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1 Problem Set 3

1.1 Problem 1

1.a

For a histogram of the income distribution, please see figure 1.

1.b

Using GMM estimation based on μ and σ , the estimates are:

$$\mu_{GMM1b} = 11.337$$

$$\sigma_{GMM1b} = 0.213$$

The value of GMM criterion function with those values is 9.11458867327e-13.

$$\text{Mean of incomes} = 85276.824$$

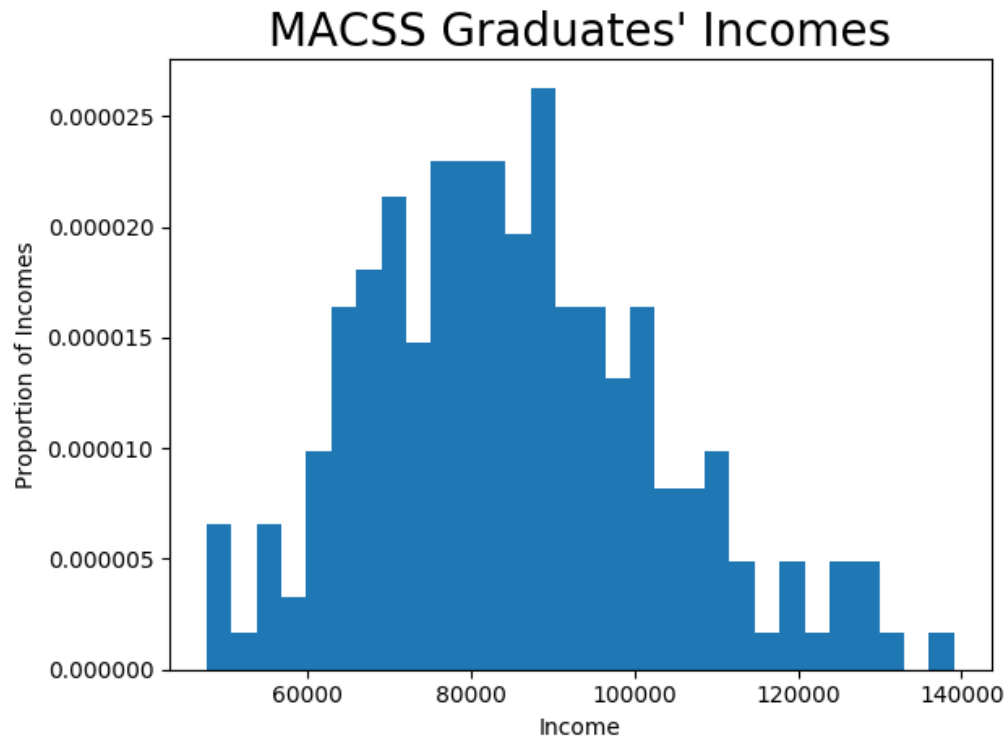
$$\text{Mean of model} = 85276.882$$

$$\text{SD of incomes} = 17992.542$$

$$\text{SD of model} = 17992.530$$

For a histogram of the income distribution along with the estimated PDF, please see figure 2.

Figure 1: Histogram of Incomes of MACSS Graduates (2018–2020)



1.c

Using two-step GMM estimation based on μ and σ , the parameter estimates are:

$$\mu_{GMM1c} = 11.337$$

$$\sigma_{GMM1c} = 0.213$$

The value of GMM criterion function with those values is 1.07136814766e-08.

Mean of incomes = 85276.824

Mean of model = 85276.882

SD of incomes = 17992.542

SD of model = 17992.555

For a histogram of the income distribution along with the estimated PDF, please see figure 3.

Figure 2: Histogram of Incomes of MACSS Graduates (2018–2020) with GMM Estimation Based on μ and σ

