

Applied Bayesian Analysis : NCSU ST 540

Homework 7

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In this assignment we will performing random slopes logistic regression in JAGS using the Gambia data described in <http://www4.stat.ncsu.edu/~reich/ABA/code/GLM> Let Y_i be the binary response for individual i , and let $\nu_i \in 1 \cdots 65$ denote the village of individual i . Let $X_i = 1$ if individual i regularly sleeps under a bed-net and $X_i = 0$ otherwise. Fit the model

$$\text{logit}(P(Y_i = 1)) = \alpha_{\nu_i} + X_i \beta_{\nu_i}$$

where α_{ν_i} and β_{ν_i} are the intercept and slope for village j . The priors (independent over village and with each other) are

$$\alpha_{\nu_i} \sim \text{Normal}(\mu_a, \sigma_a^2)$$

and

$$\beta_{\nu_i} \sim \text{Normal}(\mu_b, \sigma_b^2)$$

Choose uninformative priors for $\mu_a, \sigma_a^2, \mu_b, \sigma_b^2$

In your report address the follow questions: (1) Scientifically, why might the effect of bed-net vary by village? (2) Did the MCMC algorithm converge? (3) Do you see evidence that the slopes and/or intercepts vary by village? (4) Which village has the largest intercept? Slope? Does this agree with the data in these villages?

```
library(rjags)
library(coda)
library(modeest)

DEBUG <- TRUE
if(DEBUG)
{
nSamples <- 2000
n.chains <- 4
} else
{
nSamples <- 10000
n.chains <- 1
}

load("gambia.RData")

X.net <- as.numeric((X$netuse==1) | (X$treated==1))
Y <- pos
n <- length(X.net)
```

```

df <- data.frame(cbind(X.net,village,pos))
names(df) <- c("net","village","pos")
numVillages <- length(unique(df$village))
villages <- df$village

#boxplot(pos ~ village, data = df)
#plot(df$village,df$pos)
#ggplot(df, aes(x=village, y=net, color=pos))
#plot(df$village)
#village.counts <- unlist(table(df$village))

model_string.logistic_random_slopes <- "model{
  # Likelihood
  for(i in 1:n){
    Y[i] ~ dbern(q[i])
    logit(q[i]) <- beta[villages[i],1] + beta[villages[i],2]*X.net[i]
  }

  # Random effects
  for(j in 1:numVillages){
    beta[j,1] ~ dnorm(0,0.1)
    beta[j,2] ~ dnorm(0,0.1)
  }

  for(j in 1:numVillages){
    pred[j] <- beta[j,1] + beta[j,2]
  }
}"
```

```

model.logistic_random_slopes <- jags.model(textConnection(model_string.logistic_random_slopes))

## Compiling model graph
## Resolving undeclared variables
## Allocating nodes
## Graph information:
##   Observed stochastic nodes: 2035
##   Unobserved stochastic nodes: 130
##   Total graph size: 6625
##
## Initializing model
update(model.logistic_random_slopes, nSamples, progress.bar="none"); # Burnin
samp.coeff.logistic_random_slopes <- coda.samples(model.logistic_random_slopes, variable.names

sum.logistic_random_slopes <- summary(samp.coeff.logistic_random_slopes)
```

```

# quantiles<-sum.logistic_random_slopes$quantiles
# left.05.quantile.sign <- sign(quantiles[,1])== -1
# right.95.quantile.sign <- sign(quantiles[,5]) == 1
# significant <- xor(left.05.quantile.sign ,right.95.quantile.sign)
# beta.significant <- quantiles[significant,]
# pander(data.frame(beta.significant), caption = "significant ")
# credible.widths <- beta.significant[,5]-beta.significant[,1]
# pander(data.frame(credible.widths), caption = "credible widths ")
#
#
if (DEBUG)
{
  autocorr.plot(samp.coeff.logistic_random_slopes)

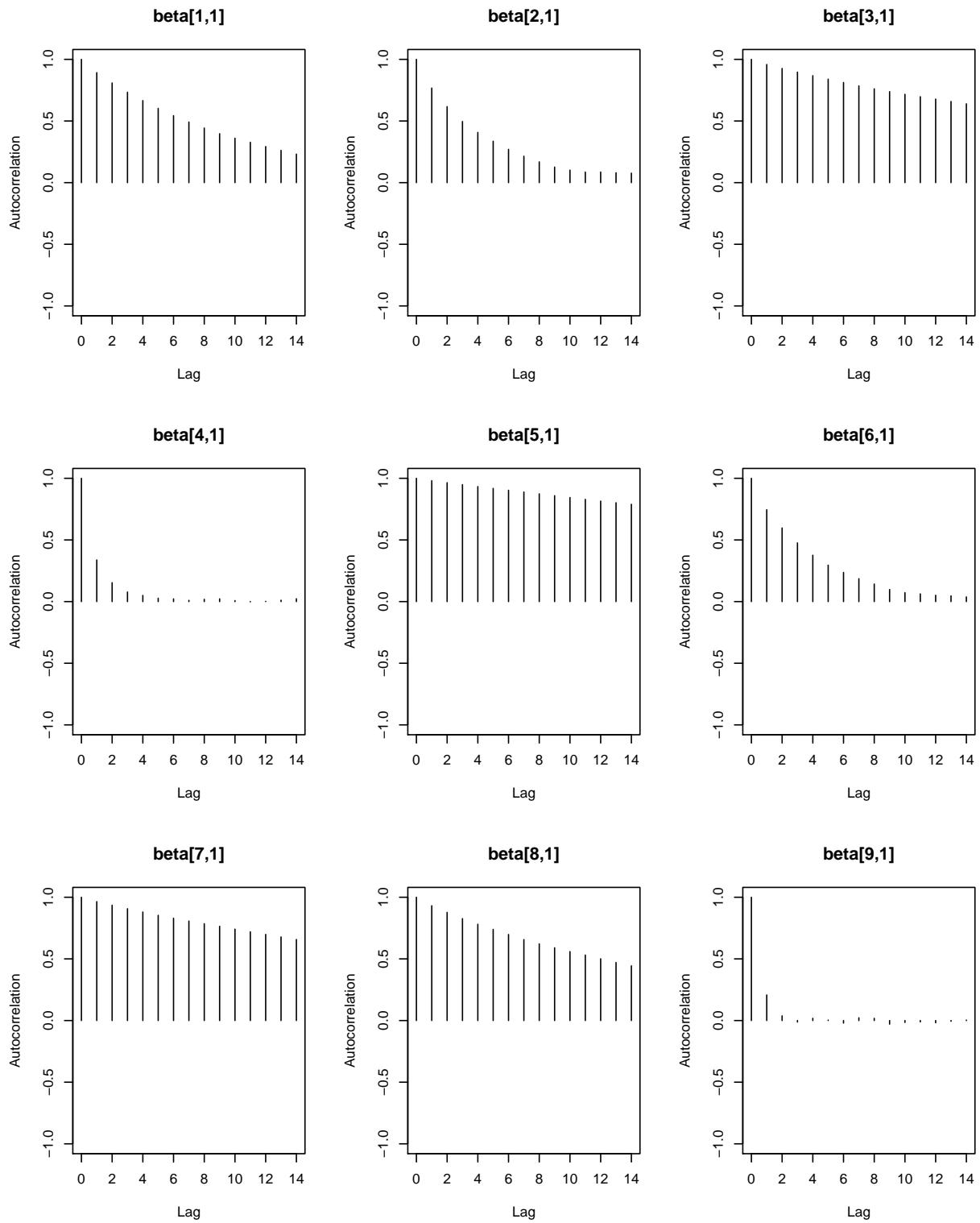
  plot(samp.coeff.logistic_random_slopes)

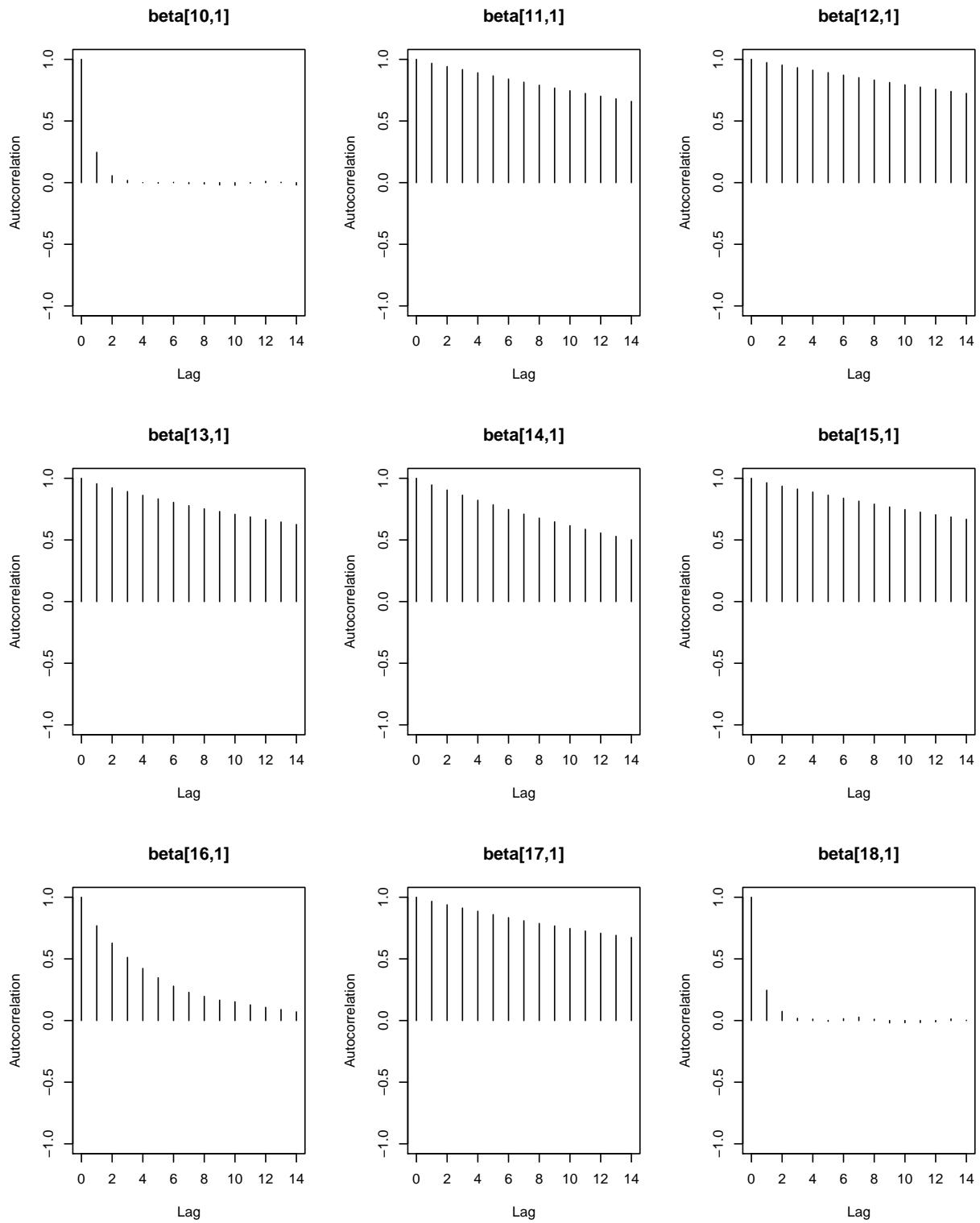
#Sample again and estimate posterior means and MAP posterior modes.
