Homework 4 - Results

October 23, 2018

Likelihood Function

$$l_i^1 = \int [\Pi_t \frac{1}{\sigma_{1t}} \phi(\frac{y_{it1} - X_{it1}\beta_1 - \theta_i}{\sigma_{1t}})] \Phi(\frac{\sum_t (X_{it1} - X_{it0})\tilde{\beta} - Z_i\delta - \theta_i\gamma}{\sigma_w}) \quad (1)$$

$$\frac{1}{\sqrt{2\pi}\sigma_\theta} \exp(-(\frac{\theta_i}{\sqrt{2}\sigma_\theta})^2) d\theta \quad (2)$$

- Use Gauss-Hermite to approximate integral. Change of variables necessary.

Test on fake data first

β0	stde	TRUE
0.65	0.86	1.00
2.08	0.18	2.00
-0.02	0.01	-0.02
0.52	0.02	0.50

β1	stde	TRUE
1.51	0.54	0.85
3.23	0.20	3.50
0.00	0.02	-0.03
1.02	0.04	1.00

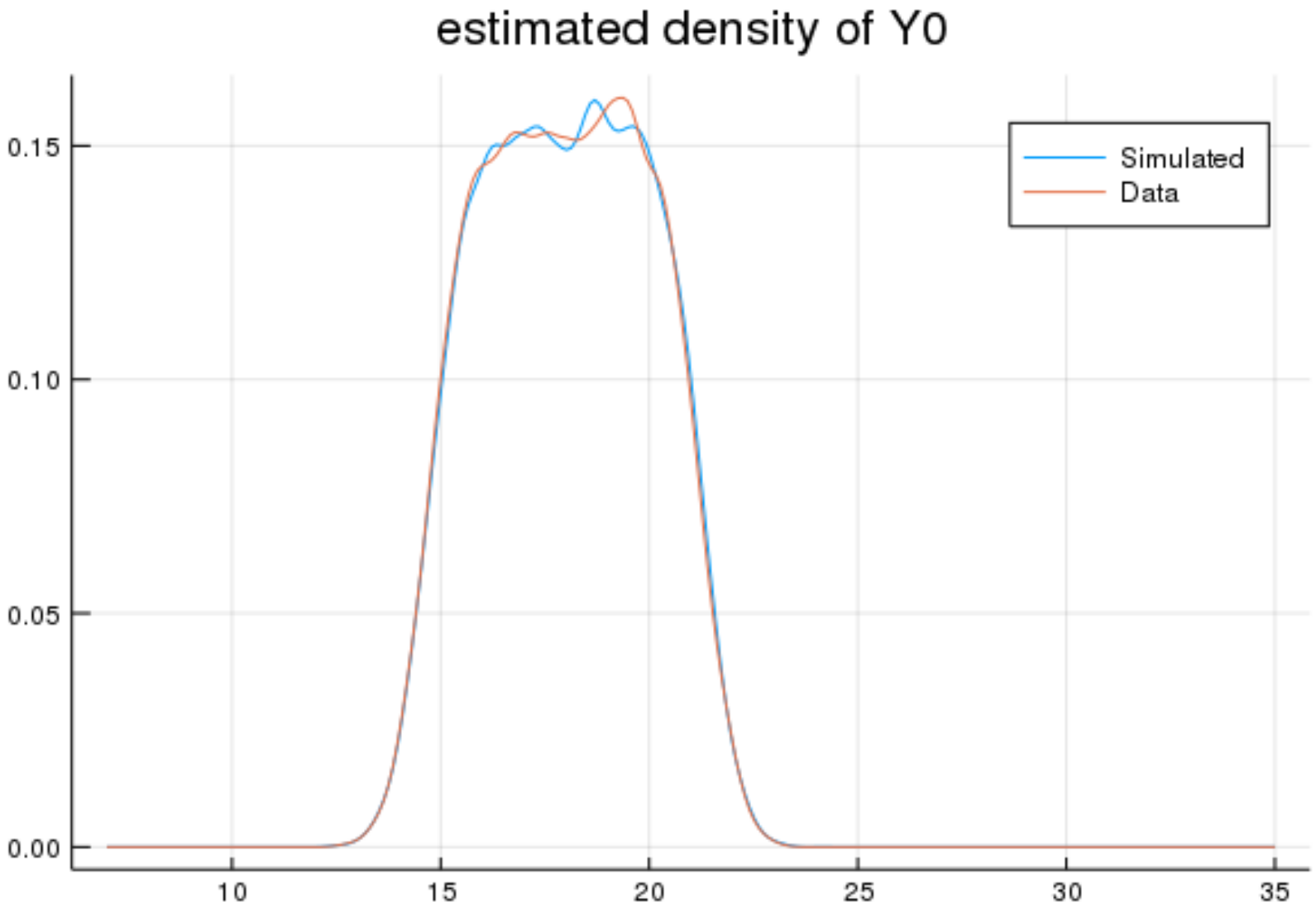
σ	stde	TRUE
0.53	0.24	0.50
0.50	0.31	0.50
0.49	0.25	0.50
0.50	0.05	0.50
0.70	0.03	0.71
0.73	0.04	0.71
0.69	0.04	0.71
0.70	0.04	0.71
0.97	0.05	1.00
0.64	0.05	0.63

