uncertain variables."

```
parameter loopdamcoef(kkdam) Coefficients for damage equation
/ 1 0.00061 , 2 0.00141 , 3 0.00227 , 4 0.00242 , 5 0.00464 / ;
 parameter loopGA0(kkprod) Coefficients for PROD equation
/ 1 .0075 , 2 0.05, 3 0.076 , 4 0.102 , 5 0.1444 / ;
 parameter loopetscoef(kkets) Coefficients for CLIMATE equation
/ 1 2.00767 , 2 2.51586 , 3 3.1 , 4 3.38802 , 5 4.49126 / ;
parameter loopsig(kksig) Coefficients for emissions intensity
/ 1 -0.02002 , 2 -0.01689 , 3 -0.0152 , 4 -0.01334 , 5 -0.01055 / ;
parameter loopcarb(kkcarb) Coefficients for carbon cycle
/ 1 233.59 , 2 292.95 , 3 360 , 4 394.35 , 5 519.33 / ;
```

4. ***Notes on running GAMS with a large number of loops.***

   On some machines, the program may stop in the middle of a GAMS loop. On inquiring with Gams support, I learned

   > "GAMS has trouble writing a particular file to disk (the instruction file for the non-linear expressions). There are several possible reasons for that. The more frequent ones are a) interference of the virus scanner, and b) use of synchronized folders (e.g. dropbox or google drive) as a working directory. It could also be a simple reason that you are out of disk space. Does it happen with the first iteration or late in the game? Can you provide the entire log of your run?"

   Usually the problem occurs when connected to the Internet and with programs that are making queries. I solved the issue by turning off Dropbox and Sync, and sometimes go on Airplane Mode. These generally solve the problem.

5. ***Programs for runs***

   The DICE model is run on GAMS software. Information is at https://www.gams.com/. Note that the version here requires purchasing the full version and cannot be run on the student version.

   The GAMS program for generating the outputs for the baseline and optimal runs are two self-contained programs. Each has 5x5x5x5x5 SOW (N=3125) different sets of outputs. These are in files "DICE2016R2-Unc-base-v5-55555-083017B.gms" (baseline) and "DICE2016R2-Unc-opt-v5-55555-083017B.gms" (optimal).

6. The output for this is then in "test-new-base-v5-55555-121417.gms.csv" for base runs and "test-new-opt-v5-55555-121417.gms.csv" for optimal runs.

7. These have been collated in "tables-unc-121517.xlsx."

8. We did three different runs for base and two for opt. There were no numerical issues. The solutions for the means and standard deviations were

accurate to 10^-9 for all variables. In earlier simulations, there were numerical problems, but the latest calibrations did not pose difficulties.

However: You should inspect the outputs to see if there are problems. There are sometimes problems in the calculations. Sometimes, there are huge problems, and it is not predictable. These can arise because of numerical complications (bad scaling), or because of the order of runs (as they restart from the last run).

9. To do the response surface function (RSF) method shown in Online Table A-1: The results of the 3125 states of the word were put into an EViews file "rsf-121817-aej-short.wf1." These were observations 1000001 to 1003125. Then the RSF results were simulated using the program "res-tab-all-121717-montecarlo.prg." Note that the results will differ slightly from that table for the RSF because of sampling differences. (The file does not contain the results because it is too large to store easily.)

10. ***Best guess runs***

The best guess runs are set as the median of the uncertain values (also equal to the expected values. These are collated in "BG" in the spreadsheet listed above, "tables-unc-121517.xlsx." Note that this is slightly different from the standard model (DICE-2016R2).