PET Model v1.0 Read Me File

March 28, 2011

These notes describe the compiling procedure, input files, and output files associated with a 9-region, 5-sector version of the PET model version 1.0, used to generate the scenarios reported in O'Neill et al., 2010.[1]

Compiling

The PET model is currently compiled using the Intel Fortran Compiler. Compiling should be done using level 1 optimization, or with optimization disabled, to avoid some numerical issues that can result from higher optimization levels.

The model is composed of two programs. The first program is called CALPET and it is the calibration procedure. The second program is called SIMPET and it is the main simulation model. In both cases compiling requires including the full set of files containing model code (3 files for CALPET, and 4 files for SIMPET, see next section).

Running the model

To run either CALPET or SIMPET, the input files should be in the same directory as the executable file. Currently, we have two sets of input files for two different baseline scenarios used in O'Neill et al. (2010): A2 and B2. To run the model for a given scenario, use the corresponding input files.

CALPET: calibration procedure to generate input files for SIMPET
Code: calpet_9r.for, numfun.for, calblock.for
Input files: precal_*.txt , where "*" varies for each of the nine regions
Output files: postcal1.dat, …, postcal9.dat

To run the code, modify the first three parameters in the CALPET code (lines 14-16) before compiling in order to match the input file names in terms of emission scenario (parameter "esc"), urbanization and population scenario (parameter "scn"), and heterogeity level (parameter "vrs"). See the next section on input files for a description of the file naming convention.

SIMPET: main PET model
Code: simpet.for, ecofun.for, numfun.for, simblock.for
Input files: postcal1.dat, …, postcal9.dat, specs.dat, tecoeff.dat

Input files: CALPET

Input files: precal_*.txt , where "*" varies for each of the nine regions

[1] O'Neill, B.C., Dalton, M., Fuchs, R., Jiang, L., Pachauri, S., Zigova, K. (2010) Global demographic trends and future carbon emissions. *Proceedings of the National Academy of Sciences - USA* 107 (41), 17521-17526.

Precal files have the following naming convention: “precal_X1_X2_X3_X4_X5.txt” where:

X1 region identifier, plus a numeral indicating the total number of regions (e.g., “chn9” for the china region)
X2 scenario identifier (e.g., “A2”)
X3 number of consumption goods (e.g., 4g)
X4 population and urbanization scenario (e.g. “mc” indicates medium population scenario, central urbanization scenario)
X5 heterogeneity identifier, indicating the dimensions of household types that are differentiated in the model. The first letter, “r”, indicates that we use a representative household type, and the following three letters indicate whether or not heterogeneity in age, size, or urban/rural status of households is accounted for. If it is not, an “x” is used; if it is, then an “a”, “s”, or “u” is used. So “rasu” indicates representative household methodology with all three demographic dimensions of heterogeneity accounted for.

Input files: SIMPET

Input files: postcal1.dat, …, postcal9.dat, specs.dat, tecoeff.dat

1. postcal*.dat files are generated from the calibration step using CALPET as described above.
2. specs.dat: The first three blocks are parameters for the Newton method used in the model solution. Those can be changed to solve some numerical issue. sclh, scll, and sclest are scale factors that operate on the pathways of technical change coefficients found in tecoeff.dat
3. tecoeff.dat: technical change coefficient at each time period by region and sector
    a. The file is divided into 4 blocks, divided by “*******”, referring to tech coefficient of four macro regions (ALM, ASIA, OECD and REF) at each time period.
    b. Within each block, the first column is the tech change coefficient values for labor productivity (b_tec), and the rest are for energy productivity (b_e).
    c. For b_e, every four columns are one group and they are the energy productivities of four types of energy included in the PET model as inputs to each industry. Given that there are ten industries (five intermediate, four final goods, investment good), there are 40 (= 4*10) columns total.