samp.coeff.logistic_random_slopes.jags <- jags.samples(model.logistic_random_slopes, variable
posterior_means.logistic_random_slopes <- lapply(samp.coeff.logistic_random_slopes.jags, appi
pander(posterior_means.logistic_random_slopes, caption = "posterior means second sample")

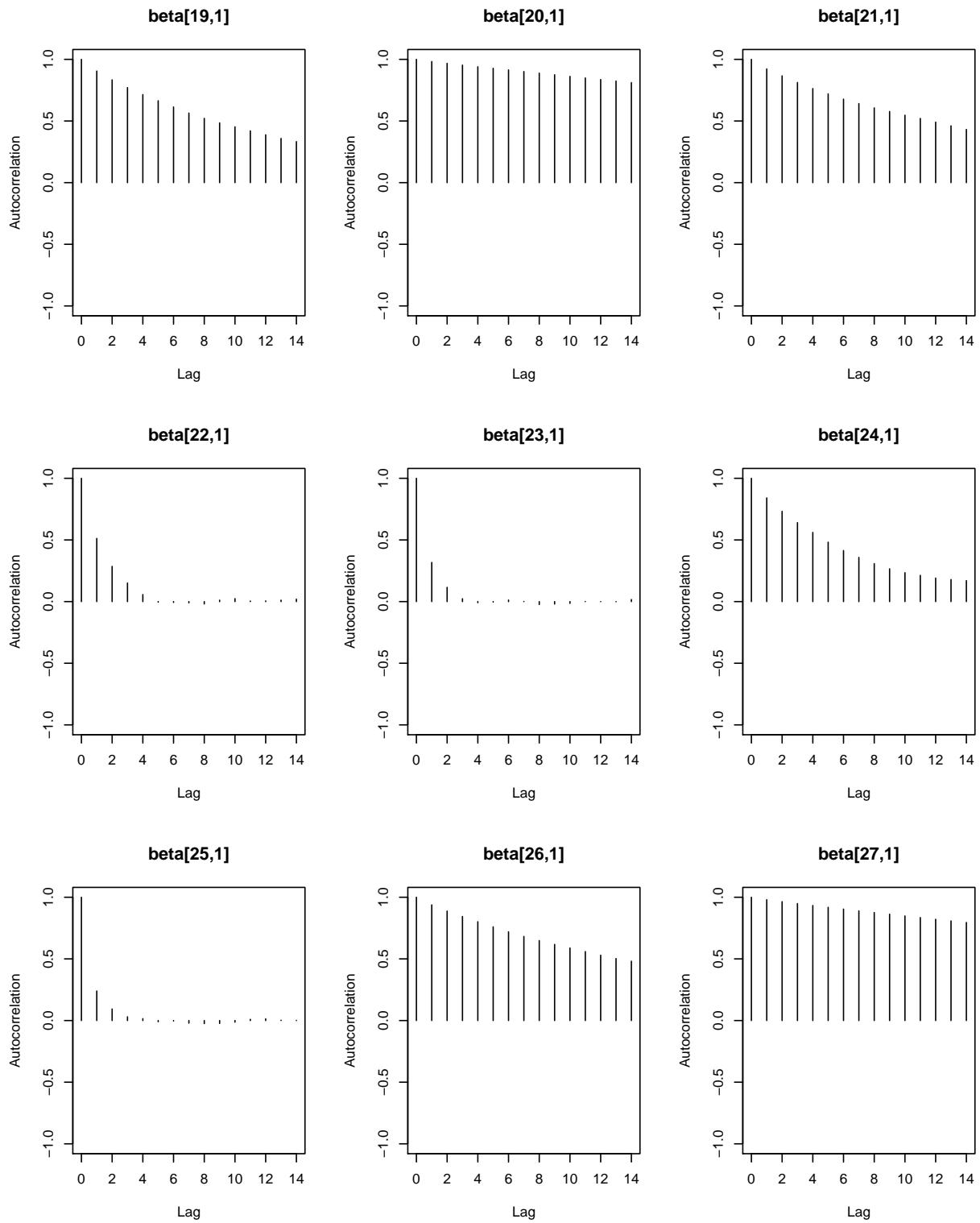
posterior_modes.logistic_random_slopes <- lapply(samp.coeff.logistic_random_slopes.jags, appi
posterior_modes.logistic_random_slopes

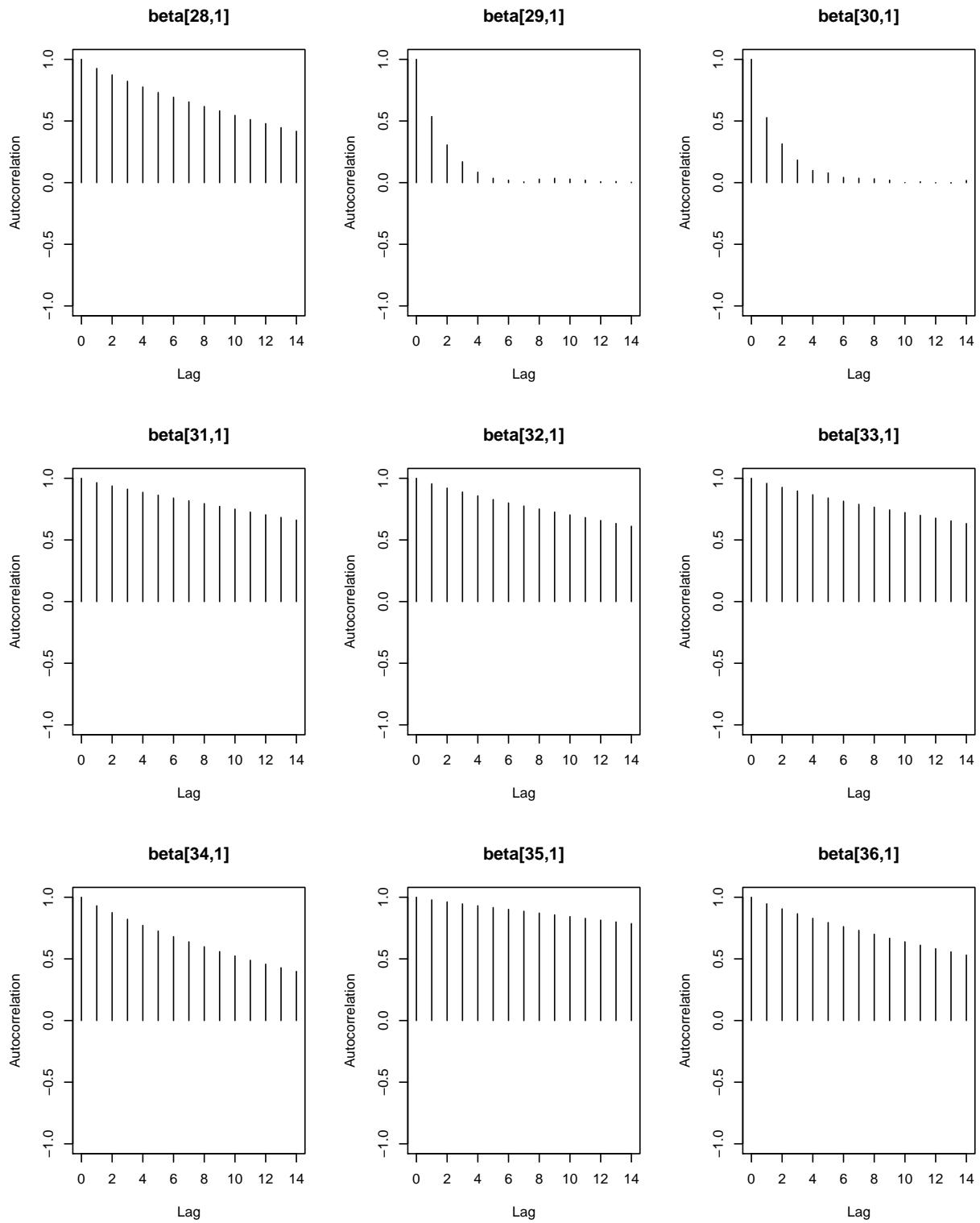
