

Final Project

Onyul Haque

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Bayesian Analysis - Give vs Do not Give

Model Equation:

$$\begin{aligned} \text{Decision}_i &\sim \text{Bin}(N, \theta) \\ \theta &= \beta_0 + \beta_1 \text{game}_i + \beta_2 \text{timer}_i + \beta_3 \text{game}_i * \text{timer}_i \end{aligned}$$

Prior:

Lottery No Timer

$$\beta_0 \sim N(30, 5)$$

Difference between Lottery No timer and Trust No Timer

$$\beta_1 \sim N(0, 1)$$

Difference between Lottery No Timer - Lottery Timer

$$\beta_2 \sim N(0, 1)$$

Difference between Lottery Timer - Trust Timer beyond the difference of Lottery no Timer and Trust No Timer

$$\beta_3 \sim N(0, 1)$$

```
m1 <-brm(  
  # Y (vote) = beta0 + beta1 (growth)  
  decision ~ game * timer,  
  data = trustlong,  
  # Normal distribution with identity link  
  family = binomial,  
  # Overwrite the default priors  
  prior = c(  
    # prior for beta0  
    prior(normal(0,1), class = "Intercept"),  
    # prior for beta1 game  
    prior(normal(0,1), class = "b", coef = "gameTrust"),  
    #prior Beta 2 Time  
    prior(normal(0,1), class = "b", coef = "timerTimer"),  
    #Beta 3 Interaction Term  
    prior(normal(0,1), class = "b", coef = "gameTrust:timerTimer")  
  )  
)
```

```

    ),
    sample_prior = TRUE, # also sample the prior distributions
    iter = 4000, # default is 4 chains, 2000 iterations each
    seed = 21
)

```

```
## Using the maximum response value as the number of trials.
```

```
## Compiling Stan program...
```

```
## Start sampling
```

```

##
## SAMPLING FOR MODEL 'd4855645b1a7dd8d4ba3d3de88379601' NOW (CHAIN 1).
## Chain 1:
## Chain 1: Gradient evaluation took 0 seconds
## Chain 1: 1000 transitions using 10 leapfrog steps per transition would take 0 seconds.
## Chain 1: Adjust your expectations accordingly!
## Chain 1:
## Chain 1:
## Chain 1: Iteration:    1 / 4000 [  0%] (Warmup)
## Chain 1: Iteration:   400 / 4000 [ 10%] (Warmup)
## Chain 1: Iteration:   800 / 4000 [ 20%] (Warmup)
## Chain 1: Iteration:  1200 / 4000 [ 30%] (Warmup)
## Chain 1: Iteration:  1600 / 4000 [ 40%] (Warmup)
## Chain 1: Iteration:  2000 / 4000 [ 50%] (Warmup)
## Chain 1: Iteration:  2001 / 4000 [ 50%] (Sampling)
## Chain 1: Iteration:  2400 / 4000 [ 60%] (Sampling)
## Chain 1: Iteration:  2800 / 4000 [ 70%] (Sampling)
## Chain 1: Iteration:  3200 / 4000 [ 80%] (Sampling)
## Chain 1: Iteration:  3600 / 4000 [ 90%] (Sampling)
## Chain 1: Iteration:  4000 / 4000 [100%] (Sampling)
## Chain 1:
## Chain 1: Elapsed Time: 1.035 seconds (Warm-up)
## Chain 1:                1.03 seconds (Sampling)
## Chain 1:                2.065 seconds (Total)
## Chain 1:
##
## SAMPLING FOR MODEL 'd4855645b1a7dd8d4ba3d3de88379601' NOW (CHAIN 2).
## Chain 2:
## Chain 2: Gradient evaluation took 0.001 seconds
## Chain 2: 1000 transitions using 10 leapfrog steps per transition would take 10 seconds.
## Chain 2: Adjust your expectations accordingly!
## Chain 2:
## Chain 2:
## Chain 2: Iteration:    1 / 4000 [  0%] (Warmup)
## Chain 2: Iteration:   400 / 4000 [ 10%] (Warmup)
## Chain 2: Iteration:   800 / 4000 [ 20%] (Warmup)
## Chain 2: Iteration:  1200 / 4000 [ 30%] (Warmup)
## Chain 2: Iteration:  1600 / 4000 [ 40%] (Warmup)
## Chain 2: Iteration:  2000 / 4000 [ 50%] (Warmup)
## Chain 2: Iteration:  2001 / 4000 [ 50%] (Sampling)

