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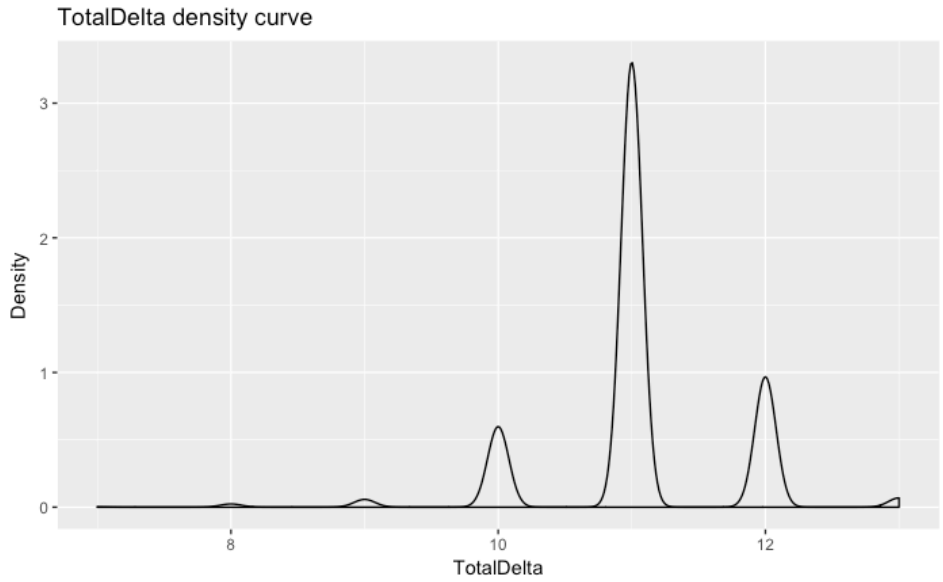
Lab 6

1. Give the posterior mean and sd of deltatotal and plot the posterior of deltatotal. Interpret deltatotal (one sentence).

- Deltatotal: Number of predictors in the model. Based on posterior of deltatotal, there will be about 11 predictor in the model.
- Table 1. Posterior of DeltaTotal

	Mean	SD	2.5%	97.5%
DeltaTotal	11.062	0.676	10	12

- Figure 1. Distribution of TotalDelta



2. Regression output for all the parameters of interest. Here it might be a table for b0, bdelta and sigma (and deltatotal is of interest too, but you reported it already in #1). You need the posterior probabilities that the bdelta are negative, zero and positive as well as the usual means, sds and 95% CIs.

- Table 2. Regression output for all the parameters of interest

	Mean	SD	2.5%	97.5%	P(>0|Y)	P(=0|Y)	P(<0|Y)
Beta0	22.5291	0.2090	22.1199	22.9351	1.0000	.0000	.0000
Sigma	4.7031	0.1505	4.4210	5.0110	1.0000	0.0000	0.0000
crim	-0.8386	0.3405	-1.4223	0.0000	0.0008	0.0566	0.9427
zn	1.0138	0.3580	0.0000	1.6538	0.9668	0.0328	0.0004
Indus	0.0095	0.1623	-0.3273	0.4657	0.0817	0.8544	0.0639

Chas	0.6595	0.2671	0.0000	1.1213	0.9402	0.0593	0.0005
Nox	-1.9509	0.4075	-2.7536	-1.1543	0.0000	0.0000	1.0000
Rm	2.6933	0.2851	2.1329	3.2525	1.0000	0.0000	0.0000
age	-0.0003	0.1285	-0.3061	0.2936	0.0601	0.8785	0.0614
dis	-3.0624	0.4014	-3.8447	-2.2505	0.0000	0.0000	1.0000
rad	2.3283	0.6028	1.0512	3.4382	0.9925	0.0073	0.0002
tax	-1.8339	0.6239	-2.9635	0.0000	0.0011	0.0243	0.9746
ptratia	-1.9833	0.2804	-2.5423	-1.4381	0.0000	0.0000	1.0000
b	0.8255	0.2731	0.0664	1.3246	0.9754	0.0243	0.0003
lstat	-3.7577	0.3382	-4.4129	-3.0928	0.0000	0.0000	1.0000

3. Give results from your sensitivity analysis for pidelta. Give a summary paragraph and a table of the numerical results.

   I choose 5 different values to make sensitivity analysis for pidelta.

   pidelta <- c(0.05, 0.25, 0.5, 0.75, 0.95)

   Higher pidelta, lower DIC value which means better model. When $p > 0.5$, delta[5] approches 1 and totaldelta larger than 11. Based on the table above, there is no big difference when pidelta > 0.5.