δz	stde	TRUE
4.95	0.05	5.00
2.94	0.05	3.00

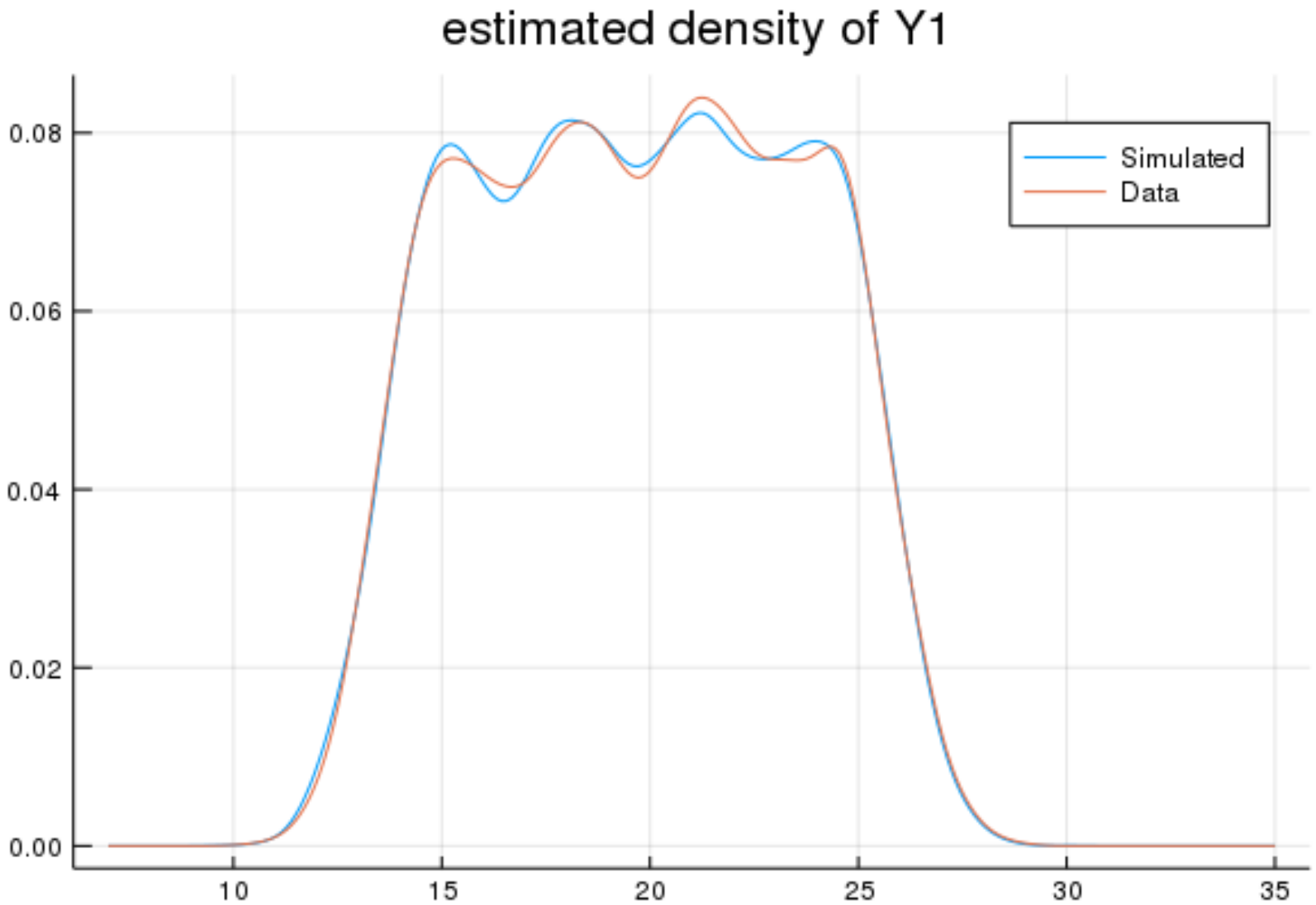
δt	stde	TRUE
0.71	0.12	0.50

ρ	stde	TRUE
0.76	0.05	0.80

Test on fake data first



Test on fake data first



Test on fake data first

- Mean school choice: Data $= 0.367$; Simulated $= 0.366$

Summary stats of zb

Mean: 0.020392
Minimum: -2.929359
1st Quartile: -0.628405
Median: 0.002442
3rd Quartile: 0.619182
Maximum: 2.957066

Test on fake data first

- New Mean school choice: 0.217

Estimates in log-units

- ATE $= 11.49$
- ATT $= 8.12$
- LATE $= 8.46$

NLSY data

- X = experience, experience2 and family income
- Z = tuition, family income, numsibs, scores, mother and father education

Likelihood Function

$$\Phi\left(\frac{Xs_{1i}\tilde{\beta} + (exp_{s=1,i} - exp_{s=0,i})\tilde{\beta} + (exp^2_{s=1,i} - exp^2_{s=0,i})\tilde{\beta} + Xs_i^4\tilde{\beta} - Z_i\delta}{\sigma_w}\right) \tag{3}$$

(4)

1.0	22.0	38.0
0.0	38.0	22.0
0.0	38.0	22.0
0.0	38.0	22.0
0.0	38.0	22.0
0.0	38.0	22.0
1.0	22.0	38.0
1.0	22.0	38.0
0.0	38.0	22.0
1.0	22.0	38.0
1.0	22.0	38.0
1.0	22.0	38.0

NLSY data

- Initial guesses:
- OLS on each wage equation, probit on Zs, standard errors from OLS
- probit on Xs, Zs, but experience is a perfect predictor!

