Problem Set #[4]

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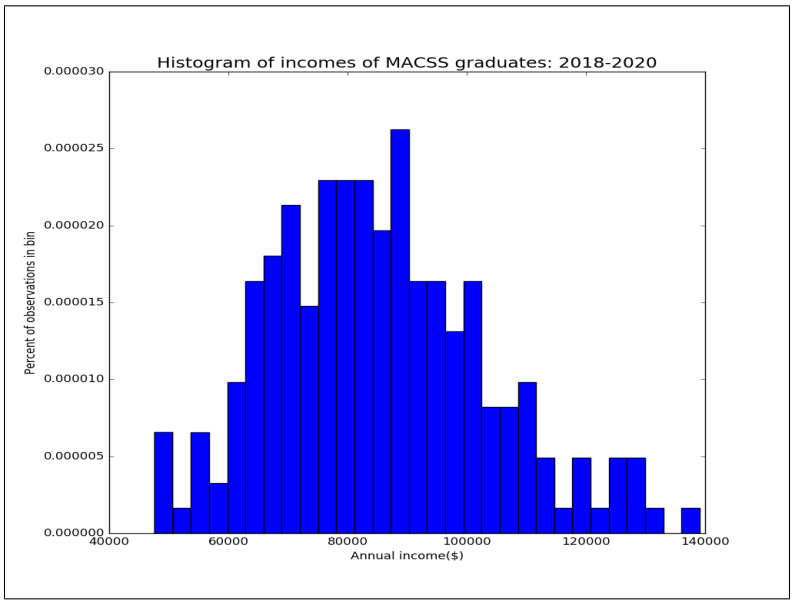
1. Some income data, lognormal distribution, and SMM.

Part (a). Plot a histogram of percentages of the income.txt data with 30 bins.

Answer: Figure 1 is the histogram of percentages of the income.txt data with 30 bins.

Figure 1: Histogram of incomes of MACSS graduates: 2018-2020



Part (b). Write your own function for the lognormal PDF and test your function.

Answer: The array returned is shown below.

$$\begin{bmatrix} 0.0019079 & 0.00123533 \\ 0.00217547 & 0.0019646 \end{bmatrix}$$

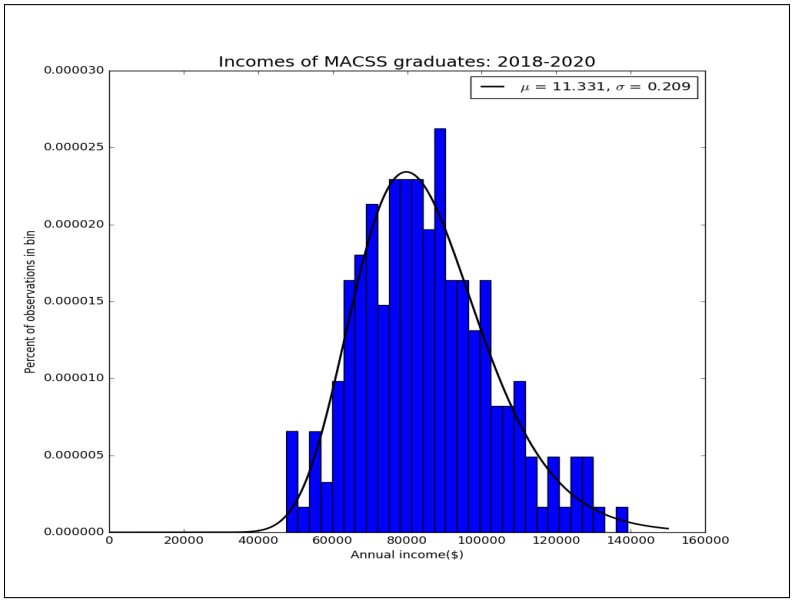
Part (c). Plot your estimated lognormal PDF against the histogram from part (a). Report the value of your SMM criterion function at the estimated parameter values. Report and compare your two data moments against your two model moments at the estimated parameter values.

Answer:

Figure 2 is the estimated lognormal PDF against the histogram from part (a). The value of SMM criterion function at the estimated parameter values is 9.73347968247e-15. And the data moments are $\mu = 85276.8236$, $\sigma = 17992.5421$. And the model moments are $\mu = 85276.8299$, $\sigma = 17992.5415$.

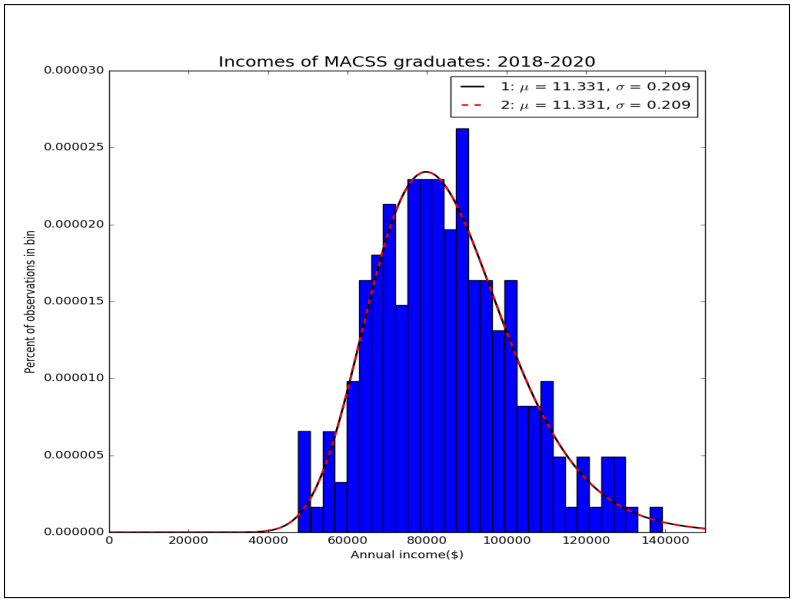
Part (d). Perform the two-step SMM estimator by using your estimates from part

Figure 2: Incomes of MACSS graduates: 2018-2020



(c) with two moments. Report your estimates as well as the criterion function value at these estimates. Plot your estimated lognormal PDF against the histogram from part (a) and the estimated PDF from part (c).
Answer: Figure 3 is the new estimated lognormal PDF against the histogram from part (a) and part (b).

Figure 3: Incomes of MACSS graduates: 2018-2020



The value of SMM criterion function at the estimated parameter values is 0.00123.

And the data moments are $\mu = 85276.8236$, $\sigma = 17992.5421$. And the model moments are $\mu = 85276.8371$, $\sigma = 17992.5437$.
We can see that the two estimations are quite close to each other. However, since these two estimators are weighted by different weighting matrix, so there is no way to compare any of them in terms of criterion function.