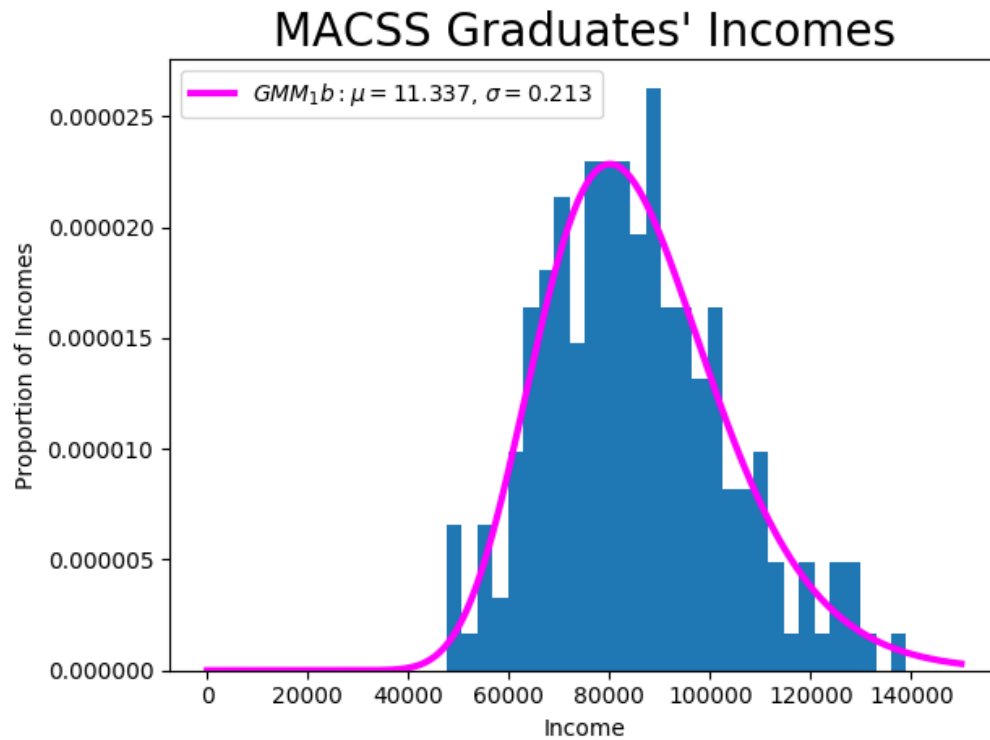


Figure 3: Histogram of Incomes of MACSS Graduates (2018–2020) with GMM Estimation and Two-step GMM Estimation Based on μ and σ

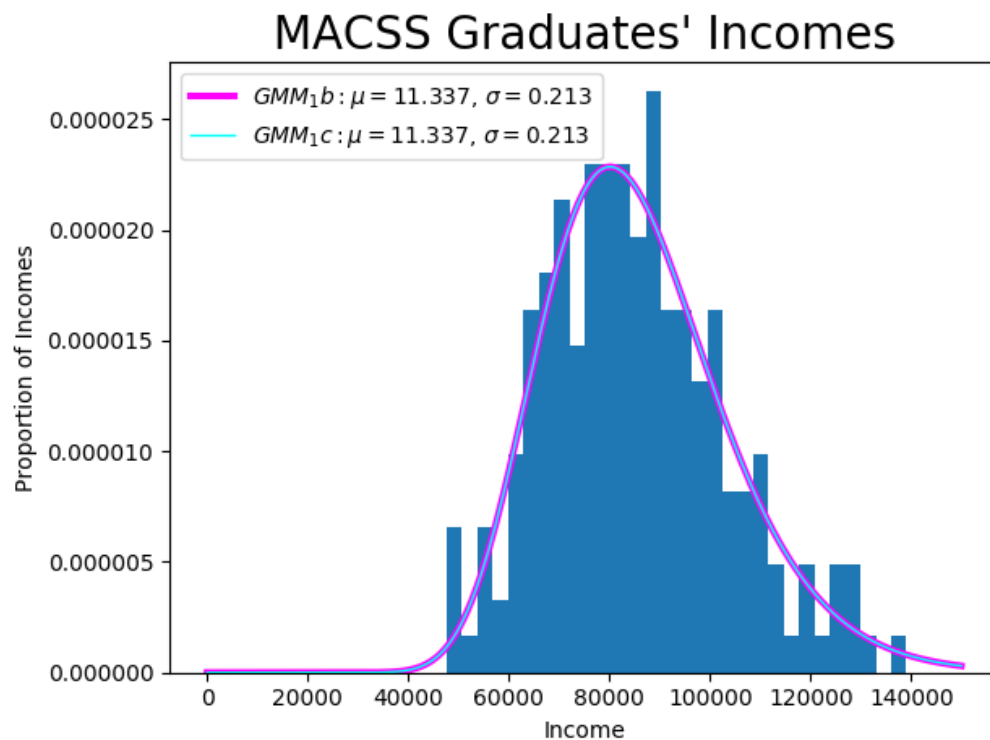
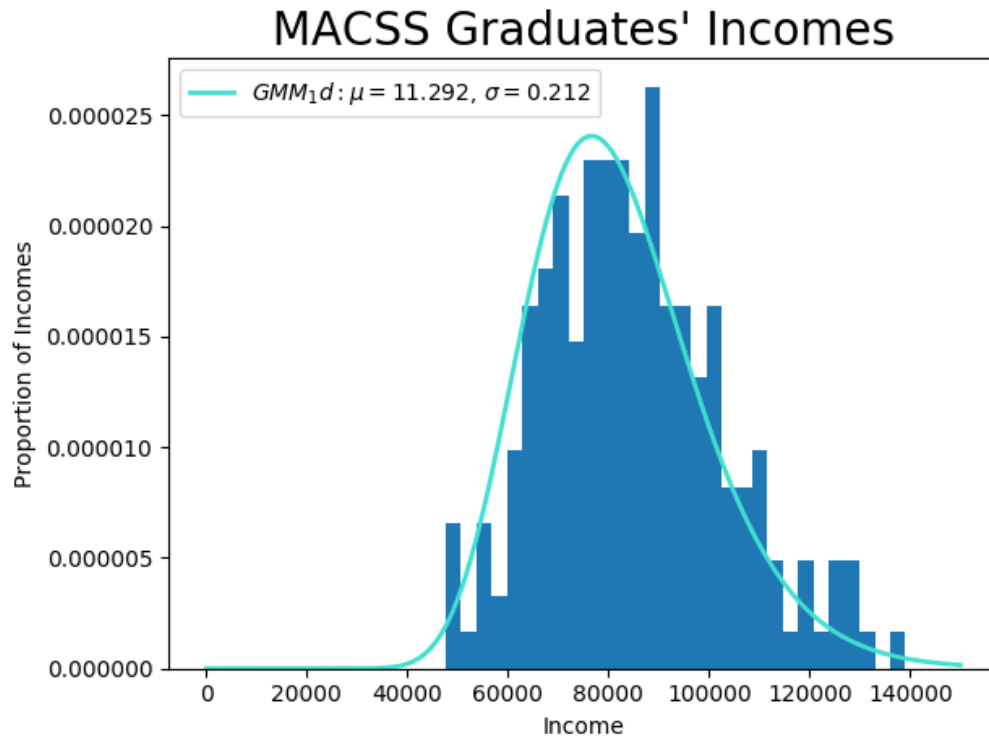