if(n.chains>1)
{
  gelman.plot(samp.coeff.logistic_random_slopes)
}
}

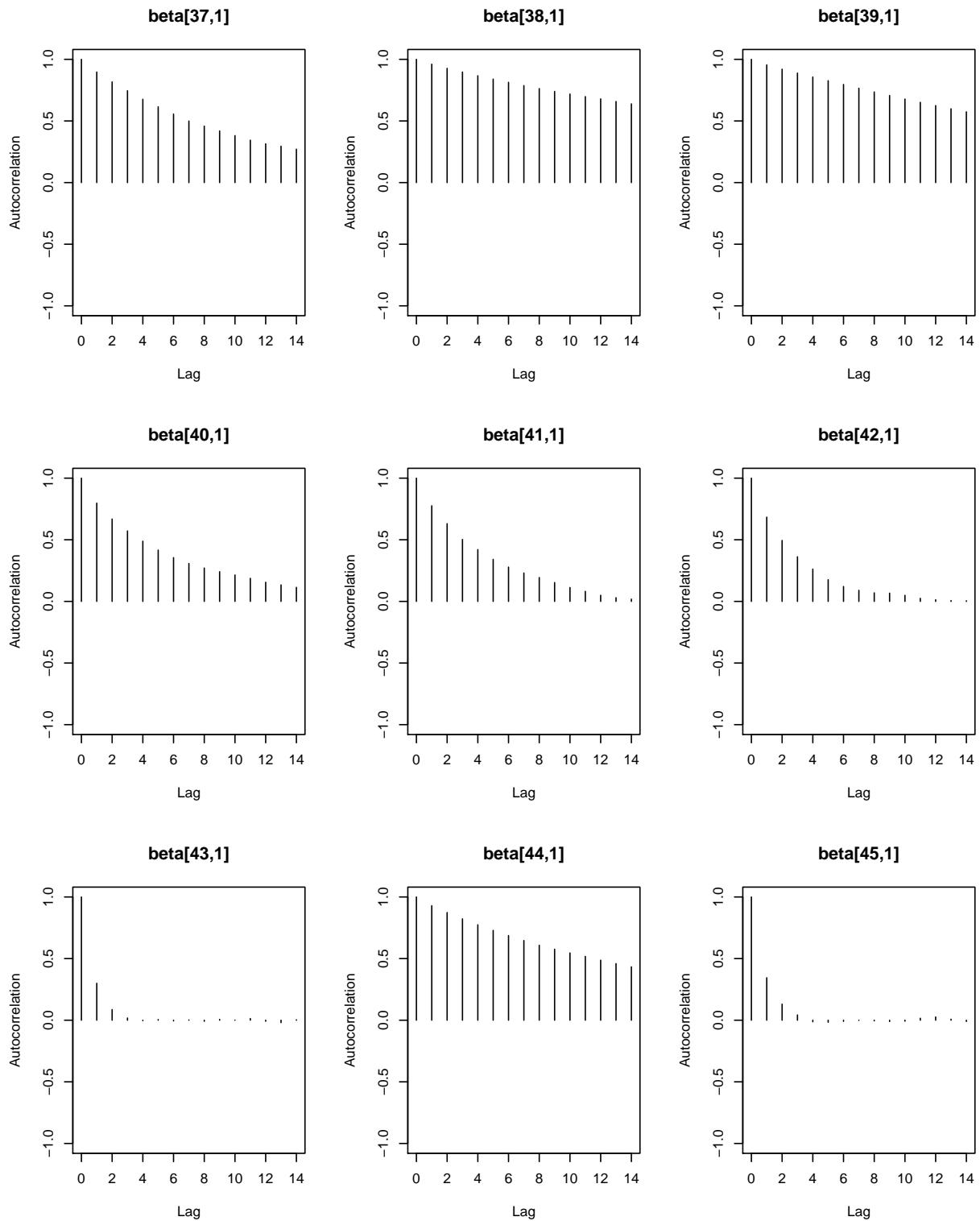
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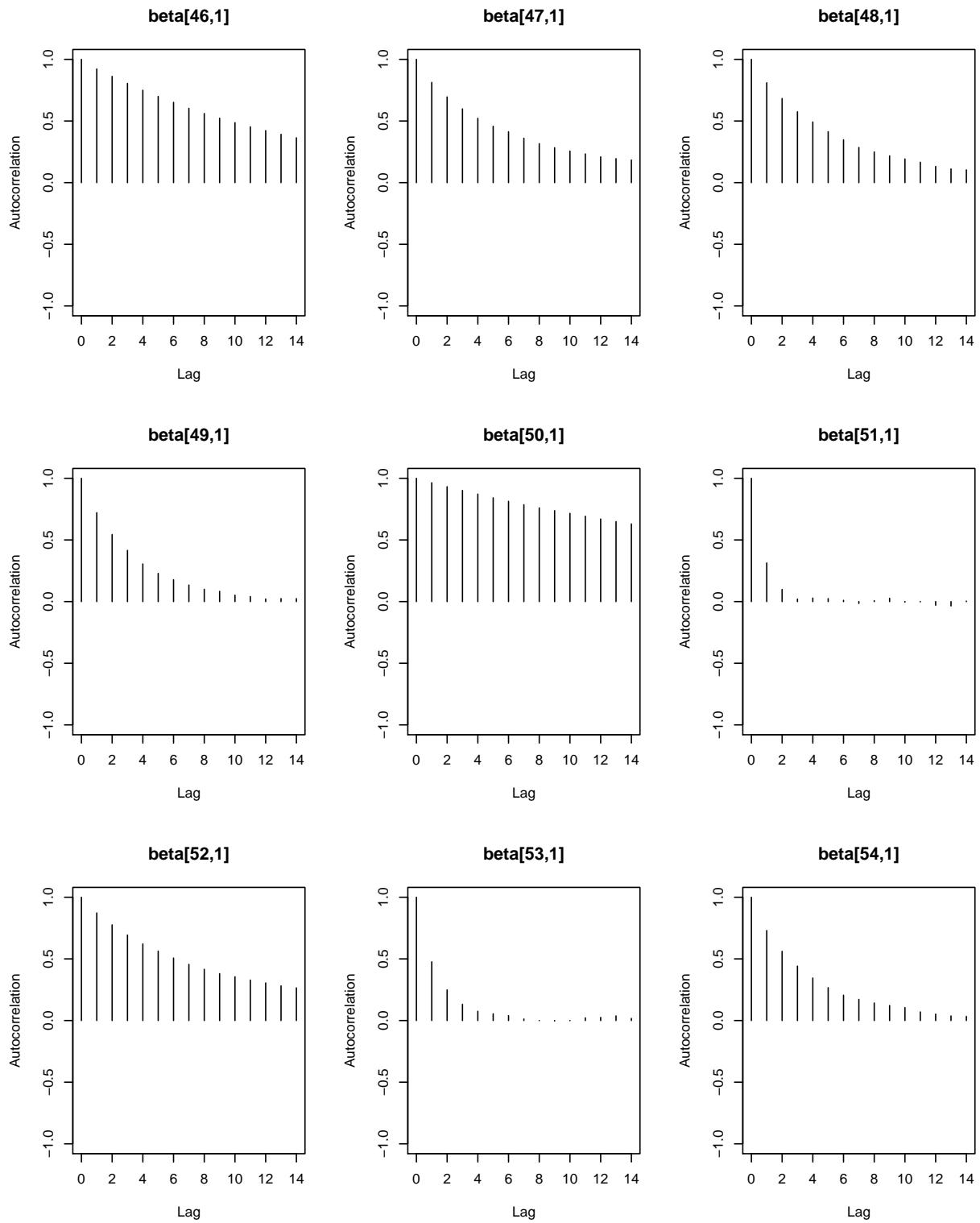


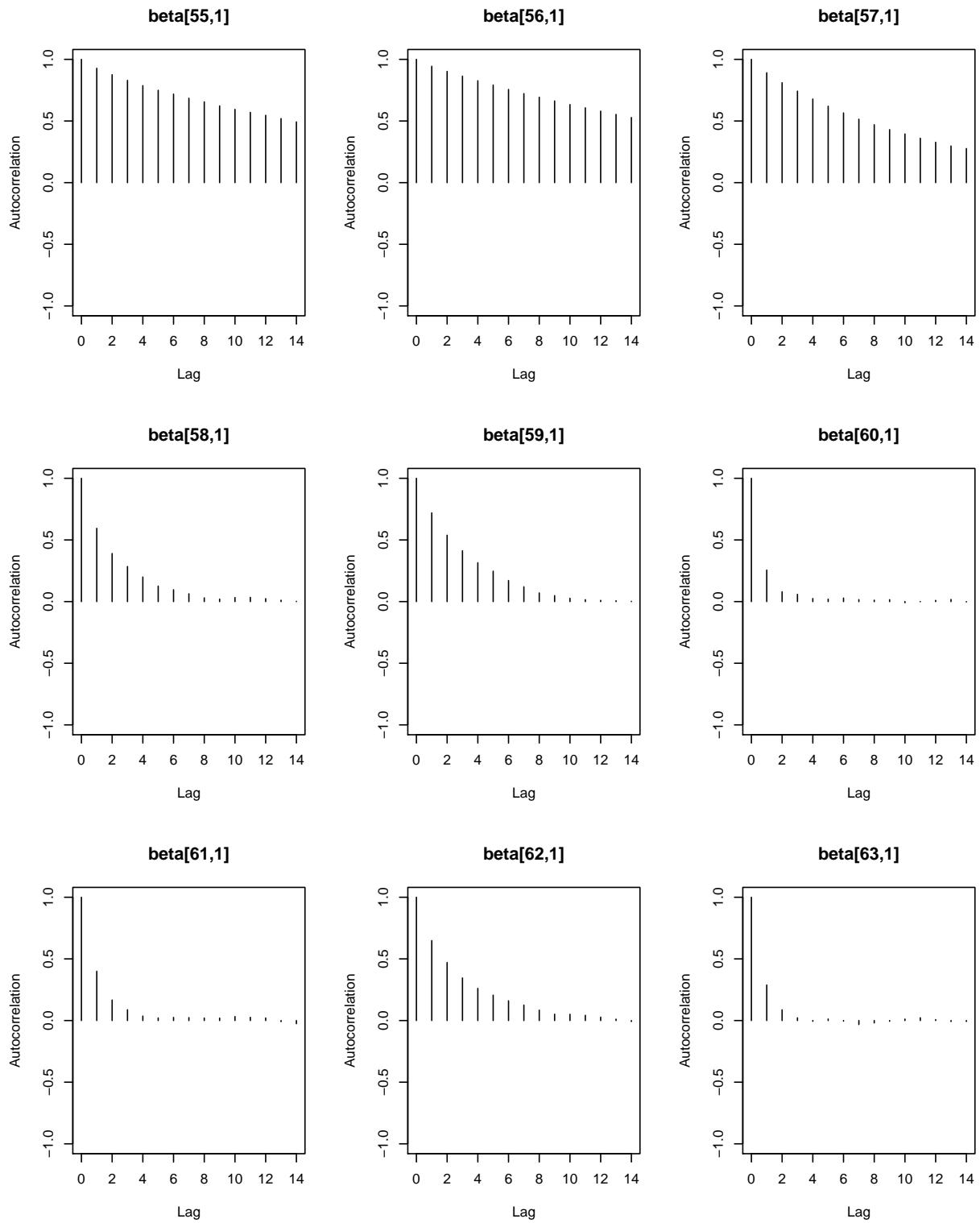


