Readme file for posted estimation programs

"Selection on Moral Hazard in Health Insurance"
by Einav, Finkelstein, Ryan, Schrimpf, and Cullen

The files in this zip file generate the primary results in the paper. To actually run them, the data files are required. The data is proprietary, however, so the actual data files cannot be posted online. For further details about obtaining access to the data files associated with these estimation programs, please contact Liran Einav (e-mail: leinav@stanford.edu) or Amy Finkelstein (e-mail: afink@mit.edu). For questions about the code, please contact Paul Schrimpf (e-mail: schrimpf@mail.ubc.ca).

Running the code

Prerequisites

The majority of the code is for Matlab or GNU Octave. The code has been verified to run in Matlab version 7.10.0.499 (R2010a), and Octave version 3.6.1. Other versions likely work as well. Computationally intensive portions are written as C language mex files. To compile these mex files, you will need a C compiler with OpenMP support (we have tested the code with gcc versions 4.1.2 and 4.6.3). Additionally, the code needs to be linked with LAPACK, NLOPT,[1] MPFR,[2] and ARMS.[3] The file make.m attempts to compile all the mex files. You will likely need to modify make.m to fit your system.

Before running the code you must:

1.Install Matlab or Octave
2.Install gcc or another C compiler with OpenMP
3.(Optional) Install LAPACK (this is included with Matlab or Octave, see make.m for a bit more information)
4.Install MPFR (be sure to run configure with --enable-thread-safe)
5.Install NLOPT
6.Modify make.m
7.Compile the mex files by running make.m

make.m tries to download ARMS automatically, so you should not need to do so.

[1] Johnson, Steven G. (2010). "The NLopt nonlinear-optimization package." http://ab-initio.mit.edu/nlopt.
[2] Hanrot, Guillaume, Vincent Lefvre, Patrick Plissier, Philippe Thveny, and Paul Zimmermann (2010). "The GNU MPFR Library." http://www.mpfr.org.
[3] Gilks, Wally (1997). "Adaptive Metropolis rejection sampling (ARMS)." http://www1.maths.leeds.ac.uk /~wally.gilks/adaptive.rejection/arms.method/arms_method.zip.

Estimation

Execute the script runGibbs.m to produce Markov Chain Monte Carlo estimates of our model. This will take some time. There are many options that can be set in runGibbs.m to produce the various robustness results in append table A8. The options are currently set to produce our baseline estimates.

Graphs and tables

After producing estimates using runGibbs.m, modify postEst/config.m to contain the correct result file name. Then execute postEst/runcf.m. Tables and figures will be created in postEst/tex/tables, postEst/csv, and postEst/figures. Not all of the tables and figures are included in the paper. See the description of m files below for information on the correspondence between the created figures and tables and ones included in the paper.

Description of files

Estimation m-files

- (check.m) Used for debugging. Checks that spending and latent variables are consistent with one another.
- (combineSigOPbeta.m) As described in appendix D, Σ is sampled in various parts. This function combines the parts into Σ.
- (dropBad.m) Deletes observations from data structure.
- (gibbs.m) Runs the main MCMC loop.
- (gqzero.m) Computes Gauss-Hermite nodes and weights.
- (isOctave.m) Returns true if called from Octave and false if called from Matlab.
- (iwishrnd.m) Generates inverse Wishart random matrix. (This can be deleted if you are using Matlab, because Matlab has a builtin version).
- (loadData.m) Reads data from a csv file and stores it in a structure.
- (make.m) Compiles mex files.
- (runGibbs.m) Main script for estimation.
- (setSeed.m) Sets the random number generator seed. The random number generators differ in Octave and Matlab (and across versions of Matlab). This gives a single interface for setting the seed and choosing a reasonable generator.

Estimation C files

- (alcoa.c) Contains functions used by many of the other .c files. These include the utility function, a function to compute choices, and random number generators.
- (alcoa.h) Header file for alcoa.c.
- (chol.c) Cholesky decomposition. The chol() function in Octave seems to hang unexpectedly. This is a replacement. Not needed if using Matlab.
- (findChoicesNMH.c) Compute choices when there is no moral hazard (i.e. spending=λ).
- (findChoices.c) Computes choices.

- (findChoicesMultMH.c) Computes choices for a multiplicative model of moral hazard. Note: these results are not included in the paper.
- (findChoiceNmultMH.c) Computes choices for a multiplicative model of moral hazard when spending=λ. Note: these results are not included in the paper.
- (findValidLatent3.c) Attempts to find values for the latent variables that rationalize the observed choices. Only used to find initial values for our chain.
- (findValidLatentMultMH.c) Attempts to find values for the latent variables that rationalize the observed choices in the multiplicative moral hazard model.
- (kronEye.c) Computes the kronecker product of a matrix and the identity, $x \otimes I$.
- (randdtn.c) Draws random truncated normal variables.
- (sampleLambdaOmega.c) Samples λ and ω as described in appendix D.
- (sampleLambdaOmegaMultMH.c) Samples λ and ω for the multiplicative model.
- (sampleLamlo.c) Samples κ as described in appendix D.
- (sampleMu.c) Samples μ_λ as described in appendix D.
- (samplePsi.c) Samples ψ as described in appendix D.
- (sampleShape.c) Samples γ_2 as described in appendix D.
- (sampleSigL.c) Samples σ_λ as described in appendix D.
- (XtTimesKronSIdTimesY.c) Computes $X'(\Sigma \otimes I)Y$.

Files generating tables and figures

All of these files are in the postEst directory.

- (balance15.m) Find prices such that a given portion of a simulated observations choose plan 5 when only select 1 and 5 offered.
- (config.m) Sets which mcmc results to use for generating tables and figures.
- (exCost.m) Computes expected spending and cost.
- (findcfPrice.m) Compute counterfactual prices as described in table 10.
- (mnrnd.m) Samples from a multinomial distribution. Only needed if using Octave. Matlab has a builtin version.
- (mycorr.m) Computes correlation.
- (mycov.m) Computes covariance.
- (newRep.m) Script that creates tables 8 and 9, and figures 2.
- (p10plot.m) Creates additional figures (not included in paper).
- (paperTablesCSV.m) Creates csv version of table 7.
- (paperTables.m) Creates latex version of table 7.
- (plotLatent.m) Creates additional figures (not included in paper).
- (plotP5psiOm.m) Function to create figure 3.
- (plotSpend.m) Additional function to create figure 3.
- (randInitReport.m) Plots MCMC results (not included in paper).
- (runcf.m) Script that creates all graphs and tables included in the paper.
- (simulate.m) Simulates a dataset.
- (slideTables2.m) Creates figures 3 and 4.

- (spending.m) Computes spending.
- (welfare.m) Creates table 10.
- (writecsv.m) Writes a matrix to a csv file.

Note that the generated figures and latex tables will not exactly match the formatting of the figures and tables in the paper, but the content should coincide. The figures and tables in the paper were created in excel from the csv files created by these programs. The correspondence between the created files and the paper's figures and tables is shown in the table below.

Paper	eps/tex	csv
Figure 2	prefixSpendFlex.eps & prefixSpendSel.eps	prefixspendFlex.csv & prefixspendSelect.csv
Figure 3	prefixP5latent.eps & prefixAXP5latent.eps	prefixP5latent.csv & prefixP5latentAvgXnoCorr.csv
Figure 4	prefixEcond1v2.eps	prefixselectMH.csv
Table 7	prefixParmP.tex	prefixParmPse.csv
Table 8	prefixfit.tex	---
Table 9	prefixds.tex	---
Table 10	prefixs00WelfareP.tex	---