

lecture 4.10 example 1

preliminaries

```
#clear workspace
rm(list=ls())
#set random seed
set.seed(123)

# import libraries
library(MASS)
library(invgamma)

# load data
data = read.csv("~/Desktop/wages1.csv")

# build variables
wage = data$wage
school = data$school
exper = data$exper
gender = rep(0, length(wage))
gender[data$sex=="female"]=1
```

fit interaction model using OLS (pooling all data) and use fits to build posteriors

```
sC = school - mean(school)
eC = exper - mean(exper)
m = lm(log(wage) ~ sC + gender + gender * sC )
```

```
#posterior parameters
betaHat = coef(m)
sigmaHat = vcov(m)
shape = (length(wage) - 3) / 2
rate = sum(resid(m)^2)/2
```

posterior predictive checks

```
#specify simulation parameters
deltaSchool = -6:6
nSimsPer = 10000

predictMale = array(rep(-1, length(deltaSchool) * nSimsPer),
                    dim = c(length(deltaSchool), nSimsPer))
predictFemale = array(rep(-1, length(deltaSchool) * nSimsPer),
                      dim = c(length(deltaSchool), nSimsPer))

for (t in 1:nSimsPer) {
  # sample parameters from posteriors
  beta = mvrnorm(n=1, mu=betaHat, sigmaHat, tol = 1e-10)
```

```

sigma2 = rinvgamma(1,shape,rate)
sigma = sqrt(sigma2)
for (n in 1:length(deltaSchool)) {
  predictMale[n,t] = rnorm(1, beta[1] + beta[2] * deltaSchool[n],sigma)
  predictFemale[n,t] = rnorm(1, beta[1] + beta[3] + (beta[2]+beta[4]) * deltaSchool[n] ,sigma)
}
}

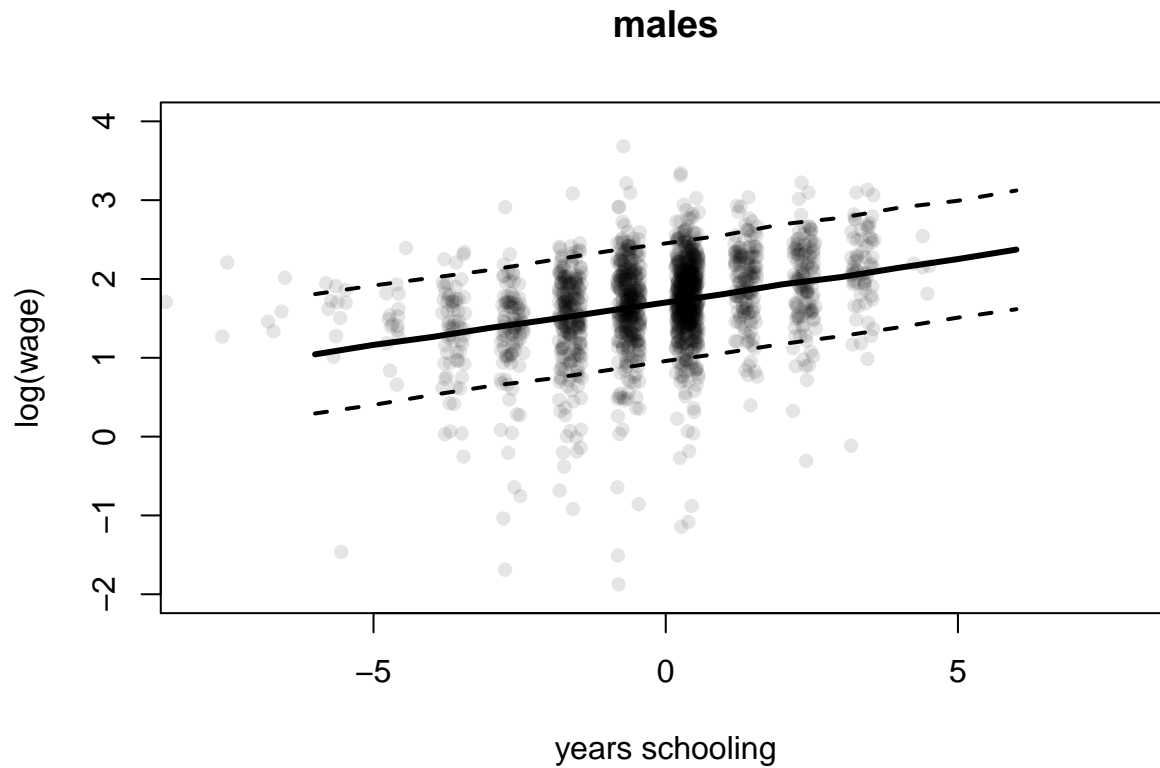
#predictive plot for males
meanMale = apply(predictMale,c(1),mean)

male10 = rep(0, length(deltaSchool))
for (t in 1:length(deltaSchool)) {
  male10[t] = quantile(predictMale[t,],probs=0.1)
}

male90 = rep(0, length(deltaSchool))
for (t in 1:length(deltaSchool)) {
  male90[t] = quantile(predictMale[t,],probs=0.9)
}

sCMale = sC[gender==0]
wageMale = wage[gender==0]
plot(jitter(sCMale,1), log(wageMale),
     col=rgb(red=0.0, green=0.0, blue=0.0, alpha=0.1),
     pch = 16, xlim = c(-8,8), ylim=c(-2,4),
     xlab = "years schooling", ylab = "log(wage)",
     main = "males")
points(deltaSchool, meanMale,
       type="l", lwd = 3)
points(deltaSchool, male10,
       type="l", lwd=2, lty=2)
points(deltaSchool, male90,
       type="l", lwd=2, lty=2)

```



```
#predictive plot for females
meanFemale = apply(predictFemale,c(1),mean)

female10 = rep(0, length(deltaSchool))
for (t in 1:length(deltaSchool)) {
  female10[t] = quantile(predictFemale[t,],probs=0.1)
}

female90 = rep(0, length(deltaSchool))
for (t in 1:length(deltaSchool)) {
  female90[t] = quantile(predictFemale[t,],probs=0.9)
}

sCFemale = sC[gender==1]
wageFemale = wage[gender==1]
plot(jitter(sCFemale,1), log(wageFemale),
     col=rgb(red=0.0, green=0.0, blue=0.0, alpha=0.1),
     pch = 16, xlim = c(-8,8), ylim = c(-2,4),
     xlab = "years schooling", ylab = "log(wage)",
     main = "females")
points(deltaSchool, meanFemale,
       type="l", lwd = 3)
points(deltaSchool, female10,
       type="l", lwd=2, lty=2)
points(deltaSchool, female90,
       type="l", lwd=2, lty=2)
```

females