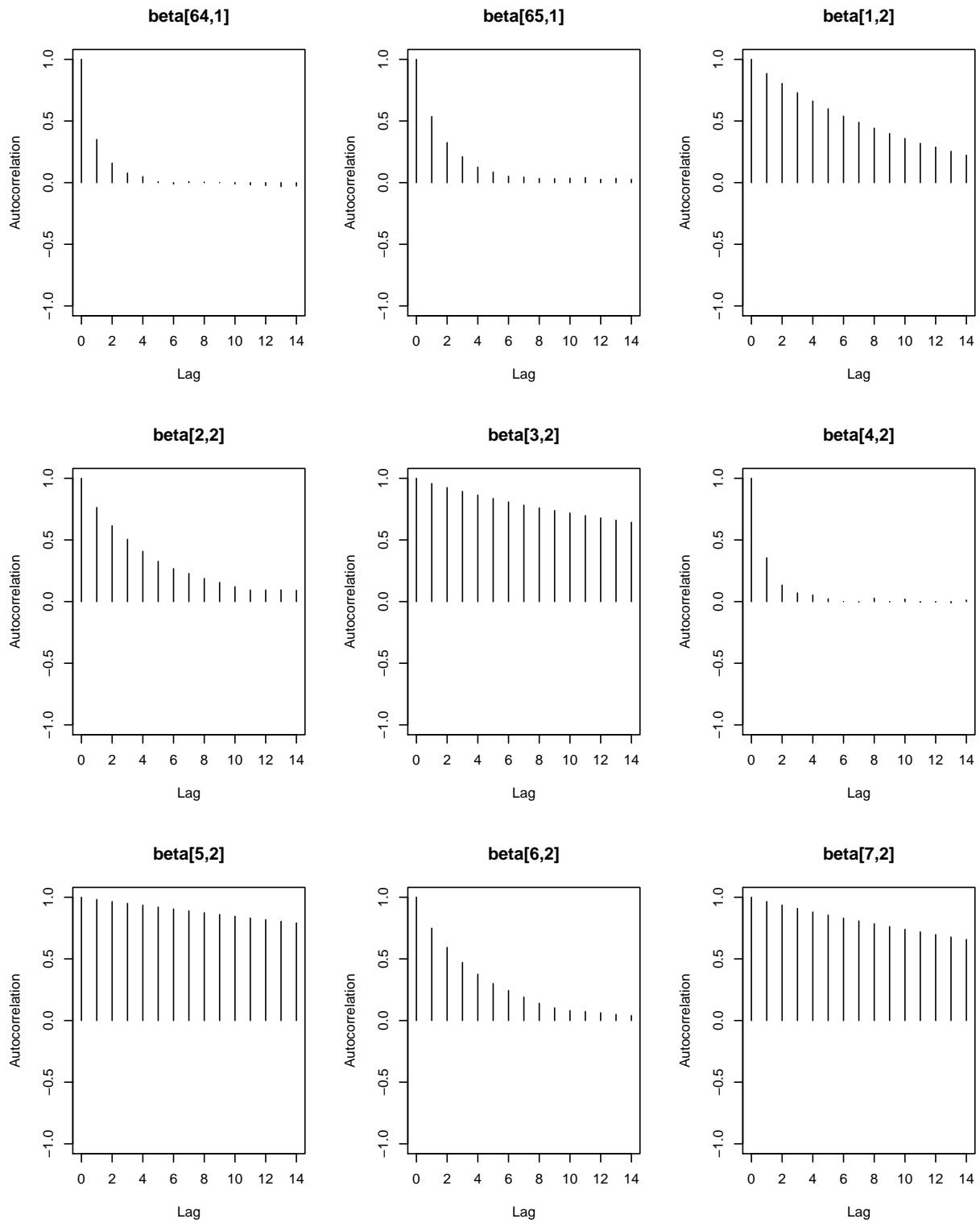


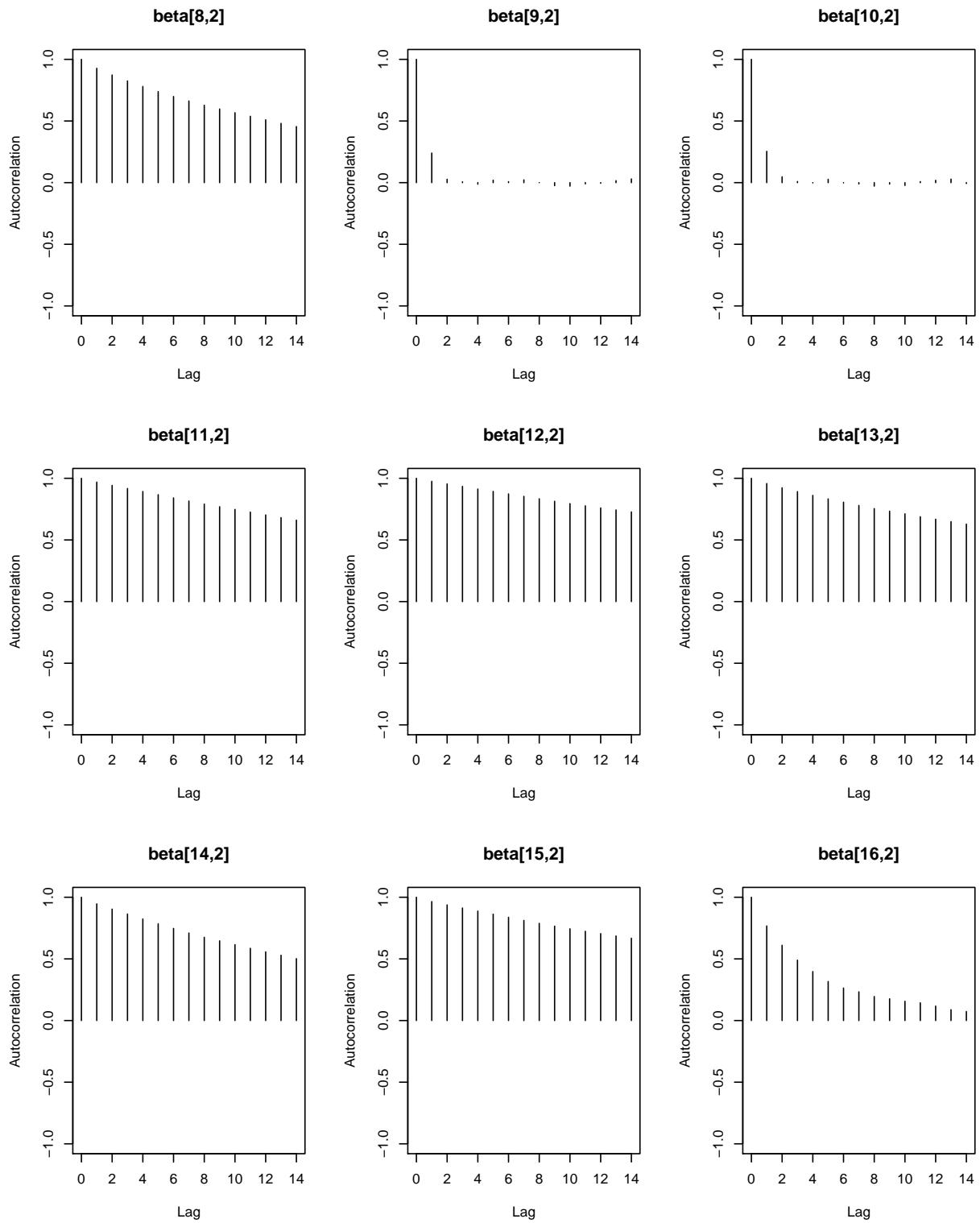


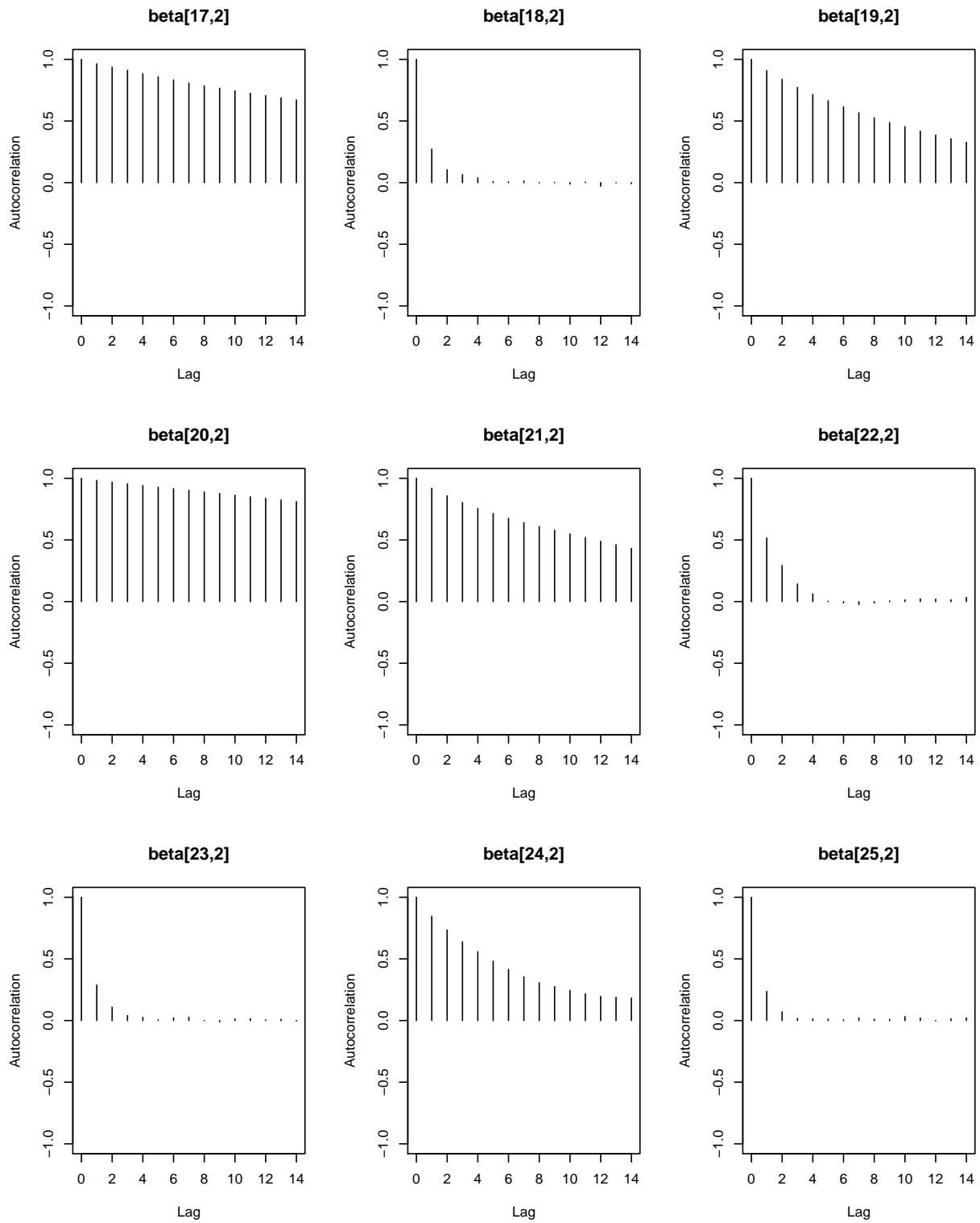


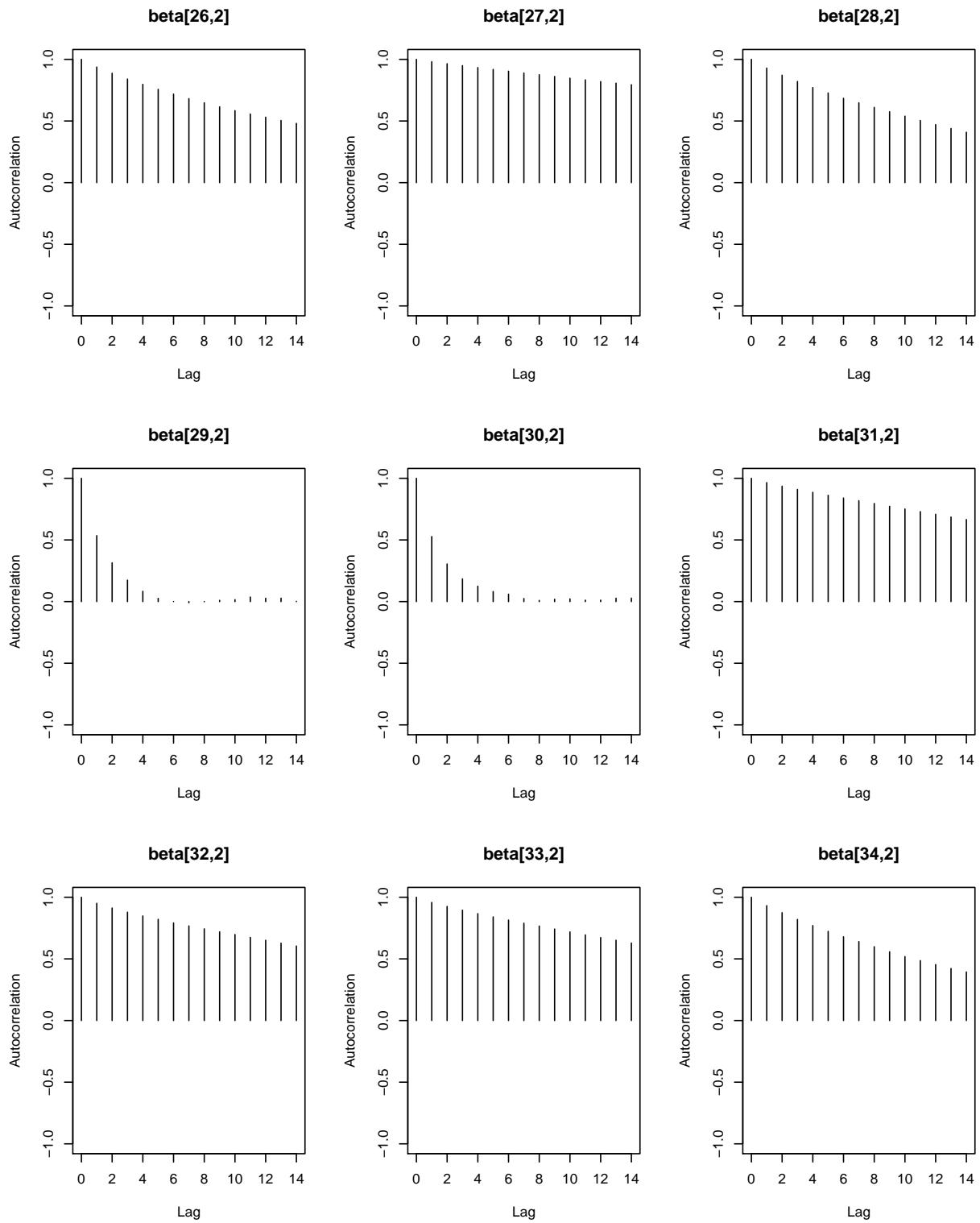


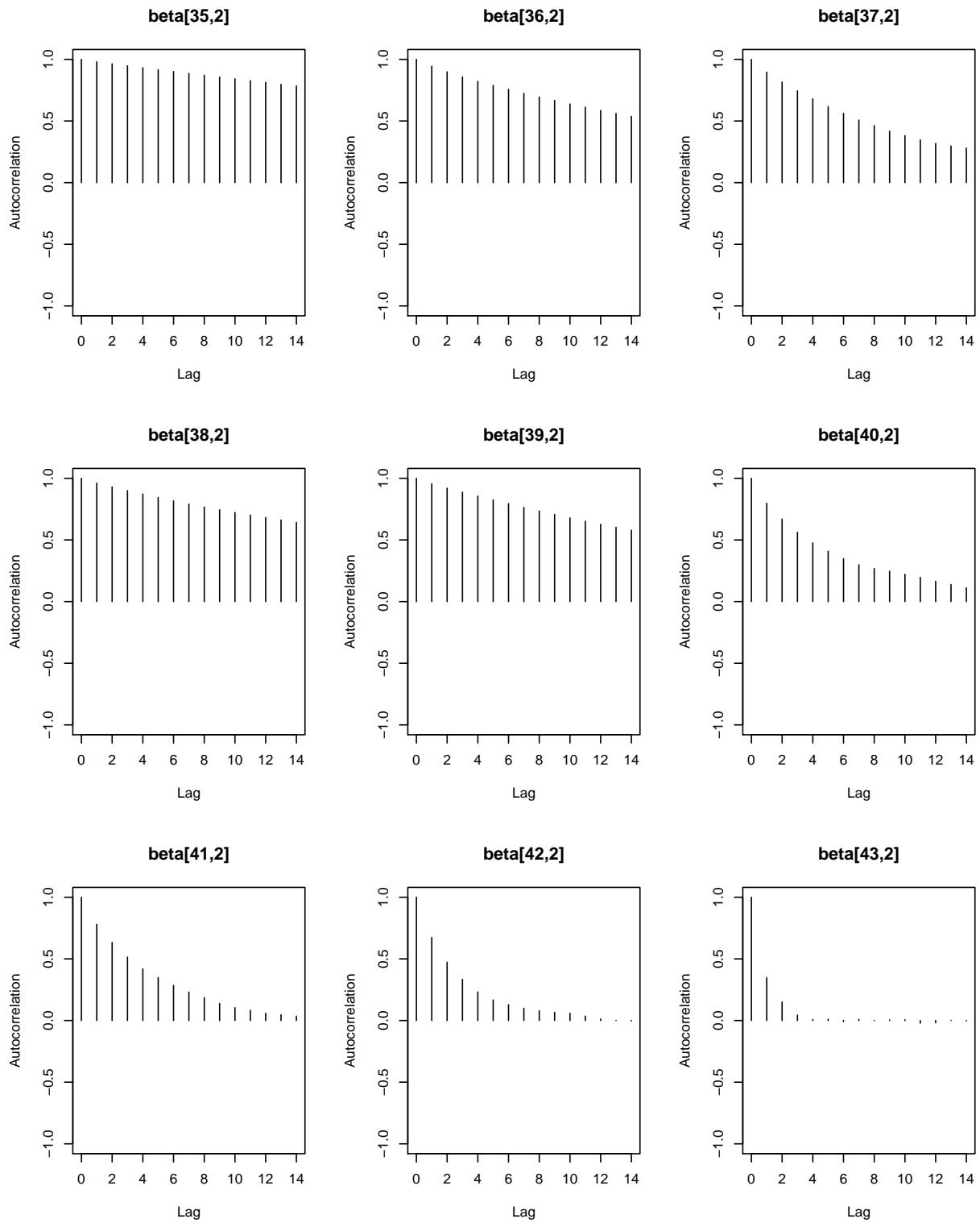


