Homework 9

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Contents

Research question

Does the influence of social rewards (i.e., likes on Twitter) on tweeting frenquency vary as a function of habit strength?

Variables

- `tdiff_pmcs`: Tweet frequency- Time difference between a user's tweet and their immediately preceding tweet (person-mean centered and scaled)
- `likes_24hours_pmcs`: Social reward- Number of likes a user received in the past 24 hours (person-mean centered and scaled)
- `likes_24hours_pms`: Person-mean number of likes received in the past 24 hours (scaled)
- `avg_day_cs`: Habit strength - Average number of a user's tweets per day (centered and scaled)

Variable Summary

```
datasummary_skim(x %>% select(tdiff_pmcs, likes_24hours_pmcs, likes_24hours_pms, avg_day_cs))
```

	Unique (#)	Missing (%)	Mean	SD	Min	Median	Max	
tdiff_pmcs	13173	0	0.0	1.0	−4.4	−0.1	3.7	
likes_24hours_pmcs	1579	2	0.0	1.0	−2.7	−0.3	19.0	
likes_24hours_pms	181	0	0.2	1.0	0.0	0.0	7.4	
avg_day_cs	209	0	0.0	1.0	−1.6	−0.2	2.0	

Model

Let $Y = $ tdiff_pmcs
$likes = $ likes_24hours_pmcs
$avg_likes = $ likes_24hours_pms
$habit = $ avg_day_cs

$$y_{ij} = \beta_{0j} + \beta_{1j}likes_{ij} + e_{ij}$$

$$\beta_{0j} = \gamma_{00} + \gamma_{01}habit_j + \gamma_{02}avg\_likes + \mu_{0j}$$

$$\beta_{1j} = \gamma_{10} + \gamma_{11}habit_j + \mu_{1j}$$

Priors

$$\gamma_{00} \sim N(0,1)$$

$$\gamma_{01} \sim N(0,1)$$

$$\gamma_{02} \sim N(0,1)$$

$$\gamma_{10} \sim N(0,1)$$

$$\gamma_{11} \sim N(0,1)$$

$$e_{ij} \sim t_4^+(0,3)$$

$$\mu_{0j} \sim t_4^+(0,3)$$

$$\mu_{1j} \sim t_4^+(0,3)$$

Results

```
m1 <- brm(tdiff_pmcs ~ likes_24hours_pmcs * avg_day_cs + likes_24hours_pms + (1 | subject),
          prior = c(
            prior(normal(0, 1), class = 'Intercept'),
            prior(normal(0, 1), class = 'b'),
            prior(student_t(4, 0, 3), class = 'sd'),
            prior(student_t(4, 0, 3), class = 'sigma')
          ),
          data = x, family = gaussian(link = "identity"),
          cores = numcor, seed = 1,
          file = 'Twitter Main Analysis.rds')
```
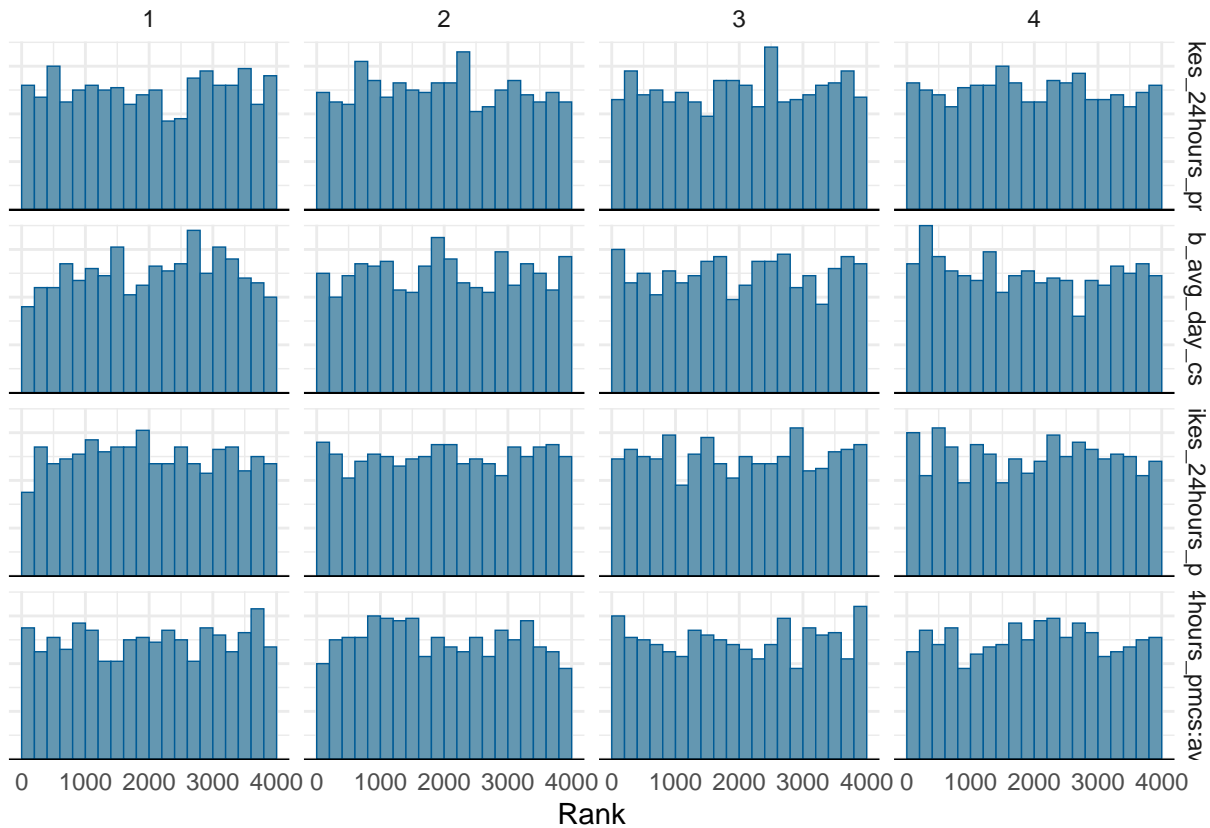
Convergence Check