```

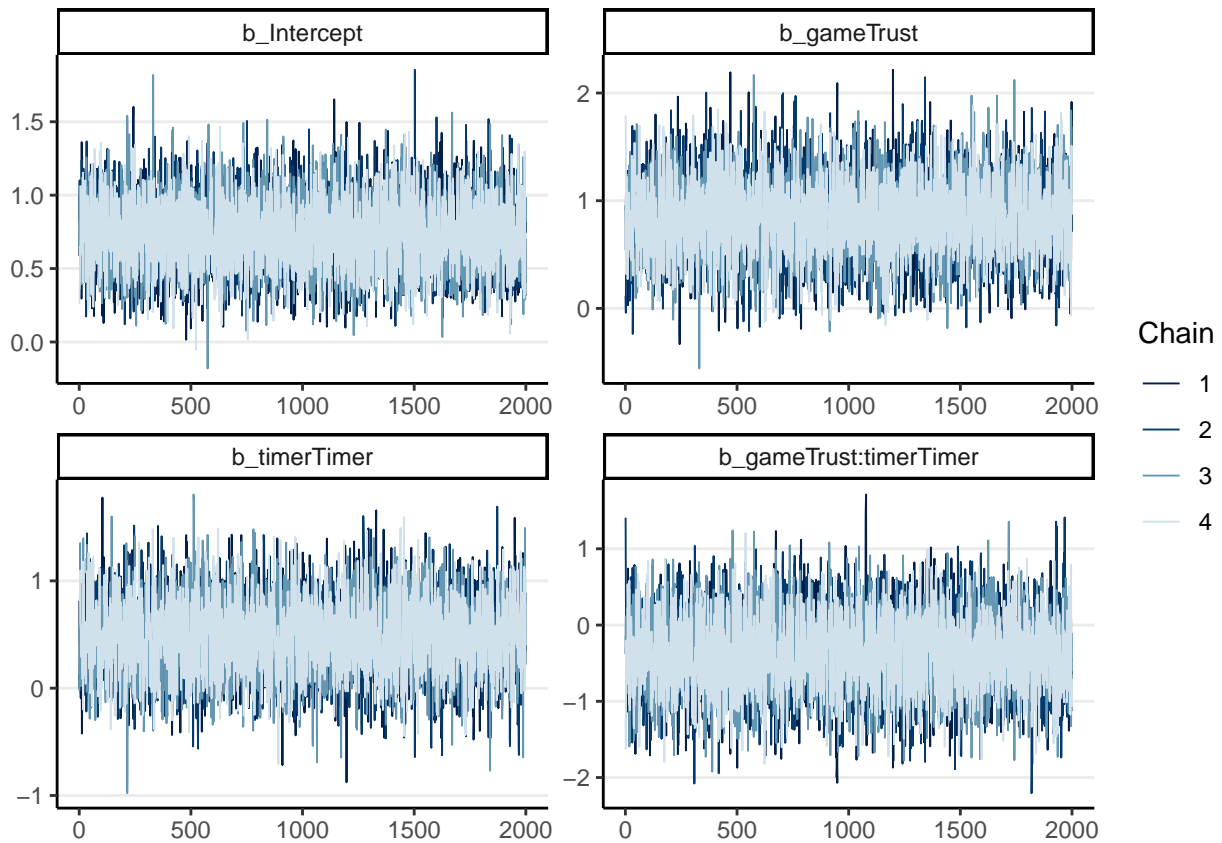
```

## Chain 2: Iteration: 2400 / 4000 [ 60%] (Sampling)
## Chain 2: Iteration: 2800 / 4000 [ 70%] (Sampling)
## Chain 2: Iteration: 3200 / 4000 [ 80%] (Sampling)
## Chain 2: Iteration: 3600 / 4000 [ 90%] (Sampling)
## Chain 2: Iteration: 4000 / 4000 [100%] (Sampling)
## Chain 2:
## Chain 2: Elapsed Time: 1.064 seconds (Warm-up)
## Chain 2: 1.089 seconds (Sampling)
## Chain 2: 2.153 seconds (Total)
## Chain 2:
##
## SAMPLING FOR MODEL 'd4855645b1a7dd8d4ba3d3de88379601' NOW (CHAIN 3).
## Chain 3:
## Chain 3: Gradient evaluation took 0 seconds
## Chain 3: 1000 transitions using 10 leapfrog steps per transition would take 0 seconds.
## Chain 3: Adjust your expectations accordingly!
## Chain 3:
## Chain 3:
## Chain 3: Iteration: 1 / 4000 [ 0%] (Warmup)
## Chain 3: Iteration: 400 / 4000 [ 10%] (Warmup)
## Chain 3: Iteration: 800 / 4000 [ 20%] (Warmup)
## Chain 3: Iteration: 1200 / 4000 [ 30%] (Warmup)
## Chain 3: Iteration: 1600 / 4000 [ 40%] (Warmup)
## Chain 3: Iteration: 2000 / 4000 [ 50%] (Warmup)
## Chain 3: Iteration: 2001 / 4000 [ 50%] (Sampling)
## Chain 3: Iteration: 2400 / 4000 [ 