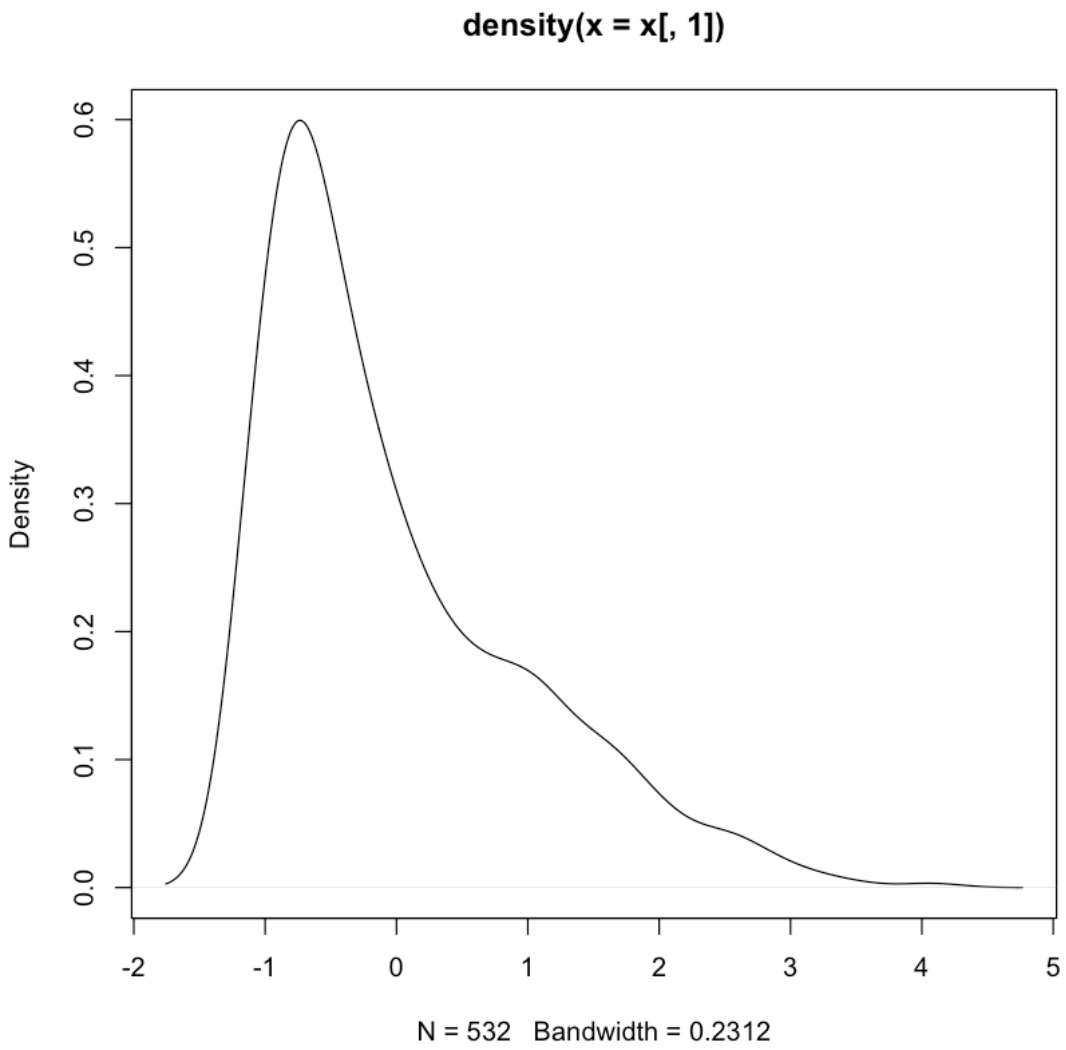
tut9

October 10, 2023

1 Problem 10.5

$$P = P(Y|\theta, \beta, \gamma)P(\theta, \beta|\gamma)P(\gamma)$$

[ ]:
```
df<-read.table('azdiabetes.dat')
y<-df[-1,8]
df<-df[-1,c(1,3,5,6,7)]
n<-nrow(df)
df[,]<-lapply(df[,],as.numeric)
y<-as.numeric(y=='Yes')
x<-df-t(matrix(rep(colMeans(df),n),nrow=5,ncol=n))#minus mean
x<-x/(t(matrix(rep(sqrt(colMeans(x^2)*n/(n-1)),n),nrow=5,ncol=n)))#divide by ssd
par(bg='white')
plot(density(x[,1]))
x<-as.matrix(x)
y<-as.matrix(y)
gamma<-rep(1,5)
beta<-c(rnorm(1,0,4),rnorm(5,0,2))
```



