Generalised Linear Model Hints

1 Data

The data are taken from an experiment performed by Topi Miettinen and Sigrid Suetens [Communication and Guilt in a Prisoners Dilemma, Journal of Conflict Resolution, Volume 52, Number 6, 2008]

1.1 Description of the experiment

Partially quoted from the paper:

The experiment was run in January 2007 in the computer laboratory of the Max Planck Institute of Economics in Jena, Germany, with a total of 140 students from different fields of study at the Friedrich-Schiller University of Jena. After being seated at a visually isolated computer terminal, participants received written instructions. Understanding of the rules was ensured by a control questionnaire that participants had to answer before the experiment could start. Each participant was randomly paired with another participant and played a simple prisoners dilemma (PD) game with payoffs in Euro, as depicted in Table 1. Eventually, they were asked to choose option 1 (defect) or option 2 (cooperate). Yet, before entering the choices in the PD, each participant had the choice between either not communicating or communicating to the other that she would like them both to cooperate. They were told that communication was not binding. After the communication phase, participants received information about the matched participants willingness to engage in a cooperative agreement. When choices in the PD had been made, a new computer screen appeared on which first- and second-order beliefs were elicited. Each participant was paid an additional 0.5 Euro, first, for correctly predicting the choice of the participant he or she was paired with and, second, for correctly predicting the others prediction of his or her own choice. Total earnings were revealed at the end of the experiment only (the sum of earnings from the PD game and earnings from predicting the matched participants choice and prediction). Beliefs were elicited to allow us to deal with guilts being a partly counterfactual emotion. Moreover, eliciting beliefs is interesting because it allows us to shed light on whether and how players expect communication to matter. Emotional reactions of guilt were first measured immediately after the choices and belief elicitation and before revealing the matched participants choice. Emotional reactions were measured another time immediately after revealing the matched participants choice. In both measurements, participants filled in their emotional valence on a 7-point scale starting from not at all to very intensely.
Table 1: Payoffs in the Prisoner’s Dilemma Game

<table>
<thead>
<tr>
<th>Your Payoff</th>
<th>The Others Payoff</th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>16</td>
<td>4</td>
</tr>
<tr>
<td>4</td>
<td>16</td>
</tr>
<tr>
<td>10</td>
<td>10</td>
</tr>
</tbody>
</table>

Table 2: Treatments

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Penalty</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>No penalty</td>
</tr>
<tr>
<td>2</td>
<td>Penalty 0.20</td>
</tr>
<tr>
<td>3</td>
<td>Penalty 0.20 and Reminder screen</td>
</tr>
<tr>
<td>4</td>
<td>Penalty 1 and reminder screen</td>
</tr>
</tbody>
</table>

1.2 Variables in the Data

The data contains the following variables:

- **Treatment**: treatment number
- **ID**: unique number for each subject
- **GroupID**: unique number for each pair of matched subjects
- **Transfer**: is 1 in treatments with penalty and 0 otherwise
- **ReminderScreen**: is 1 in treatments with reminder screen and 0 otherwise
- **PiFine**: size of penalty
- **Coop**: is 1 if subject cooperates and 0 otherwise
- **OthCoop**: is 1 if matched subject cooperates and 0 otherwise
- **Expect1**: is 1 if subject expects matched subject to cooperate and 0 otherwise
- **Expect2**: is 1 if subject expects matched subject to expect that one cooperates and 0 otherwise
- **BothAgree**: is 1 in the case of a mutual agreement to cooperate
- **SelfAgree**: is 1 if subject communicates willingness to agree to cooperate
- **OthAgree**: is 1 if matched subject communicates willingness to agree to cooperate
- **Guilt1**: before-measurement of guilt
- **Shame1**: before-measurement of shame
- **Guilt2**: after-measurement of guilt
- **Shame2**: after-measurement of shame

2 Analysis of the data

```r
pd<-read.table("http://www.stats.ox.ac.uk/~loizides/BS1/P3/PD.txt",header=T)
head(pd)
#Does Treatment affect cooperation
glm1<-glm(Coop~as.factor(Treatment), family=binomial, data=pd)
```
# Alternatively we can consider the size of the penalty

```r
glm2 <- glm(Coop ~ PiFine * ReminderScreen, family = binomial, data = pd)
summary(glm2)
```

# Again there no association seems to exist

```r
# Does the expectation about the other subject’s decision affects cooperation

glm3 <- glm(Coop ~ Expect1, data = pd, family = binomial)
summary(glm3)

# It’s more likely to cooperate if one believes the other subject will cooperate

```r
# What if we take heir prior intentions to cooperate into account

glm4 <- glm(Coop ~ Expect1 * OthAgree, data = pd, family = binomial)
summary(glm4)

# A better way to deal with that is taking the difference

glm4 <- glm(Coop ~ I(OthAgree - Expect1), data = pd, family = binomial)
summary(glm4)
plot(glm4)
```

# We now re-shape our data. Now each pair takes one row.