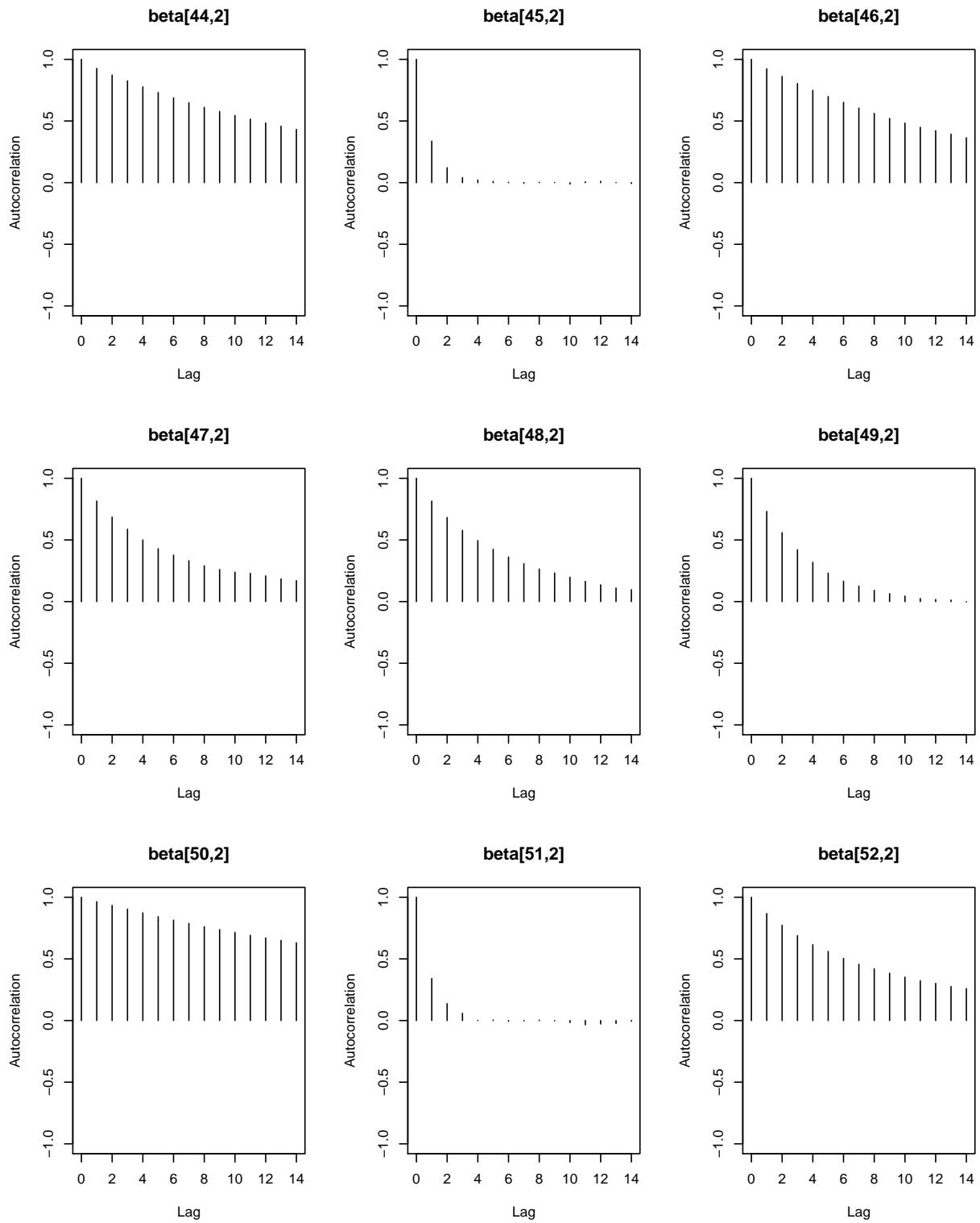


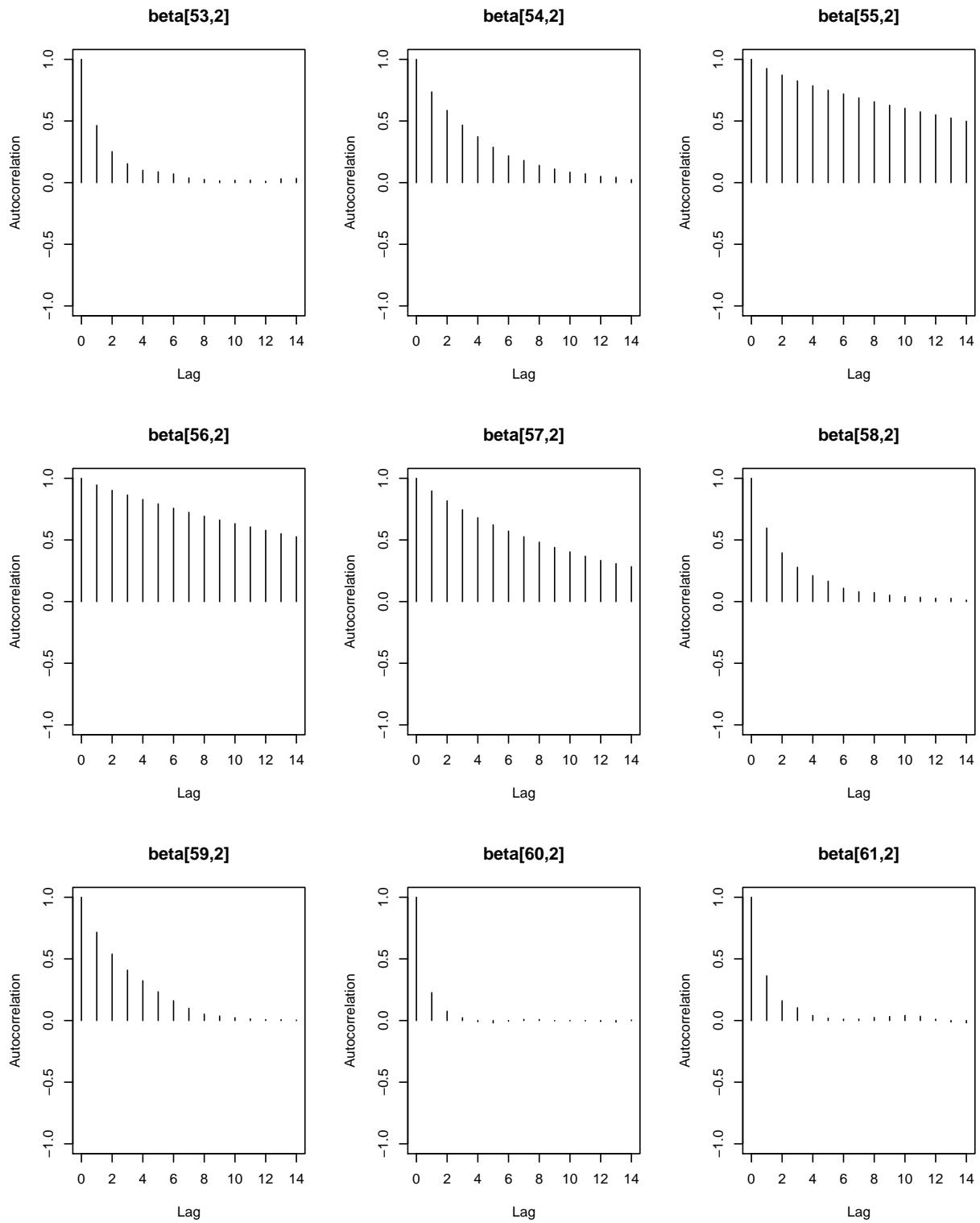


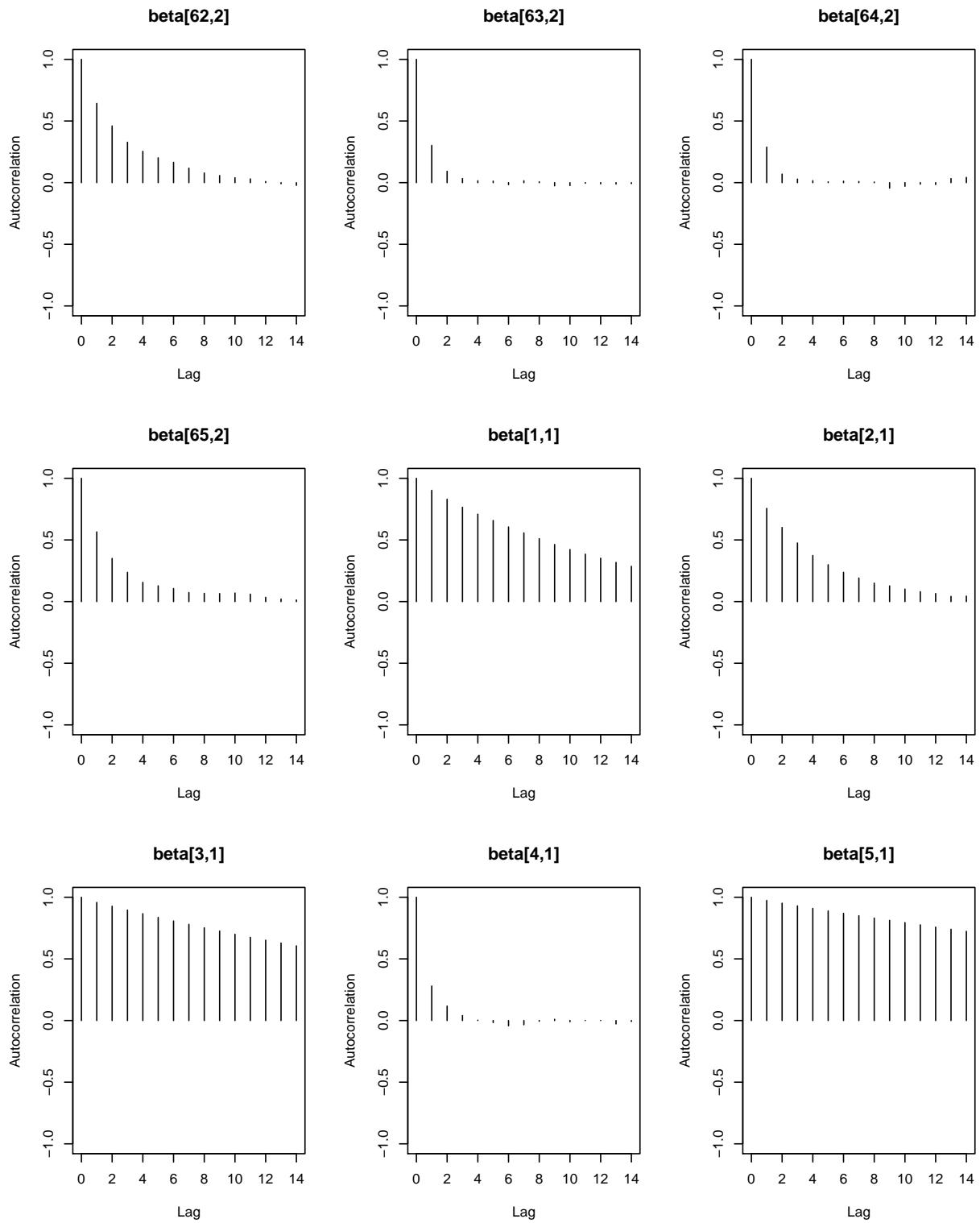


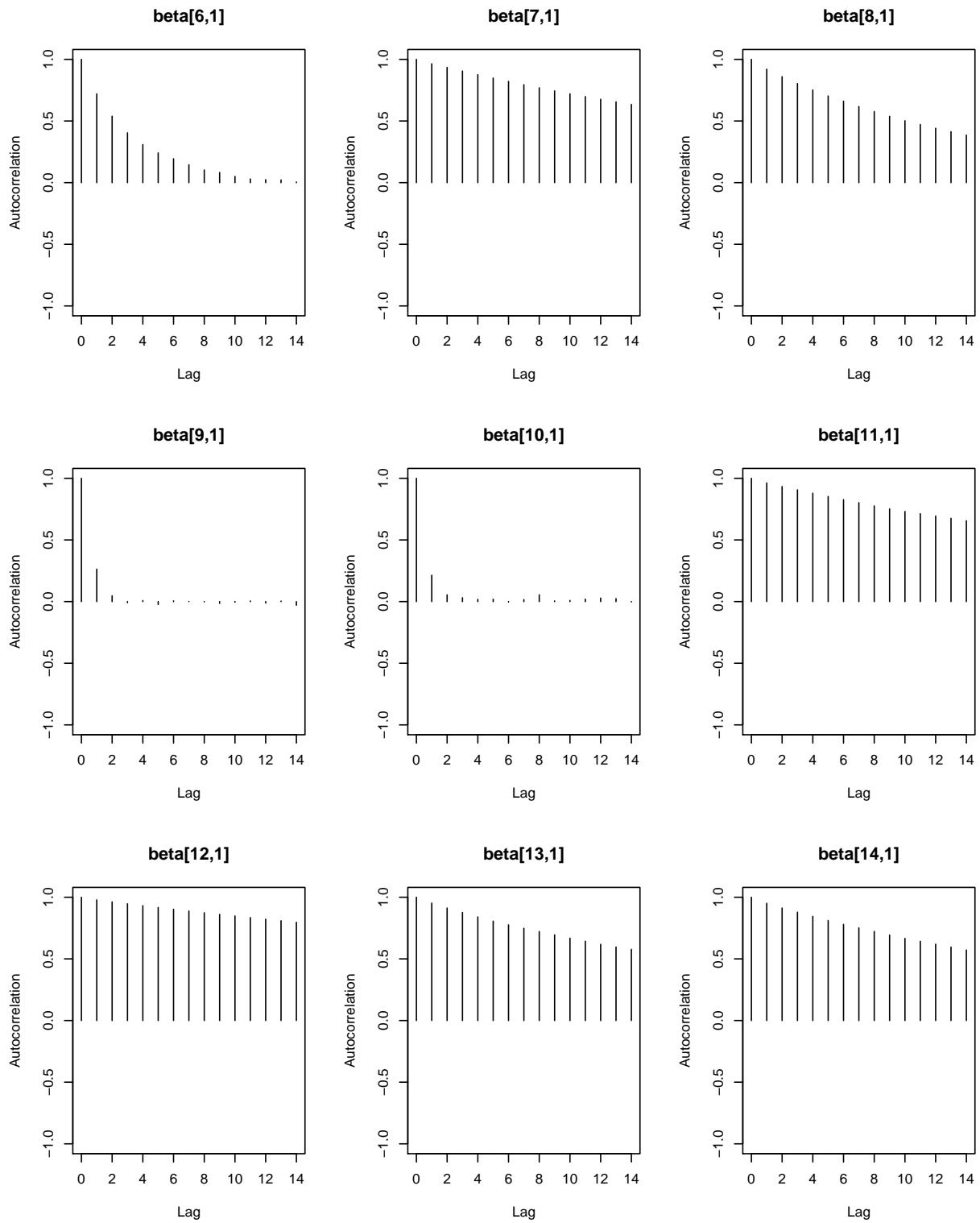


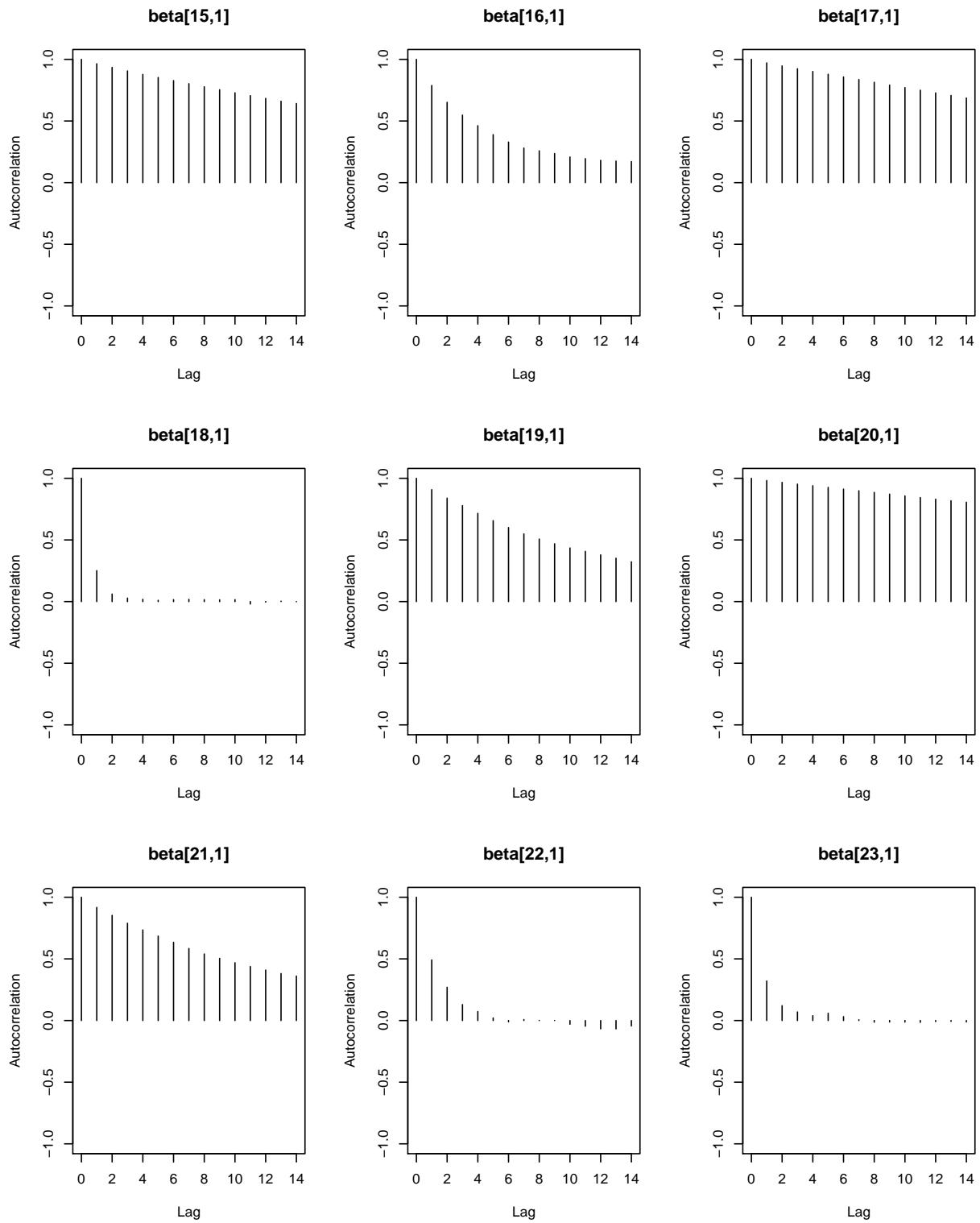


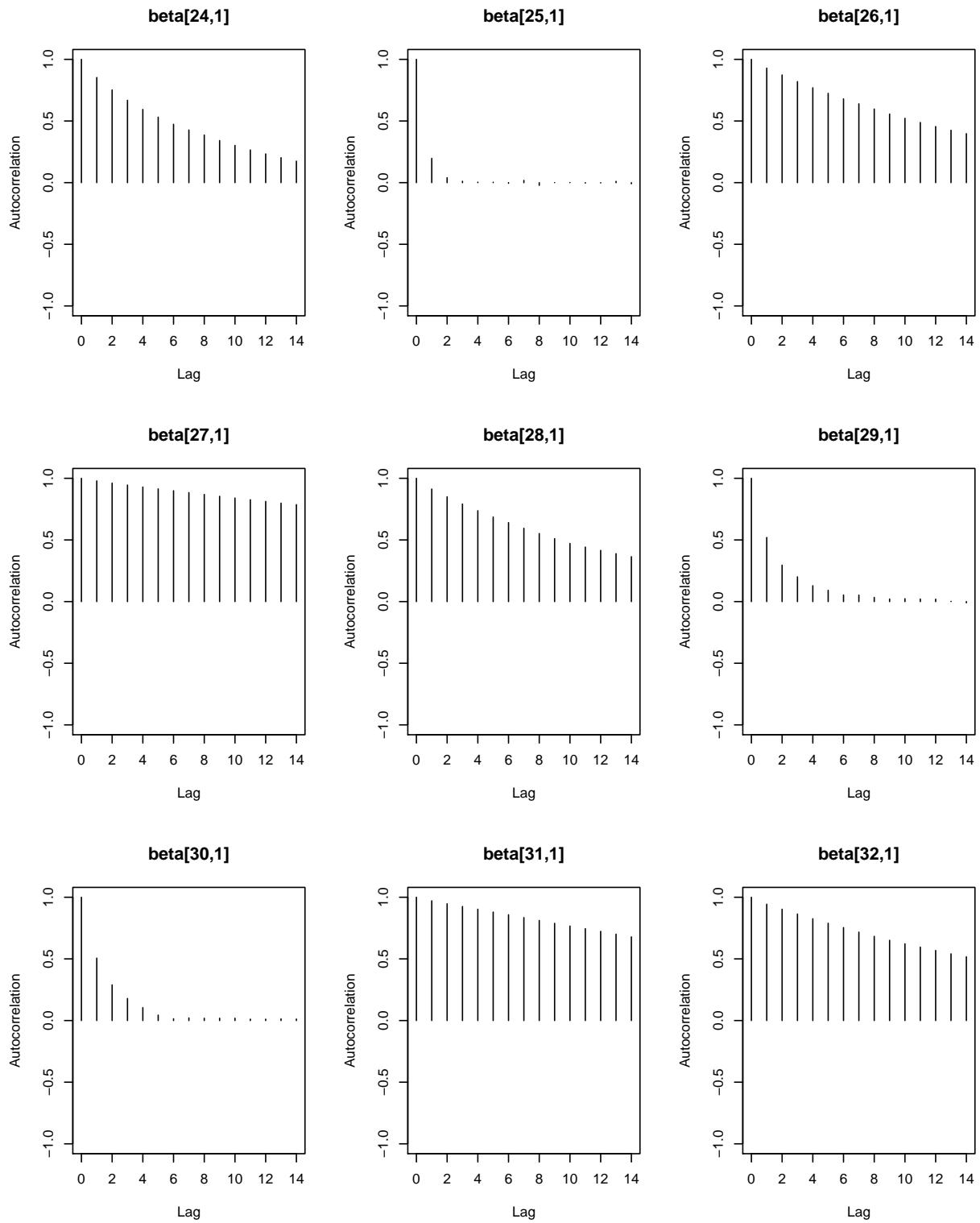