[ ]:
```
mod<-glm(y~ 1+x, family=binomial)
summary(mod)$coef
```

A matrix: 6 x 4 of type dbl

	Estimate	Std. Error	z value	Pr(>|z|)
(Intercept)	-0.86438084	0.1083823	-7.97529780	1.520138e-15
xV1	0.28042806	0.1286466	2.17983275	2.926986e-02
xV3	0.01114933	0.1154134	0.09660341	9.230413e-01
xV5	0.70252918	0.1198497	5.86174962	4.580153e-09
xV6	0.45689947	0.1076196	4.24550425	2.181024e-05
xV7	0.50473898	0.1352975	3.73058551	1.910353e-04

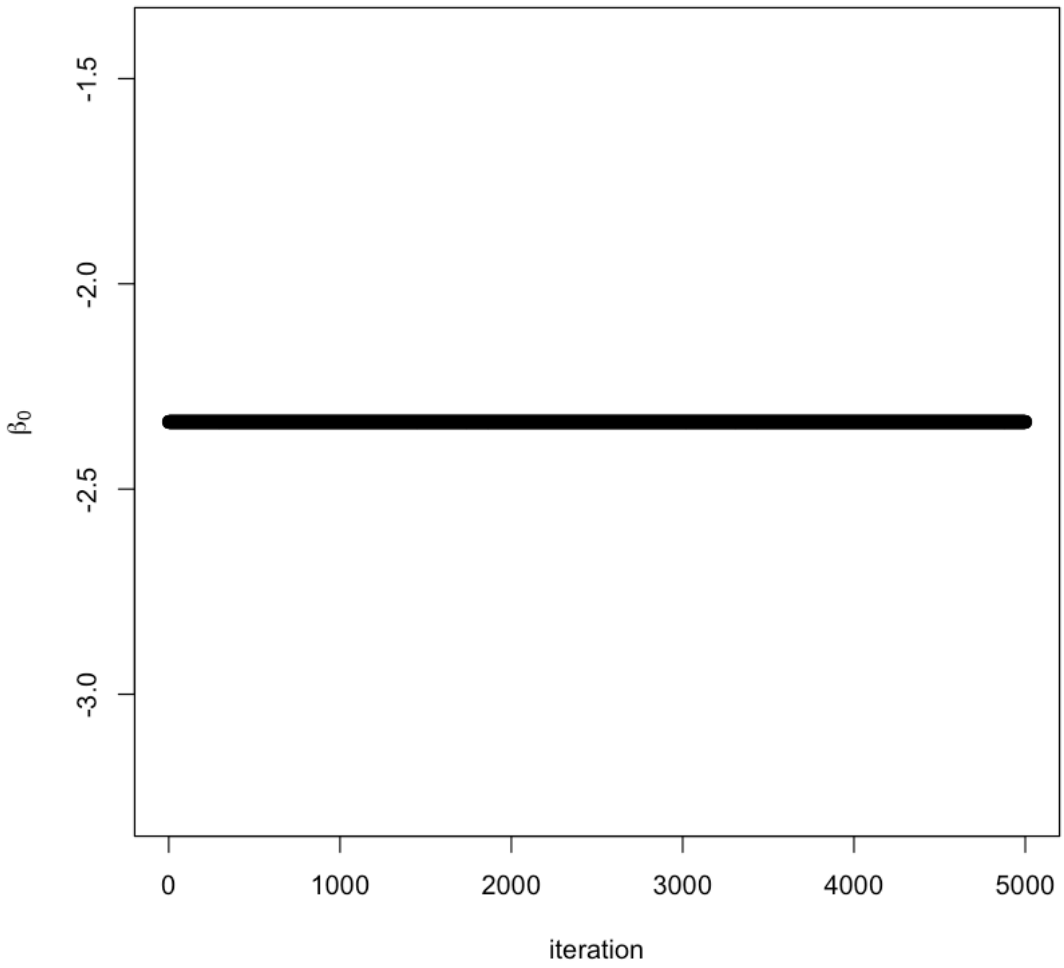
[ ]:
```
ilogit<-function(theta){
  out<-exp(theta)/(1+exp(theta))
```