```r
oddseq <- seq(1, dim(pd)[1], by = 2)
pd.odd <- pd[oddseq, -(2:3)]
pd.even <- pd[oddseq + 1, -c(1:8, 11:13)]

data.frame(Treatment = factor(pd.odd$Treatment), Penalty = (pd.odd$Transfer == 1), RemScreen = (pd.odd$ReminderScreen == 1), Fine = pd.odd$PiFine, S1.Agree = (pd.odd$SelfAgree == 1), S2.Agree = (pd.odd$OthAgree == 1), BothAgree = (pd.odd$BothAgree == 1), S1.Coop = (pd.odd$Coop == 1), S2.Coop = (pd.odd$OthCoop == 1), S1.Expect1 = (pd.odd$Expect1 == 1), S1.Expect2 = (pd.odd$Expect2 == 1), S2.Expect1 = (pd.even$Expect1 == 1), S2.Expect2 = (pd.even$Expect2 == 1), S1.GuiltBef = pd.odd$Guilt1, S1.GuiltAft = pd.odd$Guilt2, S2.GuiltBef = pd.even$Guilt1, S2.GuiltAft = pd.even$Guilt2, S1.ShameBef = pd.odd$Shame1, S1.ShameAft = pd.odd$Shame2, S2.ShameBef = pd.even$Shame1, S2.ShameAft = pd.even$Shame2)

# Does Treatment affects prior agreement to cooperate?

glm5 <- glm(BothAgree ~ Treatment, family = binomial, data = pd2)
summary(glm5)

# Or

glm6 <- glm(BothAgree ~ RemScreen * Fine, family = binomial, data = pd2)
summary(glm6)
plot(glm6)
# Is prior argeement to cooperate affects their actual decision

```r
glm7<-glm(I(S1.Coop & S2.Coop)~BothAgree, family=binomial, data=pd2)
summary(glm7)
plot(glm7)
```

# What about the expectations about the other subject’s choice.

```r
glm8<-glm(I(S1.Coop & S2.Coop)~S1.Expect1*S2.Expect1, family=binomial, data=pd2)
summary(glm8)
glm9<-glm(I(S1.Coop & S2.Coop)~S1.Expect1+S2.Expect1, family=binomial, data=pd2)
summary(glm9)
anova(glm8,glm9,test="Chisq")
```

# Does a subject choose not to cooperate based on his expectations?

```r
glm10<-glm(I(!S1.Coop & S2.Coop)~S1.Expect1+S1.Expect2, family=binomial, data=pd2)
summary(glm10)
```

# There’s a mild evidence that the subject is inclined not to coop
# when s/he expets the other to coop
# But what happens if we swap 1 & 2

```r
glm11<-glm(I(S1.Coop & !S2.Coop)~S2.Expect1+S2.Expect2, family=binomial, data=pd2)
summary(glm11)
```

# There is no evidence now.

# Create a table of counts based on the subjects' expectation
# NN: Subject expects other NOT to cooperate and thinks the other does NOT
#    expect him to cooperate
# YN: Subject expects other to cooperate and thinks the other does NOT
#    expect him to cooperate
# NY: Subject expects other NOT to cooperate and thinks the other
#    expect him to cooperate
# YY: Subject expects other to cooperate and thinks the other
#    expect him to cooperate

#First the dataframe. Each subject’s two expectations are now

```r
pd3<-with(pd2,data.frame(Subj1=factor(1+I(S1.Expect1)+2*I(S1.Expect2),
                         labels=c("NN","YN","NY","YY")),
                         S1.Coop=S1.Coop, Subj2=factor(1+I(S2.Expect1)+2*I(S2.Expect2),
                         labels=c("NN","YN","NY","YY")),
                         S2.Cop=S2.Coop))
```

A<-with(pd3,table(Subj1,Subj2))
A1<-with(pd3,table(Subj1,Subj2,S1.Coop))[,2]

```r
round(A1/A,2)
```

# Create a data frame of these counts

```r
S1<-rep(row.names(A),rep(4,4))
```
S2<-rep(row.names(A),4)
c.pd<-data.frame(Subj1=S1,Subj2=S2, S1.Coop=matrix(t(A1),16,1), Tot=matrix(t(A),16,1))

# Probabilities of the first Subject to cooperate vs the saturated model.
c.glm<-glm(cbind(S1.Coop,Tot)~1,family=binomial, data=c.pd)
summary(c.glm)
#The Probabilities are different.