What I tried

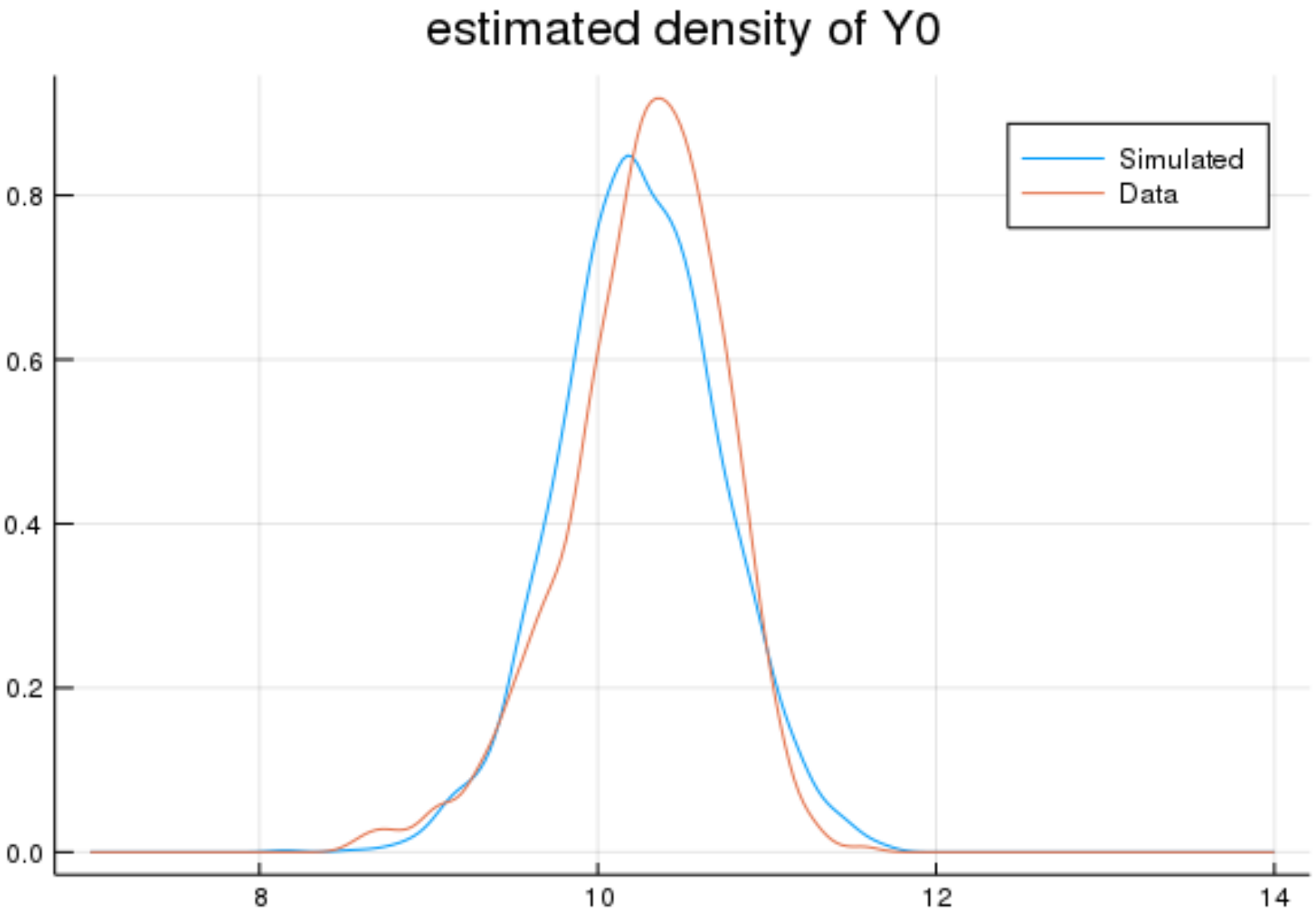
- X = experience, experience2 and family income
- Z = tuition, family income, numsibs, scores, mother and father education
- If I take the log(10000*income) and tuition, standard errors blow up to 1e10 on δ_Z and σ_w, very low variaton may be cause
- If i just multiply family income and tuition by $10^a, a = 1, 2, 3, 4$, model doesn't converge
- Same thing happens by removing family income from Z
- Same thing happens by permutating with numsbis, scores, mother and father educ.

NLSY Estimates

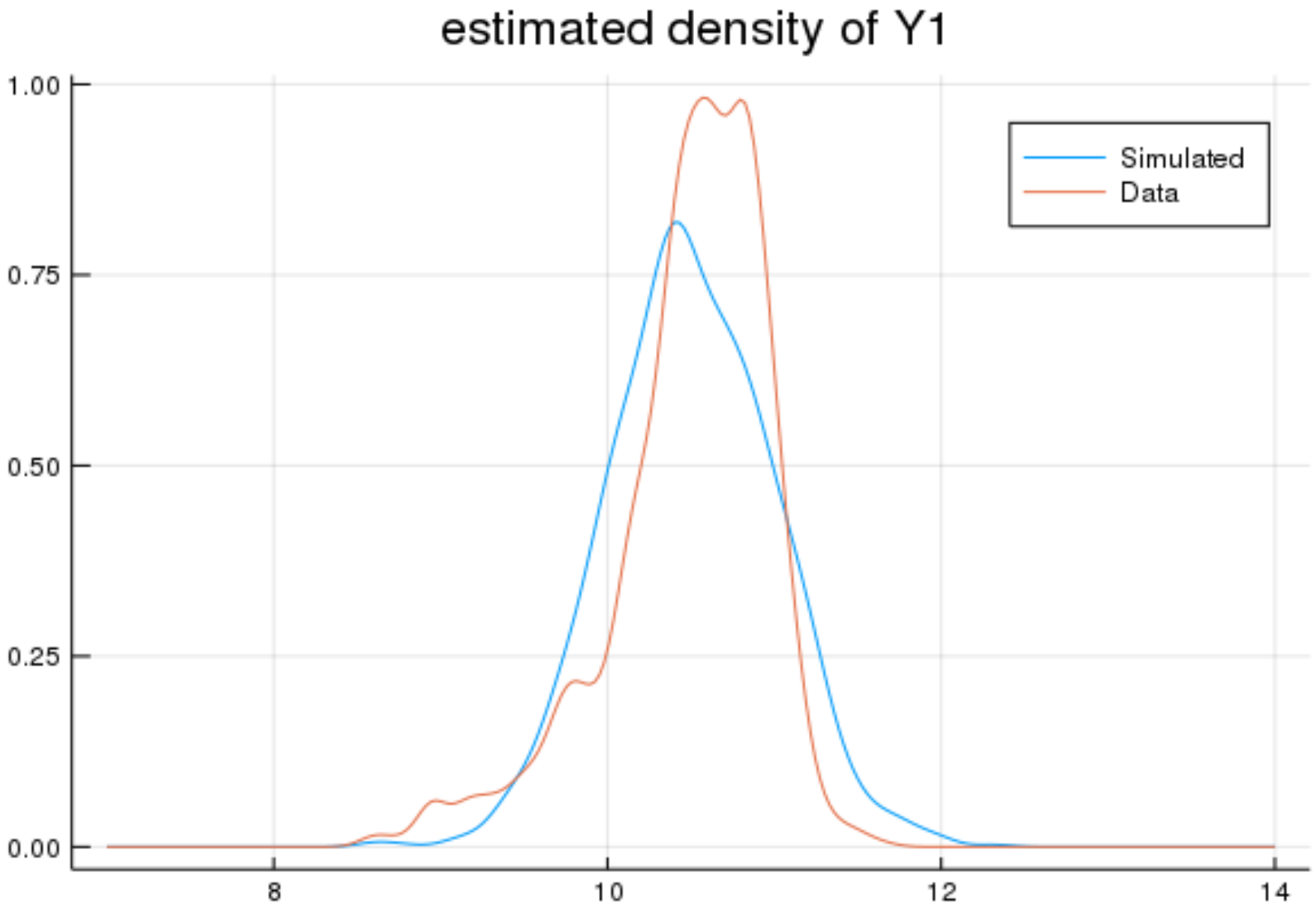
β0			σ	δz		δt	
Constant	9.58	σ0	0.30	constant	-1.09		-0.57
Exp	0.18	σ0	0.20	tuition	-0.27	ρ	
Exp^2	-0.01	σ0	0.19	family inc	-0.27		1.02
Family Inc	0.06	σ0	0.25	numsibs	-0.005168		
		σ1	0.34	scores	0.24		
β1		σ1	0.22	mother	0.05		
Constant	8.72	σ1	0.26	father	0.183375		
Exp	0.29	σ1	0.31				
Exp^2	-0.01	σw	0.33				
Family Inc	0.00	σt	0.38				

No standard errors :(

NLSY fit


estimated density of Y0
Simulated
Data
0.0
0.2
0.4
0.6
0.8
8
10
12
14

NLSY fit


estimated density of Y1
1.00
0.75
0.50
0.25
0.00
8
10
12
14
Simulated
Data

NLSY fit

- Mean school choice: Data $= 0.372$; Simulated $= 0.372$!

Summary stats of tuition

Mean: 0.214001
Minimum: 0.000000
1st Quartile: 0.159418
Median: 0.207967
3rd Quartile: 0.257659
Maximum: 0.522191

Estimates

- So, I will zero tuition for those below the mean
- New mean school choice: 0.372!

Summary stats sim y0

Mean: 31,645.128
Minimum: 4,904.970
1st Quartile: 20,792.095
Median: 28,934.711
3rd Quartile: 39,456.350
Maximum: 155,488.773

Summary stats sim y1

Mean: 29,664.918
Minimum: 3,547.429
1st Quartile: 17,553.850
Median: 25,781.921
3rd Quartile: 37,211.698
Maximum: 152,681.450

Estimates

- ATE = -1,980.21
- ATT = 8,623.56
- LATE = ?