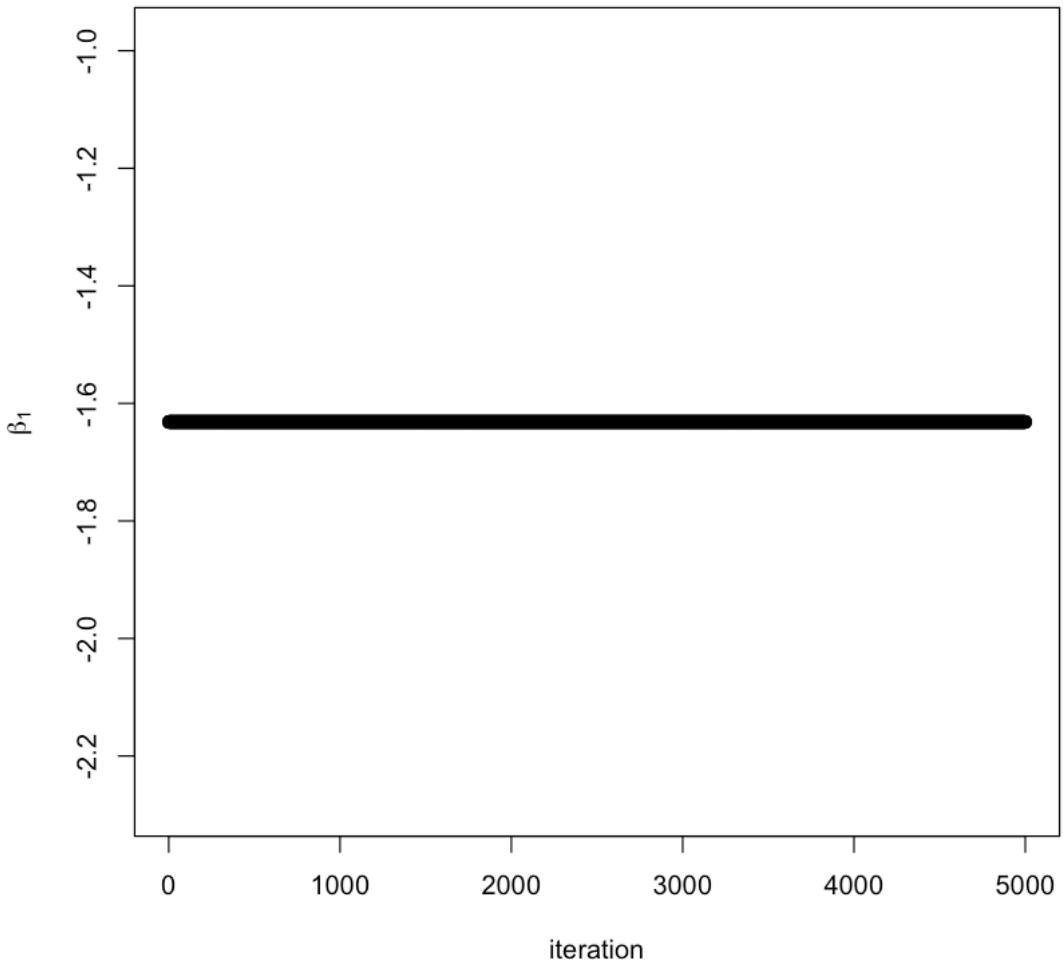
```
  return(out)
}
rit_gamma<-function(gamma){
  gamma<- rbinom(5,1,0.5)
  # loc<- 1+rmultinom(5,1,rep(1/5,5))
  # gamma[loc]<-1-gamma[loc]
  return(gamma)
}
dr_it_beta<-function(beta){
  new_rbeta<- rnorm(1,beta[1],4)
  j_dbeta<- dnorm(1,beta[1],4,log=TRUE)
  new_dbeta<- dnorm(1,0,4,log=TRUE)
  new_rbeta<- c(new_rbeta,rnorm(5,beta[-1],2))
  j_dbeta<-c(j_dbeta,dnorm(new_rbeta[-1],beta[-1],2,log=TRUE))
  new_dbeta<- c(new_dbeta,dnorm(new_rbeta[-1],0,2,log=TRUE))
  # out<-c(sum((new_dbeta+j_dbeta)*gamma),new_rbeta*gamma+beta*(1-gamma))
  out<-list(rv=new_dbeta,db=new_dbeta,dj=j_dbeta)
  return(out)
}
# gamma<-rit_gamma(gamma)
dr_beta<-dr_it_beta(beta)
dbeta<-dr_beta$db
beta<-dr_beta$rv
jbeta<- dr_beta$dj
# p1<-log(ilogit(x%*%beta[-1]+beta[1]))
# logp<- sum(p1*y+(1-p1)*(1-y))+dnorm(beta[1],0,4,log = TRUE)
```