Output files: SIMPET

1. Most outputs are documented yearly. Each row is one year.
2. Aggregated results: total quantities at each time period for every region. Row is time and column is region. NT+1(=101) rows and NR(=9) columns
    a. ghg.txt: CO2 emissions. Unit: million tons of carbon
    b. gnp.txt: GDP. Unit: trillion base year $.
    c. pop.txt: Population. Unit: million

    d. capagg.txt: Total capital. Unit: trillion $
    e. tax.txt: Carbon tax rate. Unit: billion $/million ton of carbon
3. Demand: demand of inputs by each industry at each time period for every region. Row is time. Every 11 columnsis one block, for each region. Industries are 5 intermediate, 4 consumption goods, investment, and government. NT+1(=101) rows and 11*NR(=99) columns.
    a. coal.txt: demand for coal by each sector. Unit: billion $
    b. elc.txt: demand for electricity by each sector. Unit: billion $
    c. og.txt: demand for oil and gas by each sector. Unit: billion $
    d. ref.txt: demand for refined fuels energy by each sector. Unit: billion $
    e. mat.txt: demand for materials by each sector. Unit: billion $
    f. cap.txt: demand for capital by each sector. Unit: billion $
    g. lab.txt: demand for labor by each sector. Unit: billion $
4. cigxm.txt: final demands for each time period. Row is time. Every 8 columns is one block, for each region. For each region, the eight columns are the quantities of four consumption goods (Energy, food, transportation and other), investment, government consumption, total exports and total imports. NT+1(=101) rows and 8*NR(=72) columns. Unit: trillion$
5. targ.txt: compares model results to the target values to which the model is tuned in the baseline scenario. For the O'Neill et al. (2010) study, target values were derived from B2 and A2 scenarios developed by IIASA (Riahi et al., 2007). Target values are defined every 10 years. Row is time, referring to year 2010, 2020, …, 2100. First column is the time index. From second column to the last, every 12 columns are one block, for one region. For each region, the 12 columns are separated into 6 groups. Every two columns is one group and refer to GDP (unit: billion $), CO2 emissions (million tonne of carbon), domestic consumption of four types of energy (oil and gas, coal, electricity and refined fuels, unit: EJ). Within each group, the first column is the PET model result and the second column is the target.
6. cons.txt: consumption good prices for each time period. Row is time. The first 18 columns are separated into 9 groups. Every two columns is one group, for one region. Within each group, the first column is the overall consumption price index and the second column is total real consumption value (Unit: billion $). The last four columns are the relative prices for the four consumption goods for Region 1 (CHN) (Base year prices are 1). Prices for the four consumption goods for other regions will be added soon. NT+1(=101) rows and 2*NR+4(=22) columns.
7. ecoeff.txt: energy productivity (b_e) for each period of every region. Row is time. Every 40 columns is one block, for one region. For each region, every four columns are one group, and they are the energy productivities of four types of energy inputs to each industry. NT+1(=101) rows and 4*10*NR(=360) columns.
8. pcon.txt: consumption values for each period of every region. Row is time. Every 4 columns is one block, for each region. For each block, the four columns are consumption values (price*quantities) of the four consumption goods (Energy, food, transportation and other). NT+1(=101) rows and 4*NR(=36) columns. Unit: billion $.

9. pkem.txt: prices for each time period. Row is time. Every 7 columns is one block, for each region. For each region, the seven columns are prices for capital, investment, and five intermediate production goods (oil and gas, coal, electricity, refined fuels, and materials).
10. trade.txt: trade among all regions. All rows are divided into 9 big blocks (regions) and are separated by “Home region” i. Within each big block, there are 9 smaller blocks (regions), separated by blank rows. Each small block documents the trade information between home region i with that specific foreign region (j) for each time period. Within the small block, there are ten columns. Each pair represents exports, and then imports, for a given good. The five goods that are traded are those from the five intermediate industries (oil and gas, coal, electricity, refined fuels, materials).