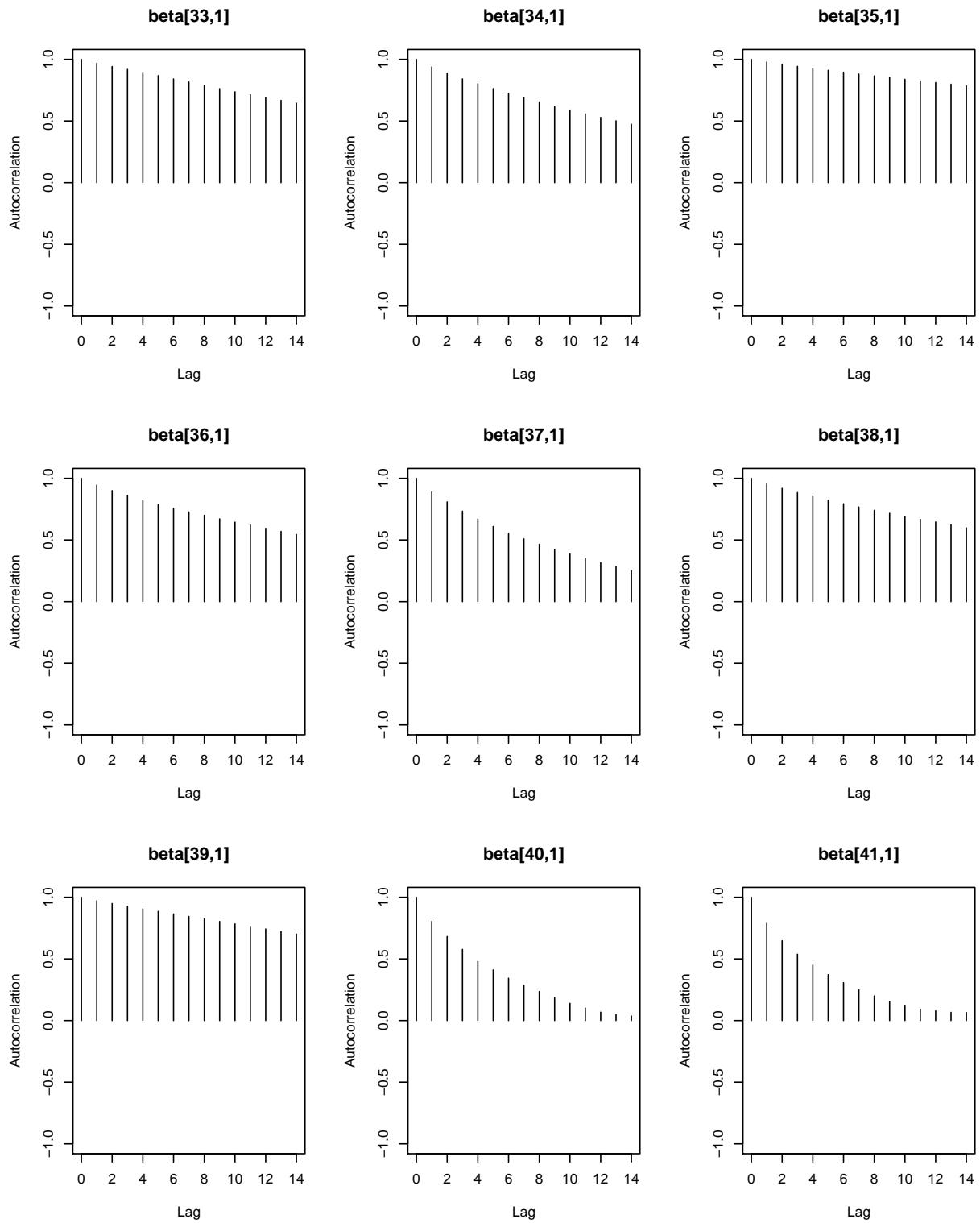


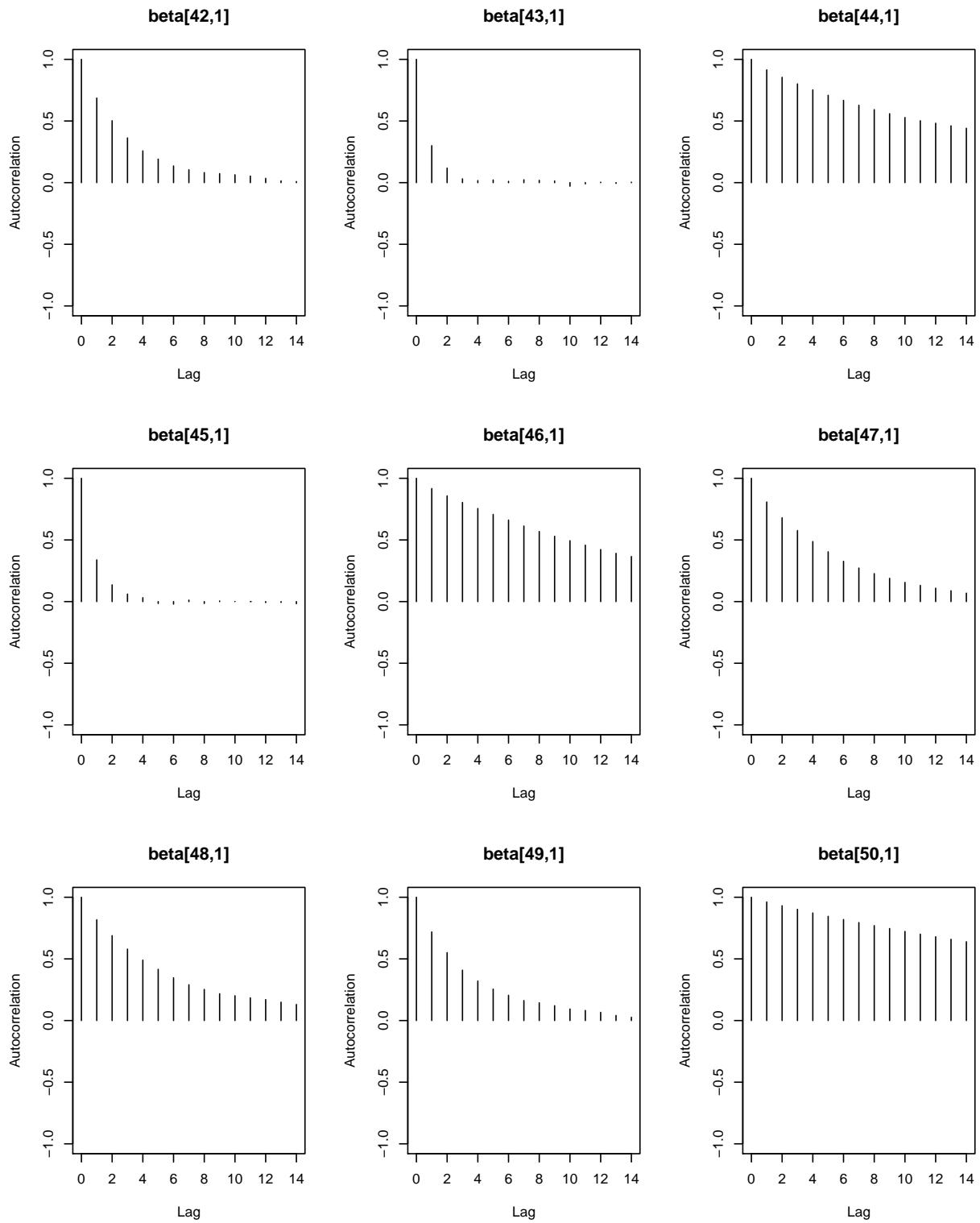


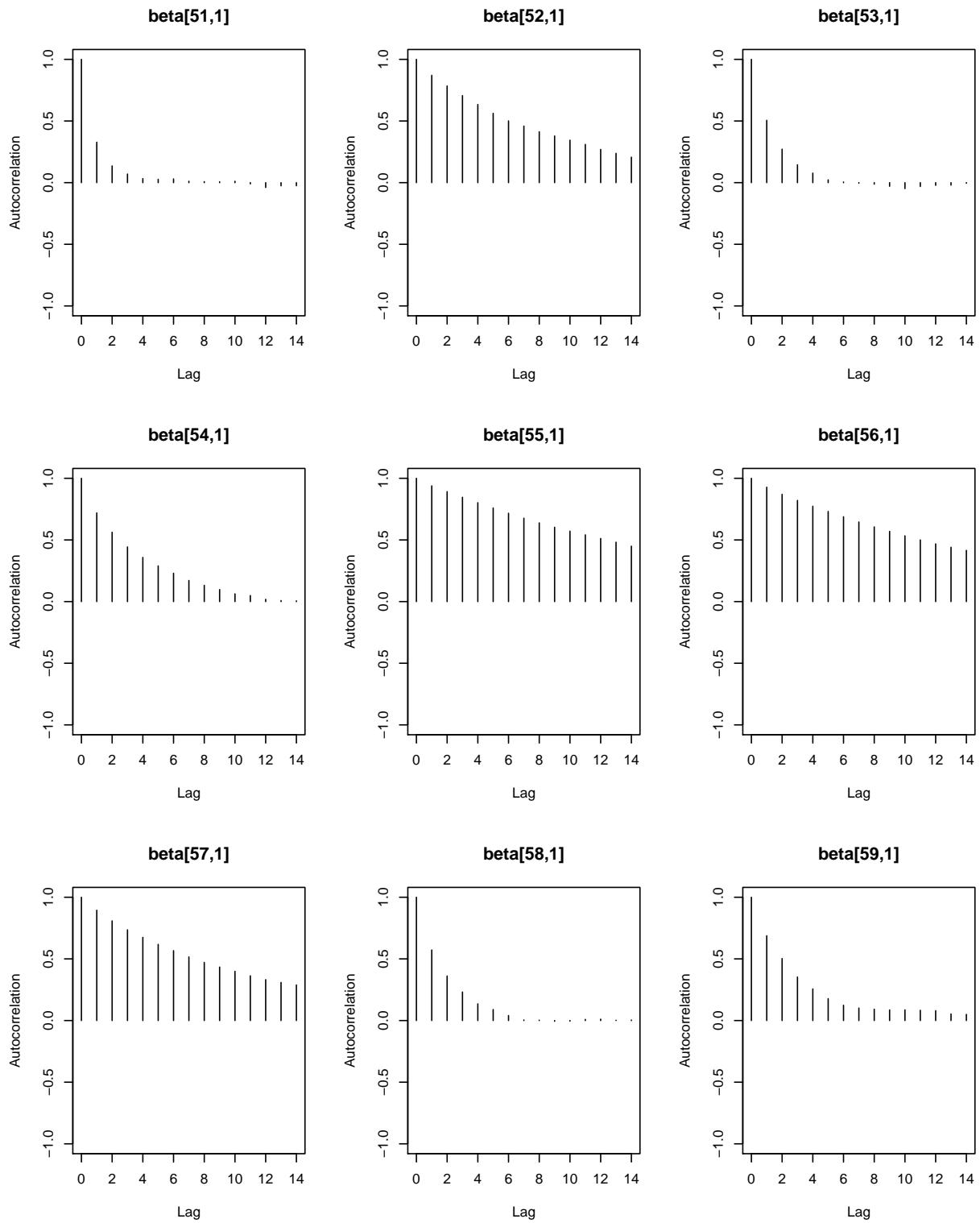


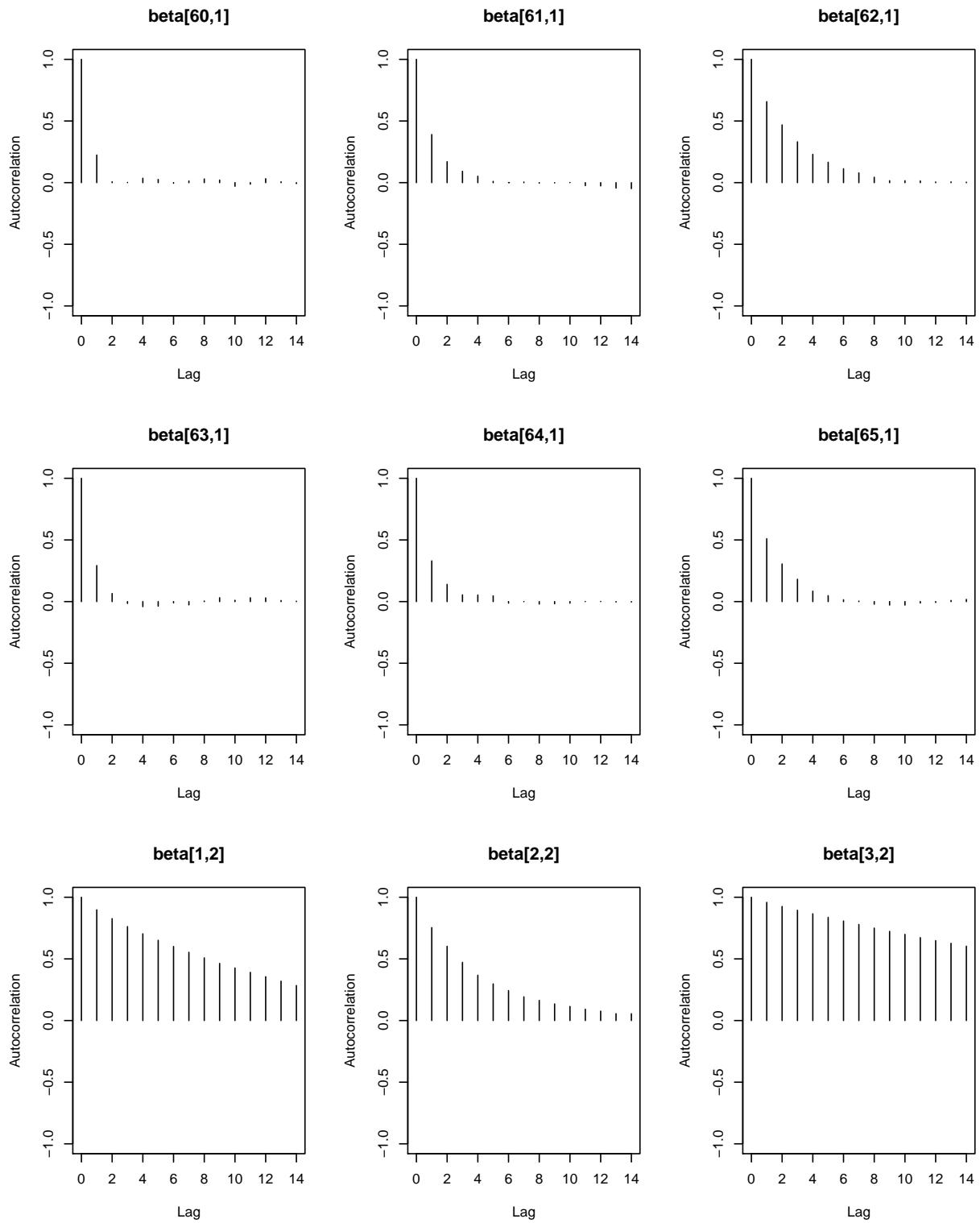


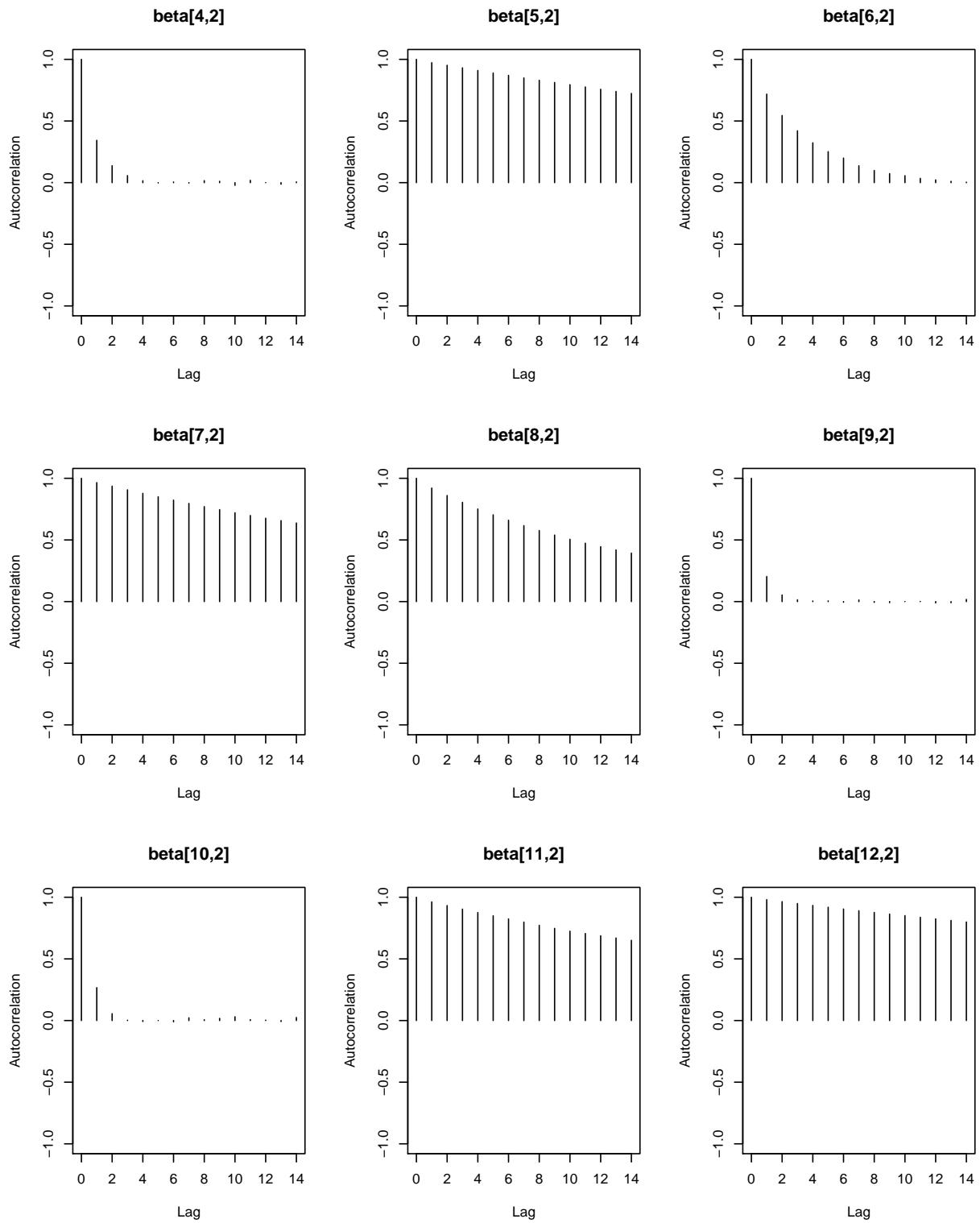