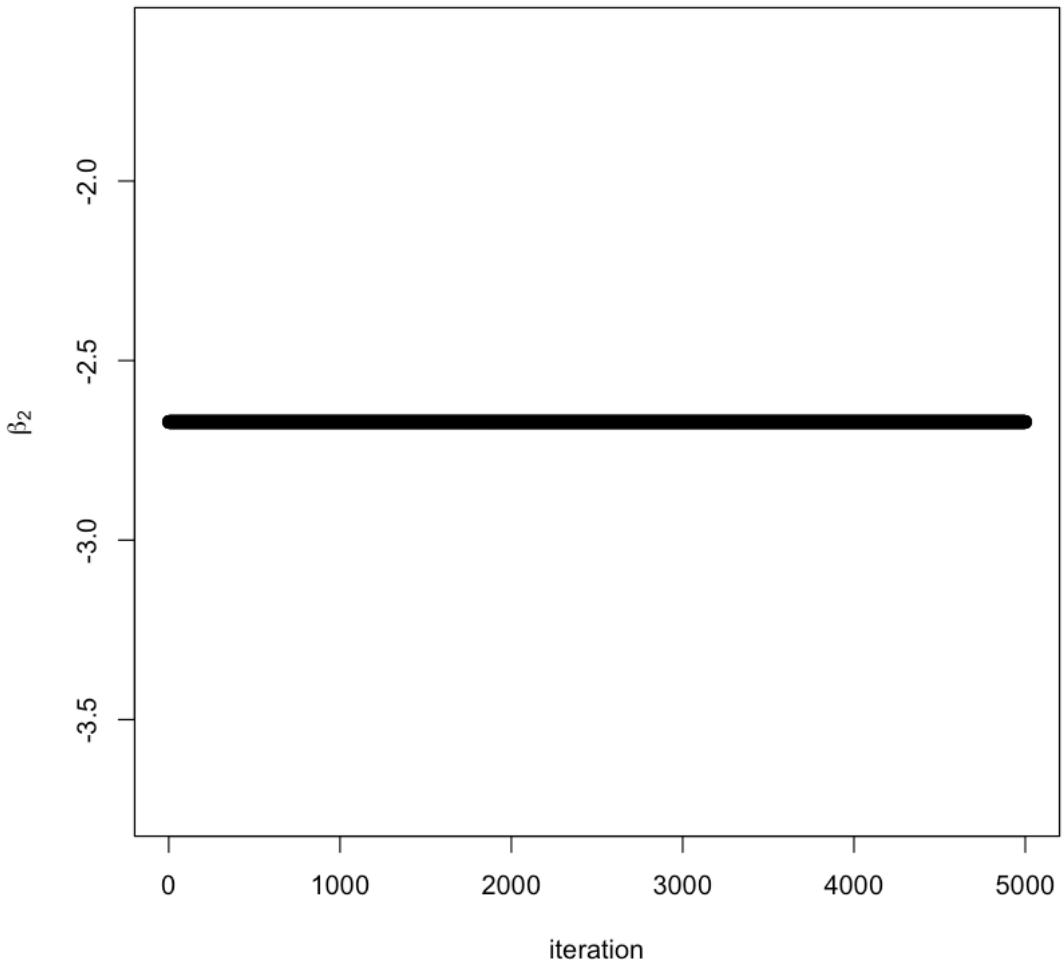
[ ]:
```
S <- 1000*5
Beta<-P<-NULL
Gamma<-NULL
for(i in 1:S){
    new_gamma<-rit_gamma(gamma)
    p0<-ilogit(x%*%(matrix(beta[-1]*gamma))+beta[1])
    p1<-ilogit(x%*%(matrix(beta[-1]*new_gamma))+beta[1])
    logp <- sum(log(p1/p0)*y+log((1-p1)/(1-p0))*(1-y))
    if(log(runif(1))<logp){
        gamma<-new_gamma
    }
    dr_beta<-dr_it_beta(beta)
    new_dbeta<-dr_beta$db
    new_beta<-dr_beta$rv
    new_jbeta<- dr_beta$dj
    p0<-ilogit(x%*%(matrix(beta[-1]*gamma))+beta[1])
    p1<-ilogit(x%*%(matrix(new_beta[-1]*gamma))+new_beta[1])
    logp <- sum(log(p1/p0)*y+log((1-p1)/
 ↪(1-p0))*(1-y))+sum((new_dbeta-dbeta+new_jbeta-jbeta)*c(1,gamma))
    if(log(runif(1))<logp){
```