60%] (Sampling)
## Chain 3: Iteration: 2800 / 4000 [ 70%] (Sampling)
## Chain 3: Iteration: 3200 / 4000 [ 80%] (Sampling)
## Chain 3: Iteration: 3600 / 4000 [ 90%] (Sampling)
## Chain 3: Iteration: 4000 / 4000 [100%] (Sampling)
## Chain 3:
## Chain 3: Elapsed Time: 1.057 seconds (Warm-up)
## Chain 3: 1.138 seconds (Sampling)
## Chain 3: 2.195 seconds (Total)
## Chain 3:
##
## SAMPLING FOR MODEL 'd4855645b1a7dd8d4ba3d3de88379601' NOW (CHAIN 4).
## Chain 4:
## Chain 4: Gradient evaluation took 0 seconds
## Chain 4: 1000 transitions using 10 leapfrog steps per transition would take 0 seconds.
## Chain 4: Adjust your expectations accordingly!
## Chain 4:
## Chain 4:
## Chain 4: Iteration: 1 / 4000 [ 0%] (Warmup)
## Chain 4: Iteration: 400 / 4000 [ 10%] (Warmup)
## Chain 4: Iteration: 800 / 4000 [ 20%] (Warmup)
## Chain 4: Iteration: 1200 / 4000 [ 30%] (Warmup)
## Chain 4: Iteration: 1600 / 4000 [ 40%] (Warmup)
## Chain 4: Iteration: 2000 / 4000 [ 50%] (Warmup)
## Chain 4: Iteration: 2001 / 4000 [ 50%] (Sampling)
## Chain 4: Iteration: 2400 / 4000 [ 60%] (Sampling)
## Chain 4: Iteration: 2800 / 4000 [ 70%] (Sampling)
## Chain 4: Iteration: 3200 / 4000 [ 80%] (Sampling)
## Chain 4: Iteration: 3600 / 4000 [ 90%] (Sampling)

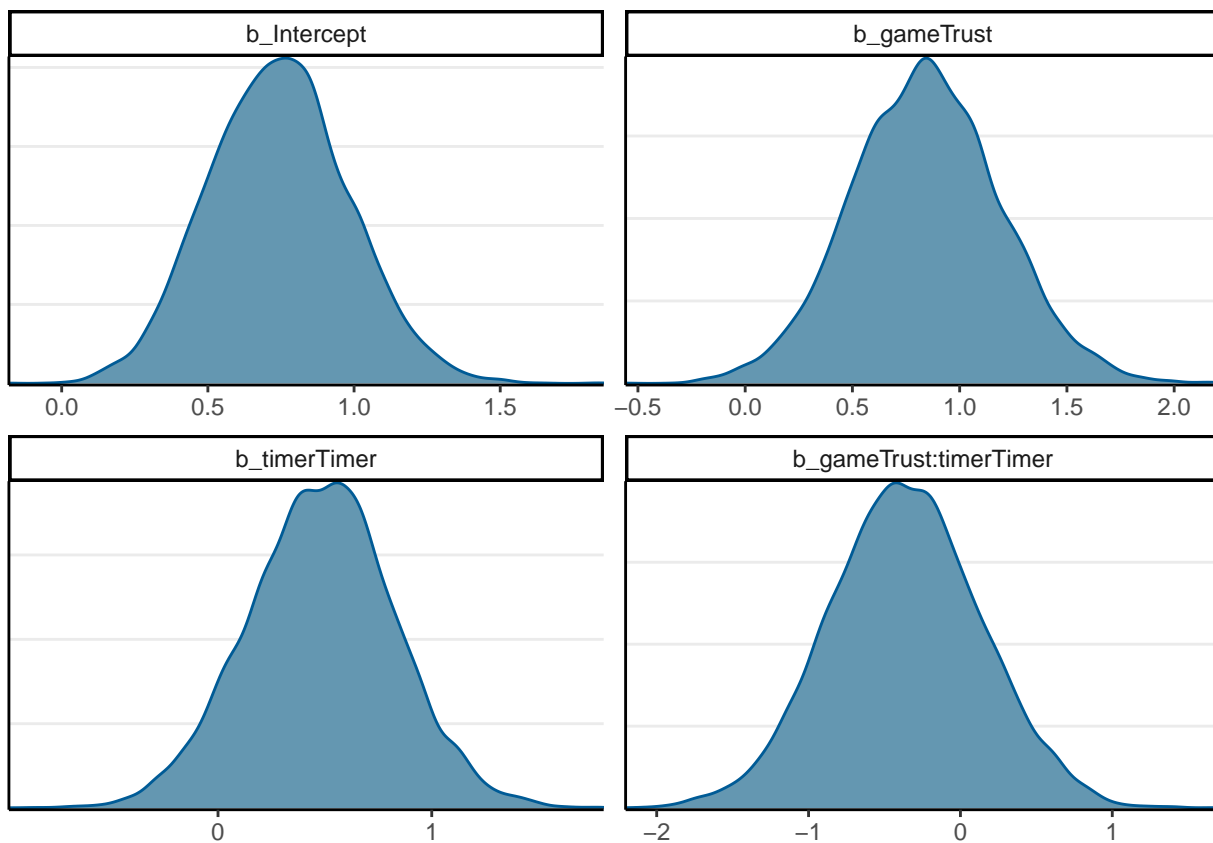