- Table 3. A. Sensitivity analysis – DIC result

P	**0.05**	**0.25**	**0.5**	**0.75**	**0.95**
DIC	3106.08	3057.82	3029.28	3020.31	3018.41

- Table 3. B. Sensitivity analysis – DeltaTotal Result

P	**0.05**	**0.25**	**0.5**	**0.75**	**0.95**
DIC	6.97	10.50	11.07	11.57	12.48

- Table 3. B. Sensitivity analysis – Delta Result

p	**0.05**		**0.25**		**0.5**		**0.75**		**0.95**	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Delta1	0.0971	0.2961	0.7891	0.4079	0.9480	0.2219	0.9855	0.1194	0.9973	0.0516
Delta2	0.2391	0.4266	0.8659	0.3407	0.9723	0.1639	0.9914	0.092	0.9983	0.0412
Delta3	0.0119	0.1084	0.0577	0.2333	0.1410	0.3481	0.3143	0.4642	0.7549	0.4301
Delta3	0.726	0.446	0.8708	0.3354	0.9443	0.2293	0.9802	0.1391	0.9968	0.0565
Delta4	0.999	0.0316	0.9988	0.0341	0.9998	0.0141	0.9998	0.0141	0.9997	0.0153
Delta5	0.9996	0.0183	0.9998	0.0115	0.9997	0.0163	1	0	1	0
Delta6	0.0093	0.0963	0.0438	0.2047	0.1225	0.3279	0.2945	0.4558	0.7323	0.4428
Delta7	0.9999	0.0115	1	0	1	0	1	0	1	0
Delta8	0.1415	0.3485	0.9202	0.2709	0.9969	0.0556	0.9999	0.0058	1	0
Delta9	0.0962	0.2949	0.8559	0.3512	0.9819	0.1331	0.9960	0.0629	0.9997	0.0163
Delta10	0.9997	0.0163	0.9998	0.0115	0.9996	0.0191	1	0	1	0
Delta11	0.7047	0.4562	0.9411	0.2355	0.9768	0.1505	0.9904	0.0972	0.9981	0.0432
Delta12	0.9997	0.0163	0.9997	0.0183	0.9998	0.0141	1	0	1	0
Delta13	0.0971	0.2961	0.7892	0.4079	0.9480	0.2219	0.9855	0.1194	0.9973	0.0516

4. Repeat for the sensitivity analysis for ccc.

- The variable ccc controls the width of the prior standard deviations of coefficients. By control the pidelta equal to 0.5, we changed the ccc.
- According to result below, ccc with value 1 will have lowest DIC. In addition, variables is more difficult to be select with higher ccc.
- Table 4. A. Sensitivity analysis – DIC result

ccc	**0.1**	**1**	**10**
DIC	3063.68	3035.78	3052.85

- Table 3. B. Sensitivity analysis – DeltaTotal Result

ccc	**0.1**	**1**	**10**
DeltaTotal	10.48	11.09	11.43

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- Table 3. B. Sensitivity analysis – Delta Result

ccc	**0.1**		**1**		**10**	
	Mean	SD	Mean	SD	Mean	SD
Delta1	0.8446	0.3623	0.9408	0.2359	0.9421	0.2336
Delta2	0.9172	0.2755	0.9609	0.1939	0.9449	0.2281
Delta3	0.0539	0.2259	0.1402	0.3472	0.3824	0.486
Delta3	0.845	0.3619	0.9419	0.2339	0.9915	0.0916
Delta4	0.9947	0.0724	0.9991	0.0294	0.9996	0.0208
Delta5	1	0.0058	0.9999	0.0082	1	0
Delta6	0.0462	0.21	0.1249	0.3306	0.3053	0.4605
Delta7	1	0	1	0	1	0
Delta8	0.9518	0.2141	0.9924	0.087	0.9701	0.1704
Delta9	0.9154	0.2782	0.9794	0.1422	0.9103	0.2857
Delta10	0.9996	0.0191	0.9999	0.0115	0.9999	0.0082
Delta11	0.9297	0.2556	0.9775	0.1482	0.9937	0.0793
Delta12	0.9997	0.0183	1	0	1	0.0058
Delta13	0.8446	0.3623	0.9408	0.2359	0.9421	0.2336

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5. Report (one very short paragraph and two appropriate tables) your conclusions regarding whether people will pay more for lower pollution or not. The sensitivity results are extremely relevant to your report – be sure to include the results from all of your sensitivity analyses. Also of interest is a list of the most probable models and whether the pollution variable is included in those models. This gets a little messy to report this for all the different priors, so only report this for the primary analysis.

- According to result below, the variable nox is highly likely to be selected (delta[5] is very close to 1) in to the model and its effect is negative, which means people will pay more for lower pollution.

- Table 5. A. Delta[5] result for different pidelta.

pidelta	**0.05**	**0.25**	**0.5**	**0.75**	**0.95**
Delta[5]	0.9975	0.9992	0.9996	1.0000	1.0000
Bdelta[5]	-1.9624	-1.9520	-1.95	-1.95	-1.95

- Table 5. A. Delta[5] result for different ccc.

ccc	**0.1(low)**	**1(median)**	**10(high)**
Delta[5]	0.9991	0.9994	0.9994
Bdelta[5]	-2.0020	-1.9500	-1.4850

Extra credit:

6. Is there an interaction between ccc and pidelta? How can you tell? Run the two way sensitivity analysis that varies both ccc and pidelta together. (Use a factorial design) and report your results for a key summary measure of the posterior.

   Based on the table above, there should be an interaction between ccc and pidelta, since they have mutual impacts on the number of variables selected. However, more analysis need to be done. We need to control each value to change another to make accurate conclusion.

Hi Jason, Just want to say thanks to you for helping us in class and via email ☺ Best wishes to your new job!