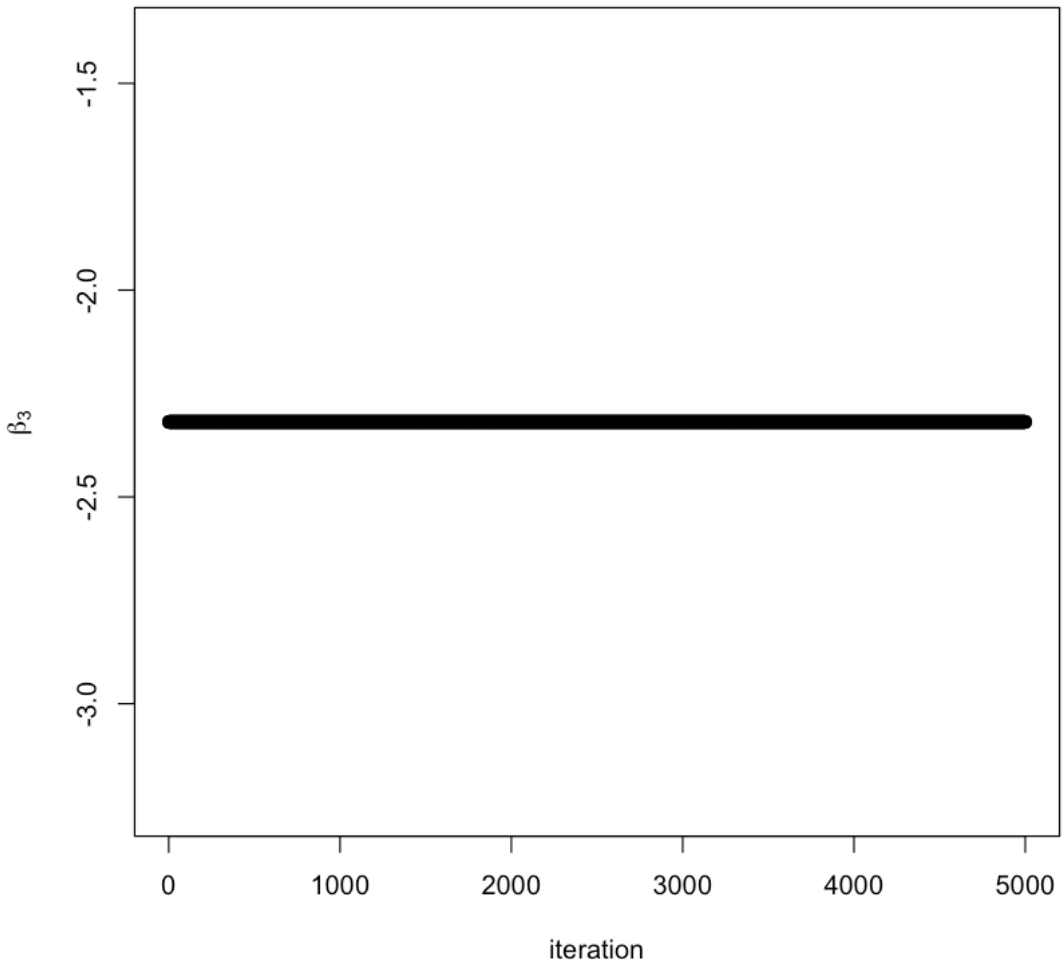
```
        beta<-new_beta*c(1,gamma)+beta*c(0,1-gamma)
        dbeta<-new_dbeta*c(1,gamma)+dbeta*c(0,1-gamma)
        jbeta<-new_jbeta
    }
    Beta<-rbind(Beta,beta)
    Gamma<-rbind(Gamma,gamma)
}
# for(i in 1:S){
#     new_gamma<-rit_gamma(gamma)
#     dr_beta<-dr_it_beta(new_gamma,beta)
#     new_dbeta<-dr_beta[1]
#     new_beta<-dr_beta[-1]
#     p0<-ilogit(x%*%(matrix(beta[-1]*gamma))+beta[1])
#     p1<-ilogit(x%*%(matrix(new_beta[-1]*new_gamma))+new_beta[1])
#     logp <- sum(log(p1/p0)*y+log((1-p1)/(1-p0))*(1-y))+new_dbeta-dbeta
#     if(is.na(logp)){
#         p<-0
#     }
#     else{
#     p<-min(c(1,exp(logp)))
#     }
#     if(p==1){
#         beta<-new_beta
#         dbeta<-new_dbeta
#         gamma<-new_gamma
#     }
#     P<-rbind(P,logp)
#     Beta<-rbind(Beta,beta)
#     Gamma<-rbind(Gamma,gamma)
# }
```