Figure 4: Histogram of Incomes of MACSS Graduates (2018–2020) with GMM Estimation Based on Percentages of Earners per Income Bracket (<\$75K, \$75–100K, >\$100K)



1.d

Using GMM estimation based on the percentage of earners in the three defined income brackets, the parameter estimates are:

$$\mu_{GMM1d} = 11.292$$

$$\sigma_{GMM1d} = 0.212$$

The value of GMM criterion function with those values is 2.10136214015e-11.

Percent of actual earners below \$75,000: 30.0000000000

Percent of model earners below \$75,000: 30.000000443

Percent of actual earners between \$75,000 and \$100,000: 50.0000000000

Percent of model earners between \$75,000 and \$100,000: 50.000000409

Percent of actual earners above \$100,000: 20.0000000000

Percent of model earners above \$100,000: 19.999999148

For a histogram of the income distribution, along with the estimated PDF, please see figure 4.

1.e

Using two-step GMM estimation based on the percentage of earners in the three defined income brackets, the parameter estimates are:

$$\mu_{GMM1e} = 11.291$$

$$\sigma_{GMM1e} = 0.212$$

The value of GMM criterion function with those values is 1.82203599915.

Percent of actual earners below \$75,000: 30.0000000000

Percent of model earners below \$75,000: 30.143483750

Percent of actual earners between \$75,000 and \$100,000: 50.0000000000

Percent of model earners between \$75,000 and \$100,000: 49.835980028

Percent of actual earners above \$100,000: 20.0000000000

Percent of model earners above \$100,000: 20.020536222

For a histogram of the income distribution, along with the estimated PDF, please see figure 5.

1.f

Of the four estimations made above, the one from part *e* fits the data the best. This is because in this example, defining the PDF based not only on μ and σ but also on the distribution of earners across income brackets allows for a tighter fit on the right side of the distribution, where there is more variation. Additionally, the two-step bracket-based estimation increases precision over the single-step estimation, albeit imperceptibly in the visualization. None of the models fits perfectly, however, and there are trade-offs: the GMM estimations based on μ and σ have a better fit on the left side and the peak of the distribution.

1.2 Problem 2

1.a

Using the values of sick_weeks as the data moments, the parameter estimates are:

$$\beta_0 = 0.252$$

$$\beta_1 = 0.013$$

$$\beta_2 = 0.401$$

$$\beta_3 = -0.010$$

The value of GMM criterion function with those values is 0.0018212898094.

Figure 5: Histogram of Incomes of MACSS Graduates (2018–2020) with GMM Estimation and Two-step GMM Estimation Based on Percentages of Earners per Income Bracket (<\$75K, \$75K–100K, >\$100K)