The trace plots and rank histograms below suggest satisfactory convergence.

```
mcmc_trace(m1, pars = c('b_likes_24hours_pmcs', 'b_avg_day_cs', 'b_likes_24hours_pms',
                        'b_likes_24hours_pmcs:avg_day_cs'))
```
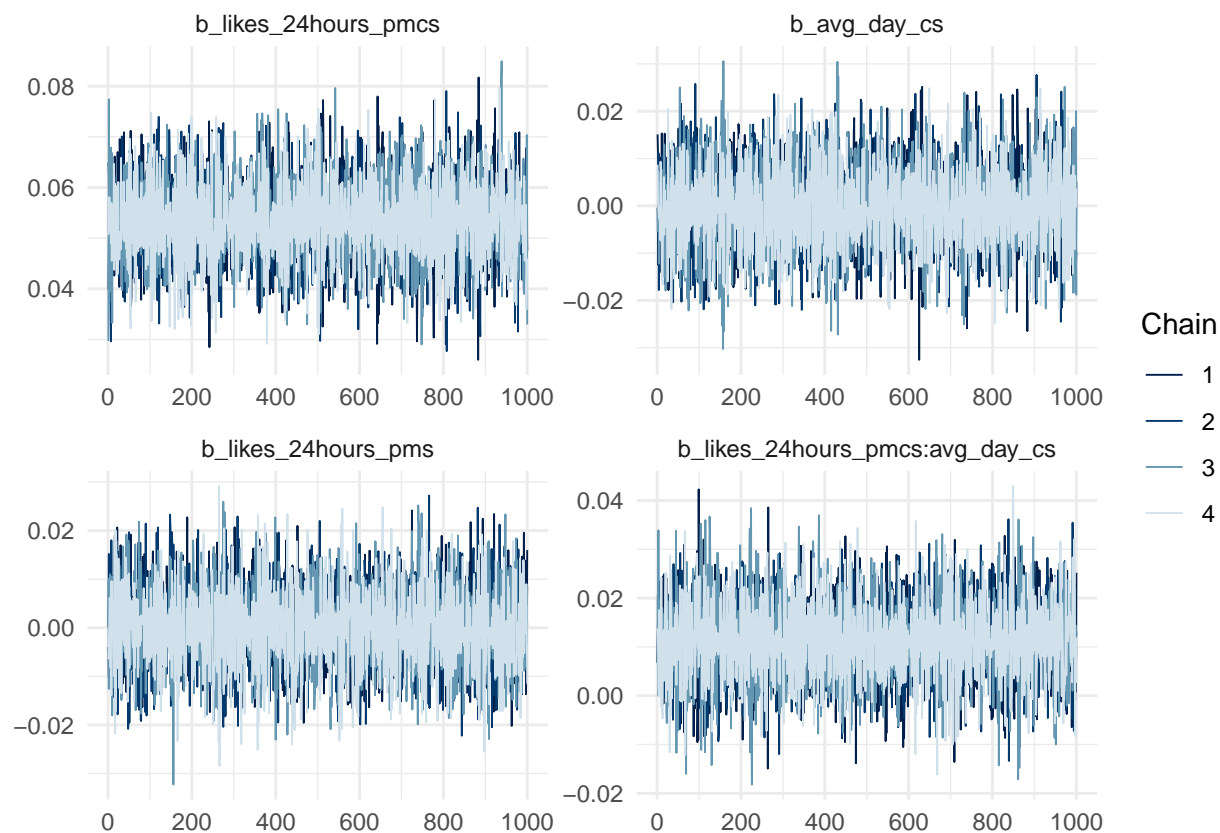


```
mcmc_rank_hist(m1, pars = c('b_likes_24hours_pmcs', 'b_avg_day_cs', 'b_likes_24hours_pms',
                            'b_likes_24hours_pmcs:avg_day_cs'))
```

Posterior distribution of key parameters

```r
sum_m1 <- as_draws_df(m1) %>%
  summarize_draws() %>%
  filter(variable %in% c('b_intercept',
                         'b_likes_24hours_pmcs', 'b_avg_day_cs', 'b_likes_24hours_pms',
                         'b_likes_24hours_pmcs:avg_day_cs'))

sum_m1 %>%
  knitr::kable(digits = 3)
```

variable	mean	median	sd	mad	q5	q95	rhat	ess_bulk	ess_tail
b_likes_24hours_pmcs	0.054	0.054	0.008	0.009	0.040	0.067	1.002	8606.480	2781.351
b_avg_day_cs	0.000	0.000	0.009	0.009	-0.015	0.014	1.003	10290.682	3125.299
b_likes_24hours_pms	0.000	0.000	0.009	0.009	-0.014	0.014	1.000	7960.863	2813.838
b_likes_24hours_pmcs:avg_day_cs	0.011	0.011	0.008	0.008	-0.002	0.025	1.003	9845.246	2832.427

Interpretation

Based on the results in the brms model above, we do not see an interaction effect between reward and habit strength in predicting tweet frequency.