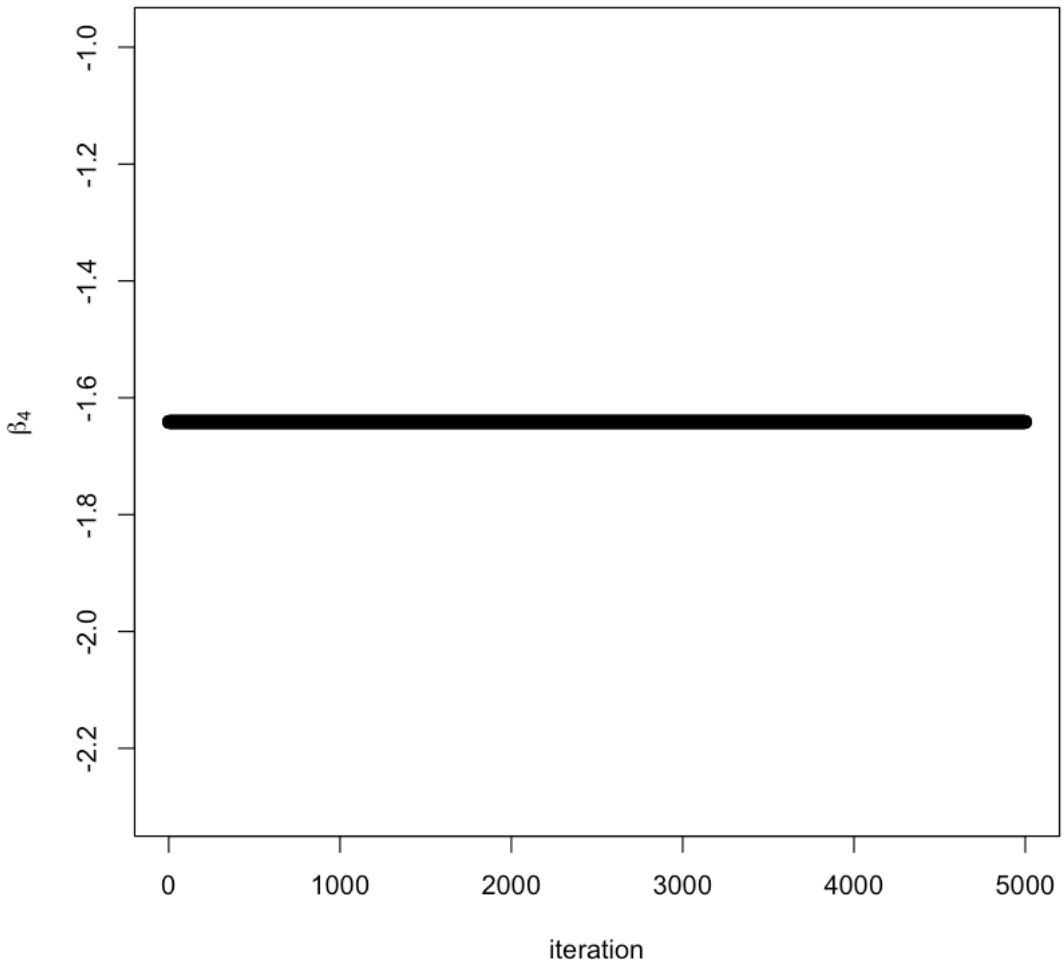
[ ]:
```
par(bg='white')
for(i in 1:6){
    plot(Beta[,i],ylab=bquote(beta[.(i-1)]),xlab='iteration')
    if(i!=6){
    # plot(Gamma[,i],ylab=bquote(gamma[.(i)]),xlab='iteration')
    }
}
```

