Problem Set #4

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Python Version: 3.5.2

Problem 1

The minimization processes in the 2 estimations of (c) and (d) both succeeded. For acquiring converged results from the algorithms, the estimation settings are as follow:
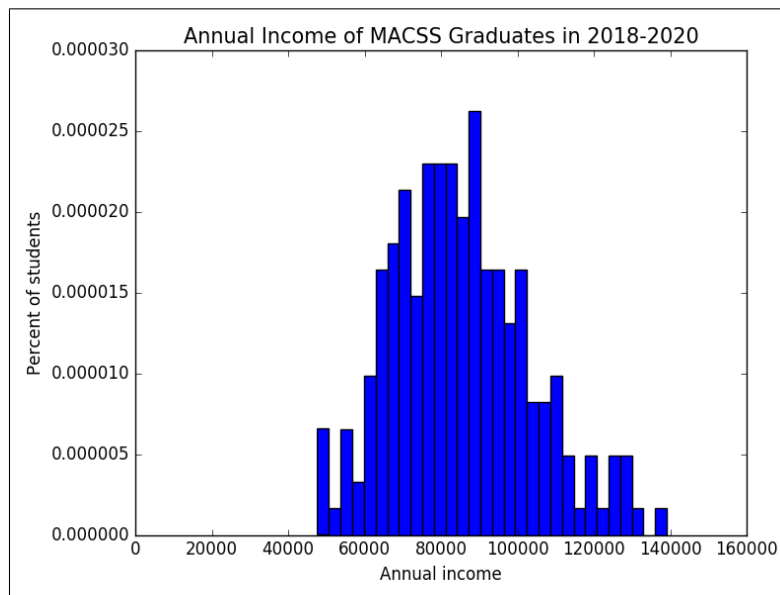(c). error simple mode = False; minimization method = L-BFGS-B.
(d). error simple mode = False; minimization method = TNC.

Part (a). histogram

A histogram of annual incomes of students who graduated in 2018, 2019, and 2020 from the University of Chicago M.A. Program in Computational Social Science.

Figure 1:

Part (b). lognormal pdf function

With $\mu = 5.0$ and $\sigma = 1.0$, and xvals = np.array([[200.0, 270.0], [180.0, 195.5]]),
The lognormal PDF values are [[0.0019079 0.00123533] [0.00217547 0.0019646]].

Part (c). One step SMM with mean and std

One step SMM is estimated with mean and standard deviation as moments and identity weighting matrix. The initial guess of μ is 11 and σ is 0.2, with 300 simulations and 200 observations each.
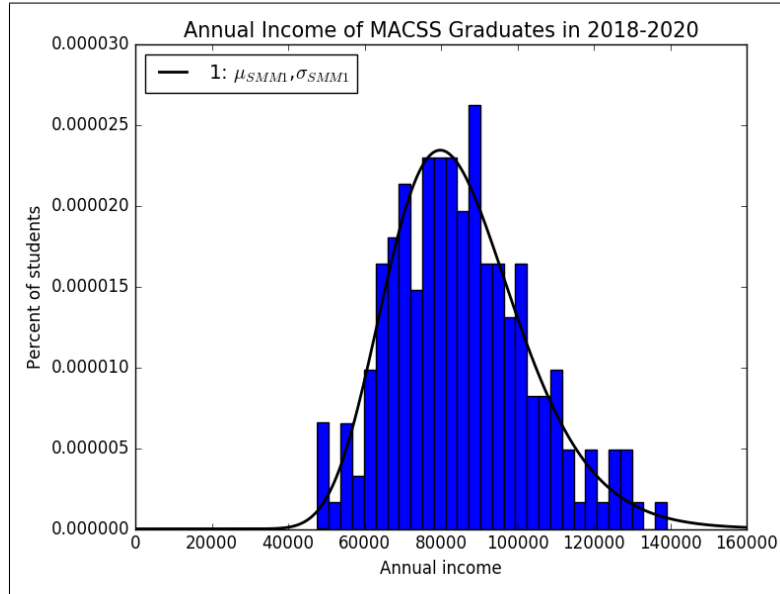The criterion value is 7.20176828929e-14. The estimated parameters are as follows:

$$\mu_{SMM1} = 11.3307149892$$

$$\sigma_{SMM1} = 0.208868329657$$

moments	mean	std^2
data	85276.8236063	323731572.23
model	85276.8464227	323731565.513
(data-model)/data	-2.67557875682e-07	2.07476758571e-08

A lognormal pdf with estimated parameters is plotted.

Figure 2:

Part (d). Two step SMM with mean and std

Two step SMM is estimated with mean and standard deviation as moments and weighting matrix derived from (c). The initial guess of μ and σ is the estimated results from (c).
The criterion value is 0.0120239766133. The estimated parameters are as follows:

$$\mu_{SMM2} = 11.3307146745$$

$$\sigma_{SMM2} = 0.208868331657$$

moments	mean	std^2
data	85276.8236063	323731572.23
model	85276.8196196	323731368.346
(data-model)/data	4.67498781548e-08	6.2979110409e-07

Lognormal pdfs with estimated parameters in previous and this questions are plotted.

Figure 3: