# Problem Set #3

MACSS 30100
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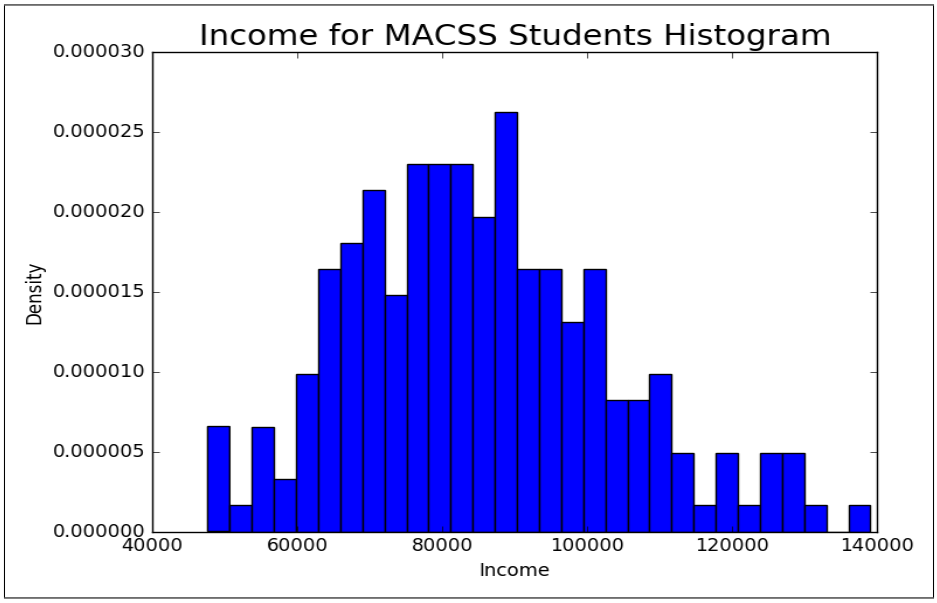
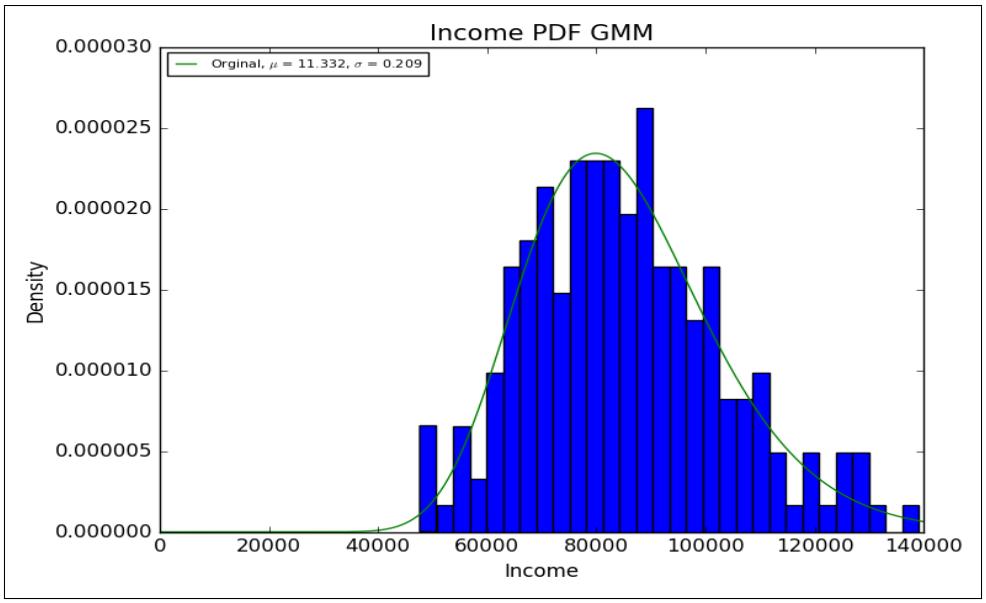
## Problem 1

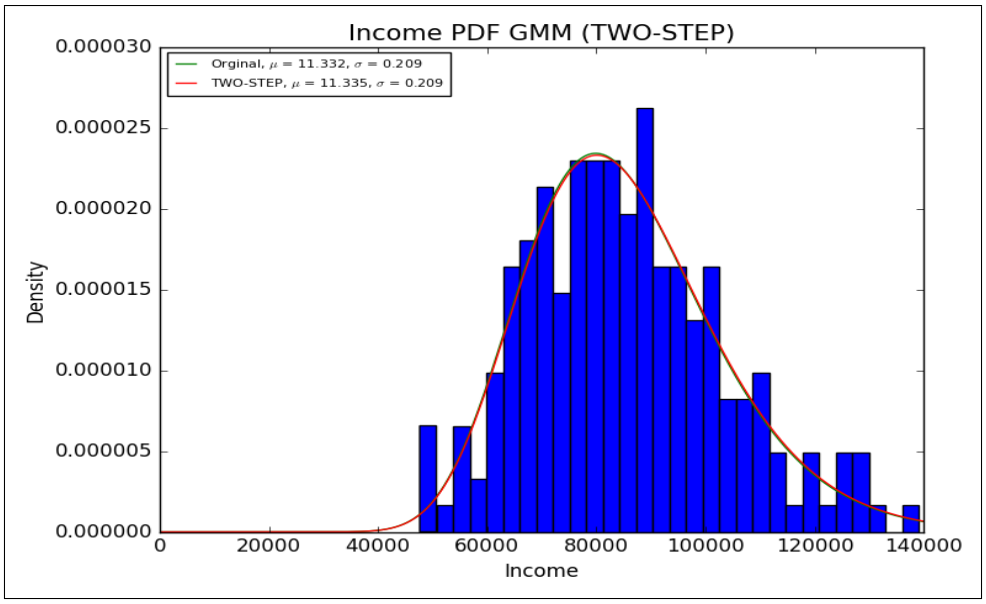
**(a)** The following graph is the histogram for the income of the MACSS Graduates:




**(b)** The GMM estimator of two moment conditions: the log normal parameters are: $\mu = 11.3317738625$, $\sigma = 0.209209064254$.
Mean of data is 85276.82360625808, Variance of data is 325358364.0497777.
Mean of model is 85276.8309999, Variance of model is 325358351.628.
Difference in mean is -0.00739366149355, Difference in variance = 12.4213916063.
The value of the criterion function is $8.97474397e-15$.



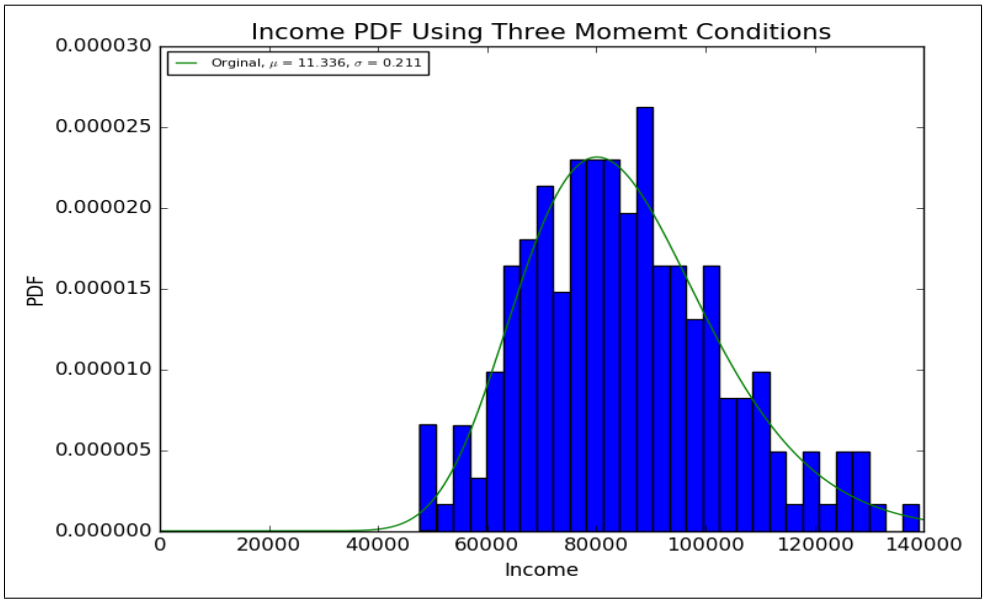

**(c)** The GMM estimator of two moment conditions: the log normal parameters are: $\mu = 11.332$, $\sigma = 0.209$.
Mean of data is 85276.82360625808, Variance of data is 325358364.0497777.
Mean of model is 85277.076, Variance of model is 323732317.170.
The value of the criterion function is 0.00192164




**(d)** The data and model moments are reported as below:
Data moment:
The proportion of students whose income is below $75000 is: 0.3
The proportion of students whose income is between $75000 and $100000 is: 0.5
The proportion of students whose income is above $100000 is: 0.2

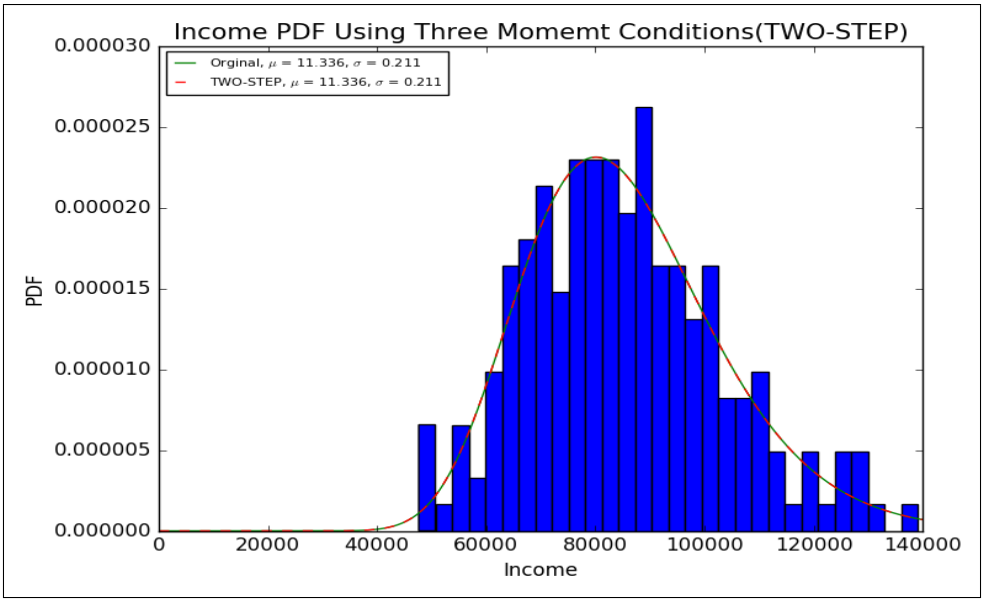
Model Moment:
The proportion of students whose income is below $75000 is: 0.30000000416846334
The proportion of students whose income is between $75000 and $100000 is: 0.4999999996659355
The proportion of students whose income is above $100000 is: 0.1999999961656011

The value of the criterion function is 5.61079401e-12




**(e)** The model moments using the variance covariance weighting matrix is as following:
Model Moment:
The proportion of students whose income is below $75000 is: 0.30040381
The proportion of students whose income is between $75000 and $100000 is: 0.49963281
The proportion of students whose income is above $100000 is: 0.19996338

The value of the criterion function is 2.38464060e-06




**(f)** The model that best fits the data is the one generated using the 3 data quantiles and the inverse of the variance-covariance matrix as a weighting matrix. In other words, the model in (e).

Visually, all of the models look incredibly similar and they all appear to fit the data well. The models from part B and C actually seem quite identical and the models from parts D and E are only very slightly different.

However, one thing that does change quite a bit from model to model is the value generated by the criterion function. This value gives added insight to the fit of the model. Out of all the models I generated, the last had the lowest criterion function value, and since the models are almost identical otherwise, I used this value to judge which is best.

## Problem 2

The estimators are:

$$\beta_0 = 0.2516448071$$
$$\beta_1 = 0.0129334339724$$
$$\beta_2 = 0.400501320985$$
$$\beta_3 = -0.00999168730293$$

The value of the criterion function is 0.00182128984298.