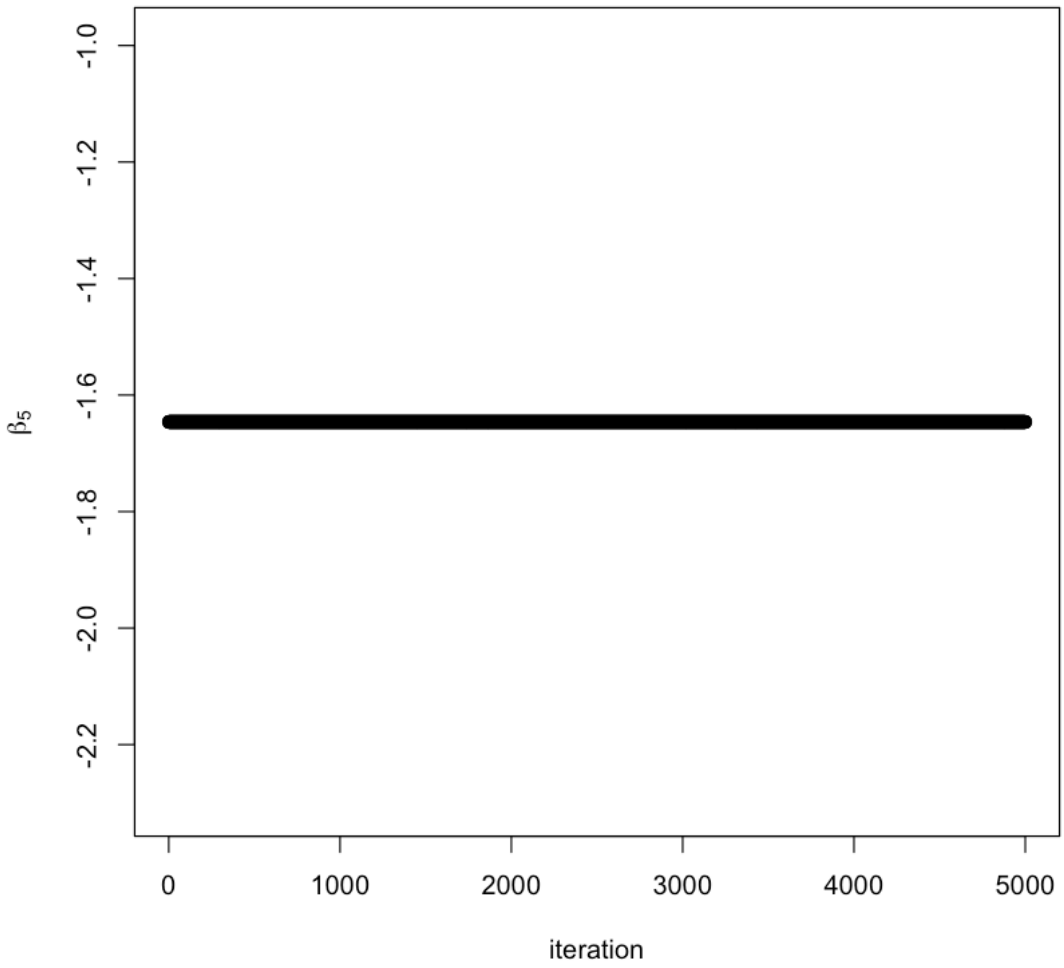

-1.5
-2.0
-2.5
-3.0
β_0
0
1000
2000
3000
4000
5000
iteration


-1.0
-1.2
-1.4
-1.6
-1.8
-2.0
-2.2
β_1
0
1000
2000
3000
4000
5000
iteration


-2.0
-2.5
-3.0
-3.5
β_2
0
1000
2000
3000
4000
5000
iteration


-1.5
-2.0
-2.5
-3.0
β3
0
1000
2000
3000
4000
5000
iteration


-1.0
-1.2
-1.4
-1.6
-1.8
-2.0
-2.2
β4
0
1000
2000
3000
4000
5000
iteration



[ ]:
```
gamma
```

1. 0 2. 0 3. 0 4. 0 5. 0