```

```
## Chain 4: Iteration: 4000 / 4000 [100%] (Sampling)
## Chain 4:
## Chain 4: Elapsed Time: 1.061 seconds (Warm-up)
## Chain 4: 1.102 seconds (Sampling)
## Chain 4: 2.163 seconds (Total)
## Chain 4:
```

```
mcmc_trace(m1,
  pars = c("b_Intercept", "b_gameTrust",
    "b_timerTimer", "b_gameTrust:timerTimer"))
```



```
mcmc_dens(m1,
  pars = c("b_Intercept", "b_gameTrust",
    "b_timerTimer", "b_gameTrust:timerTimer"))
```



```
exp(fixef(m1))
```

##	Estimate	Est.Error	Q2.5	Q97.5
## Intercept	2.1009491	1.269133	1.3422306	3.386030
## gameTrust	2.3244824	1.418419	1.1742328	4.717003
## timerTimer	1.6196001	1.410928	0.8249838	3.169089
## gameTrust:timerTimer	0.6942237	1.650363	0.2625083	1.858538

I exponentiated the results of the model to obtain the odds ratio. The only the only paramters to obtain a confidence interval not including 1 are intercept and the game effect. Thus, the odds that somebody in the trust game would give \$5 is 2.32 (95%ci[1.17,4.17]) higher than somebody in the lottery game.