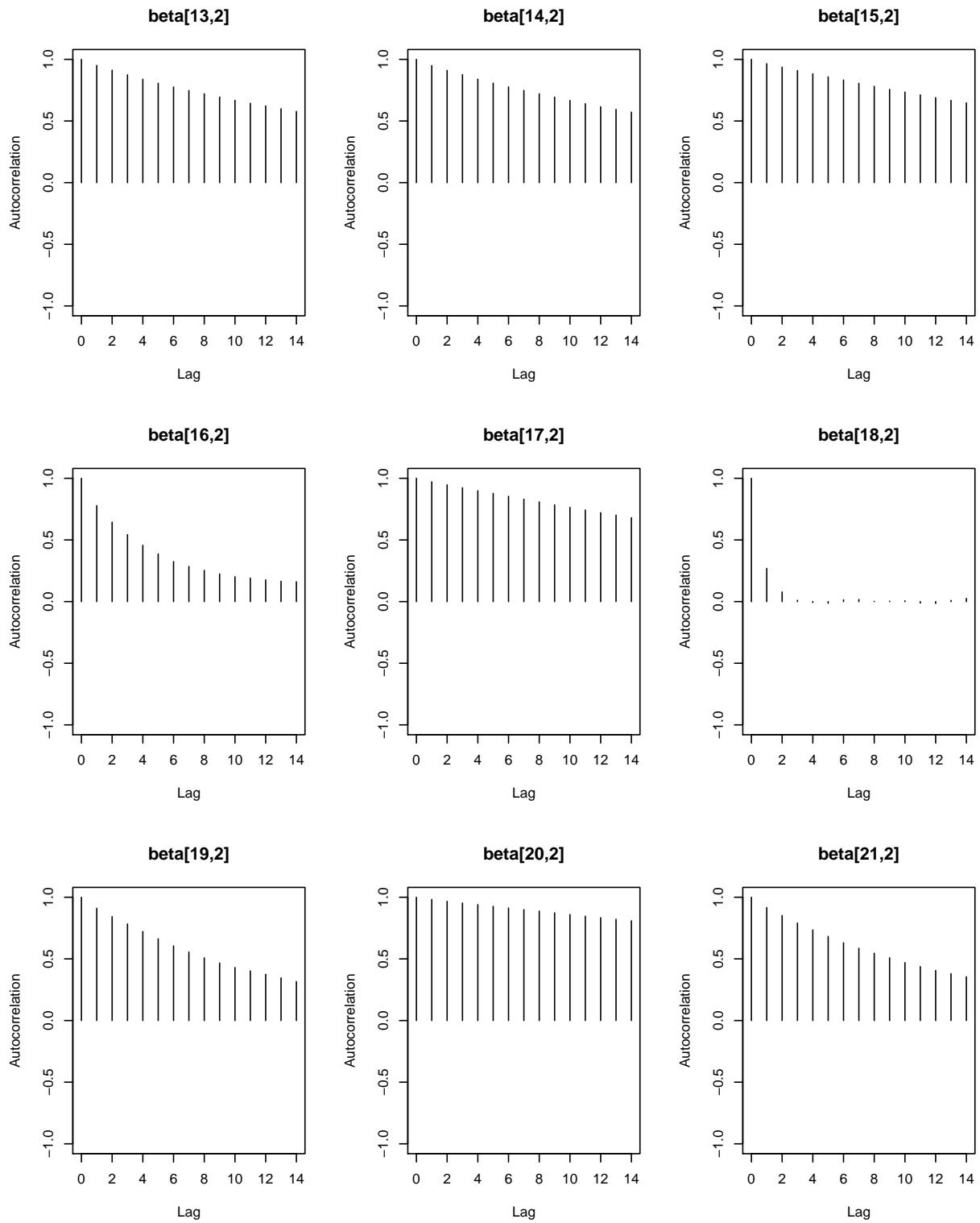


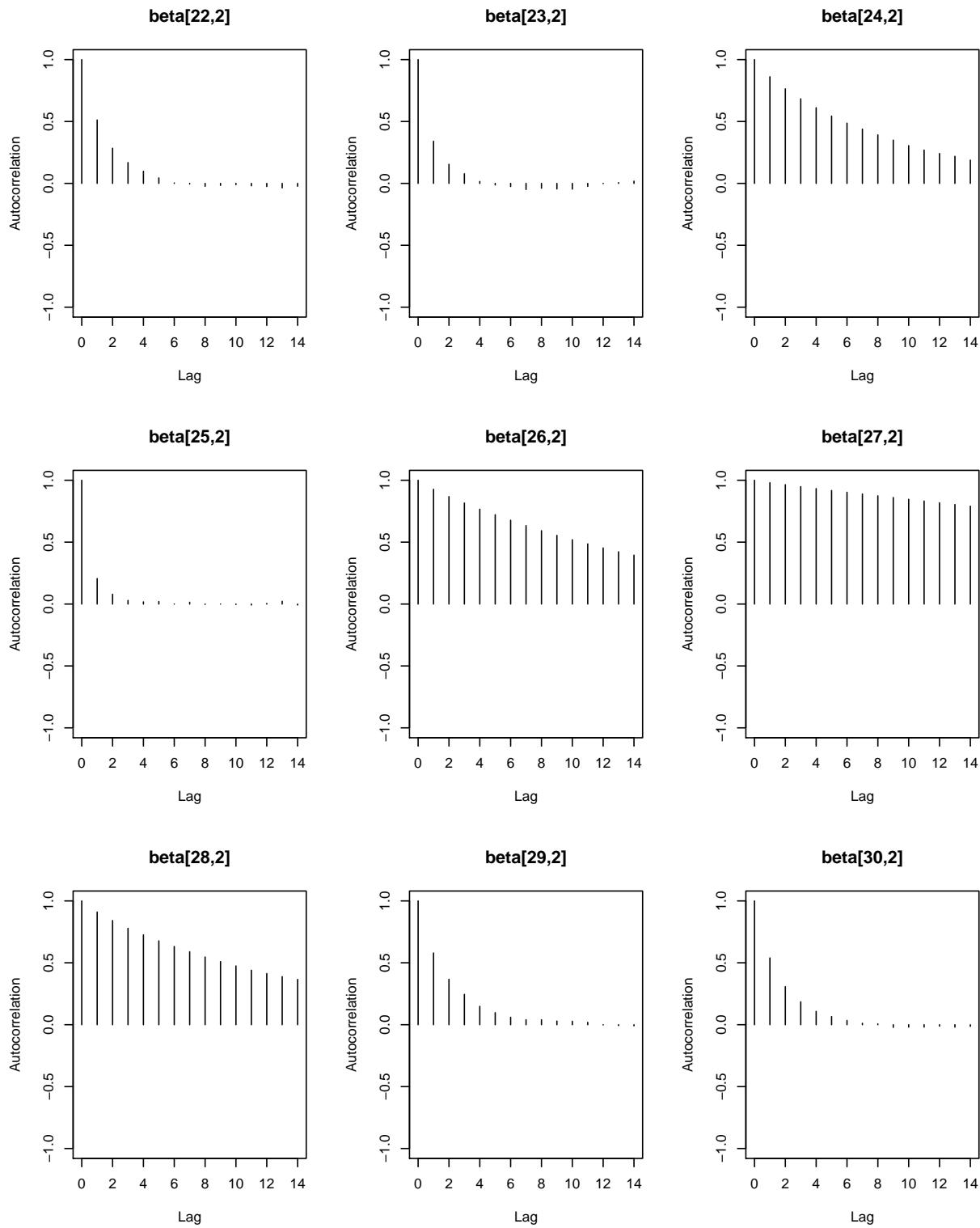


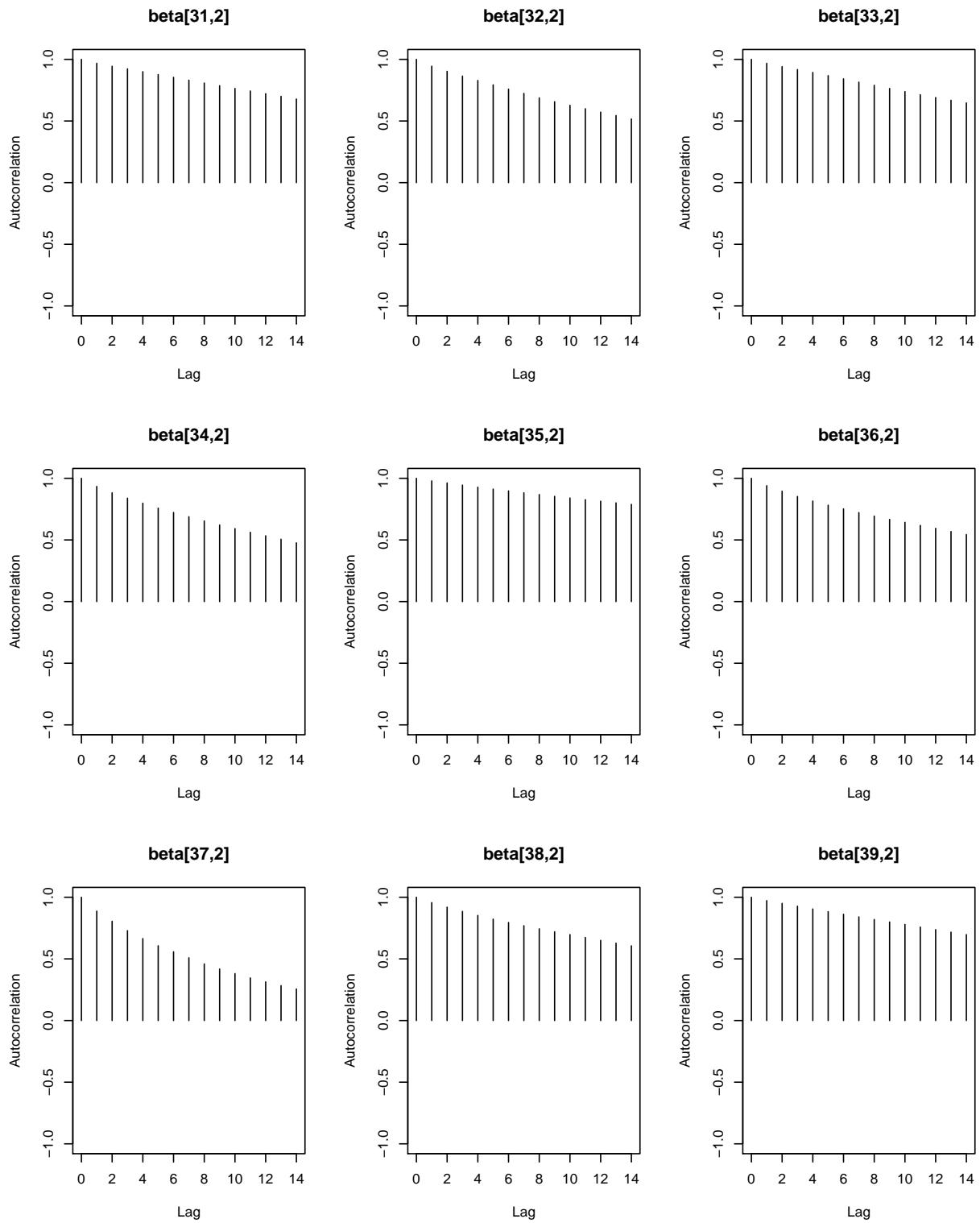


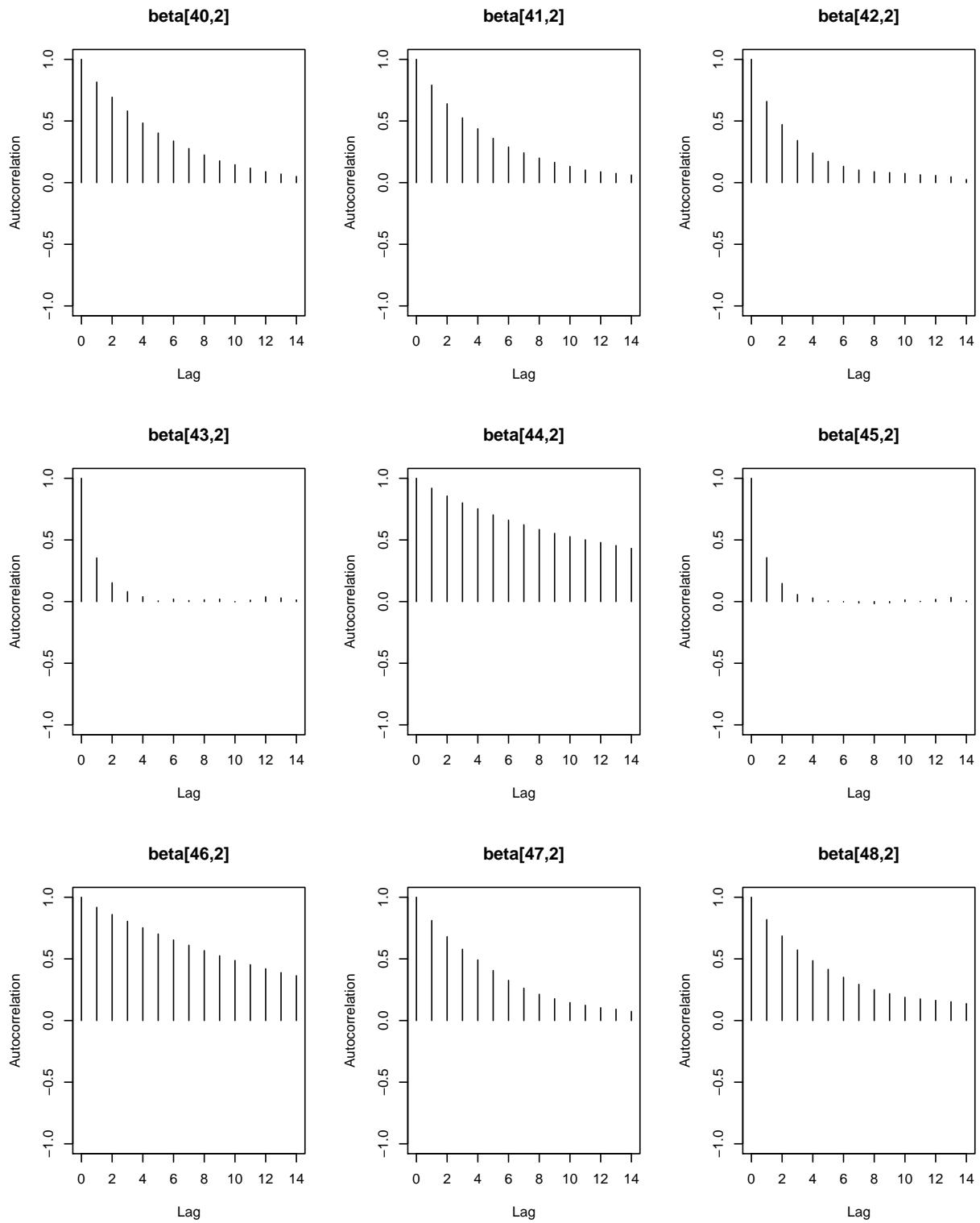


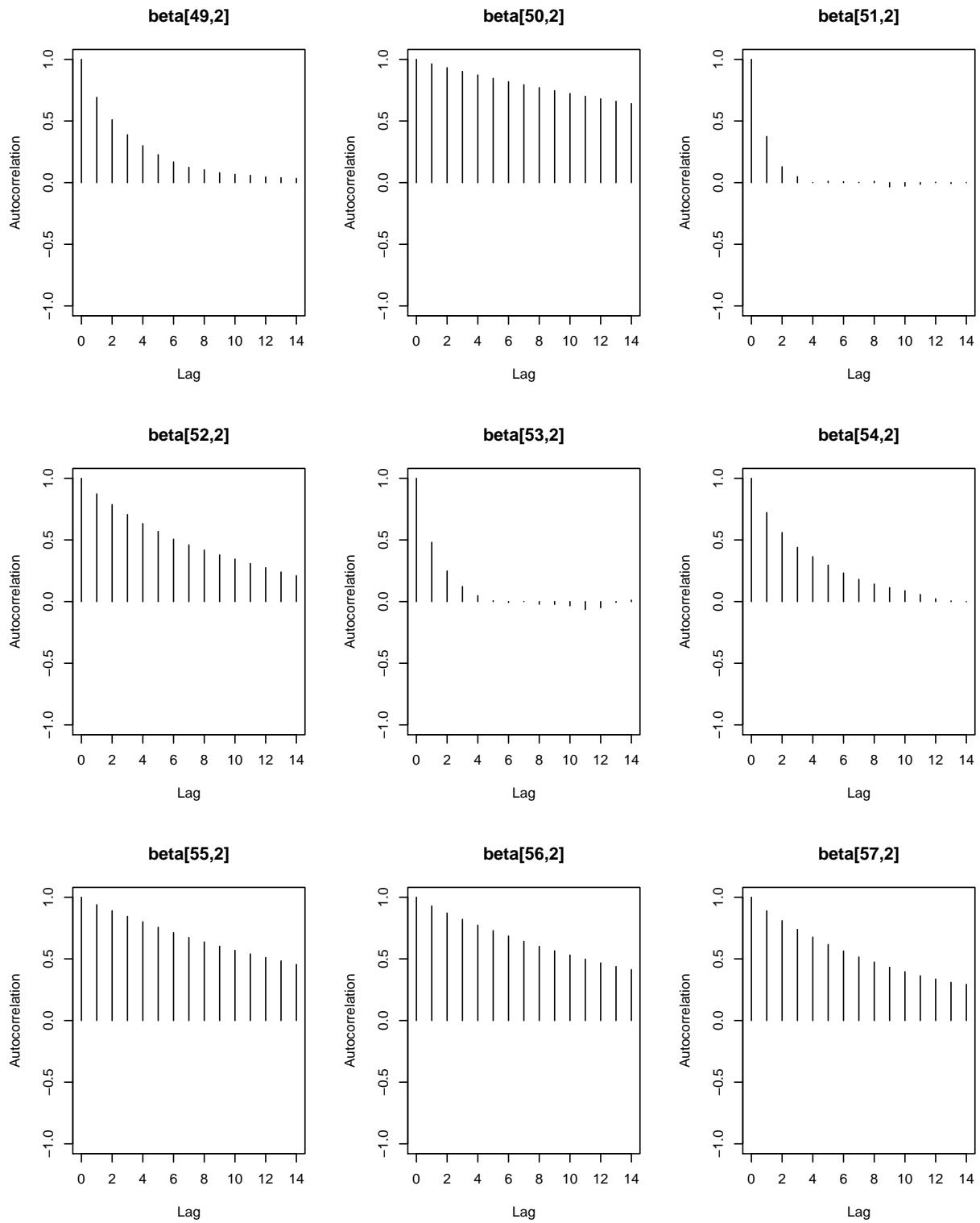


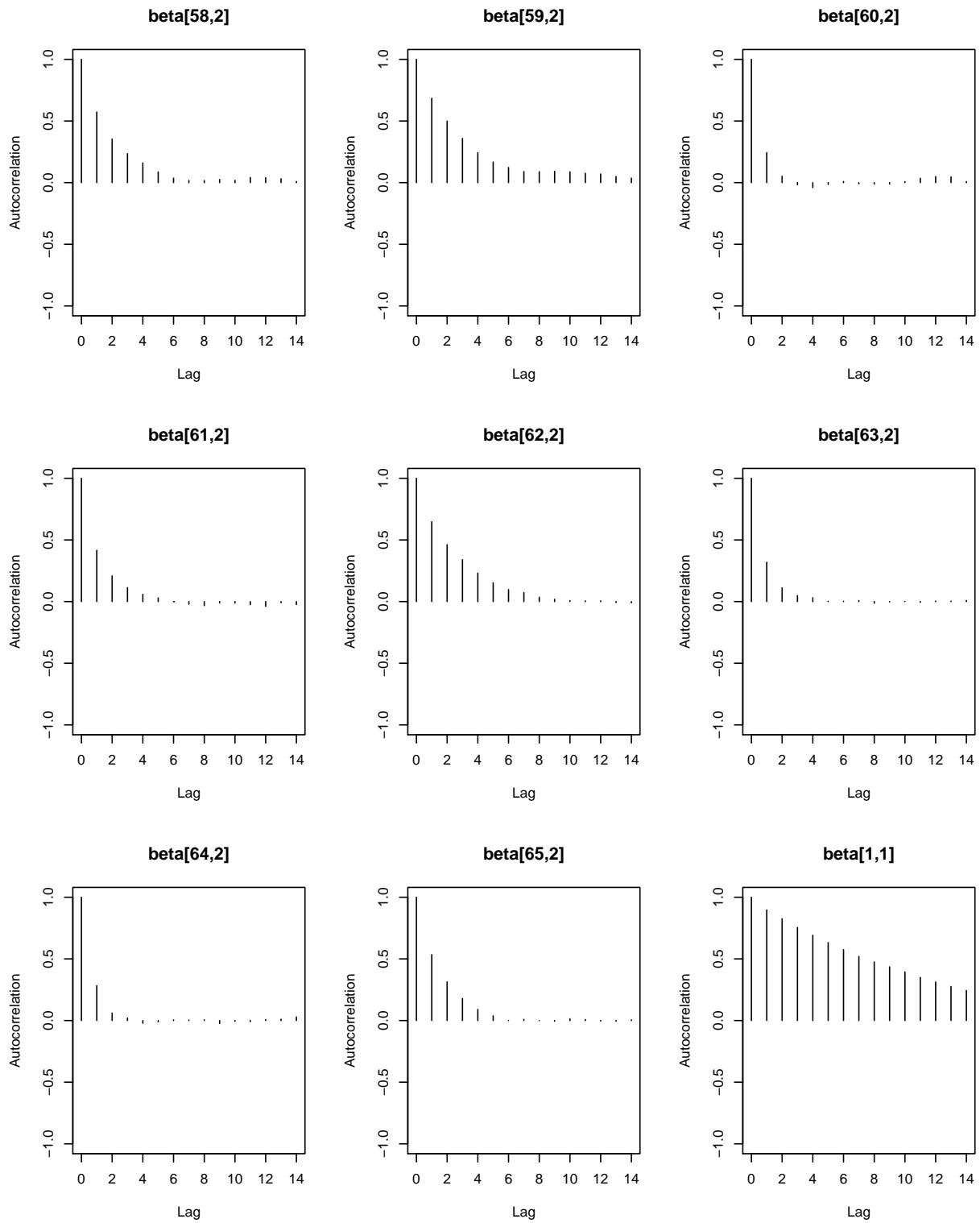


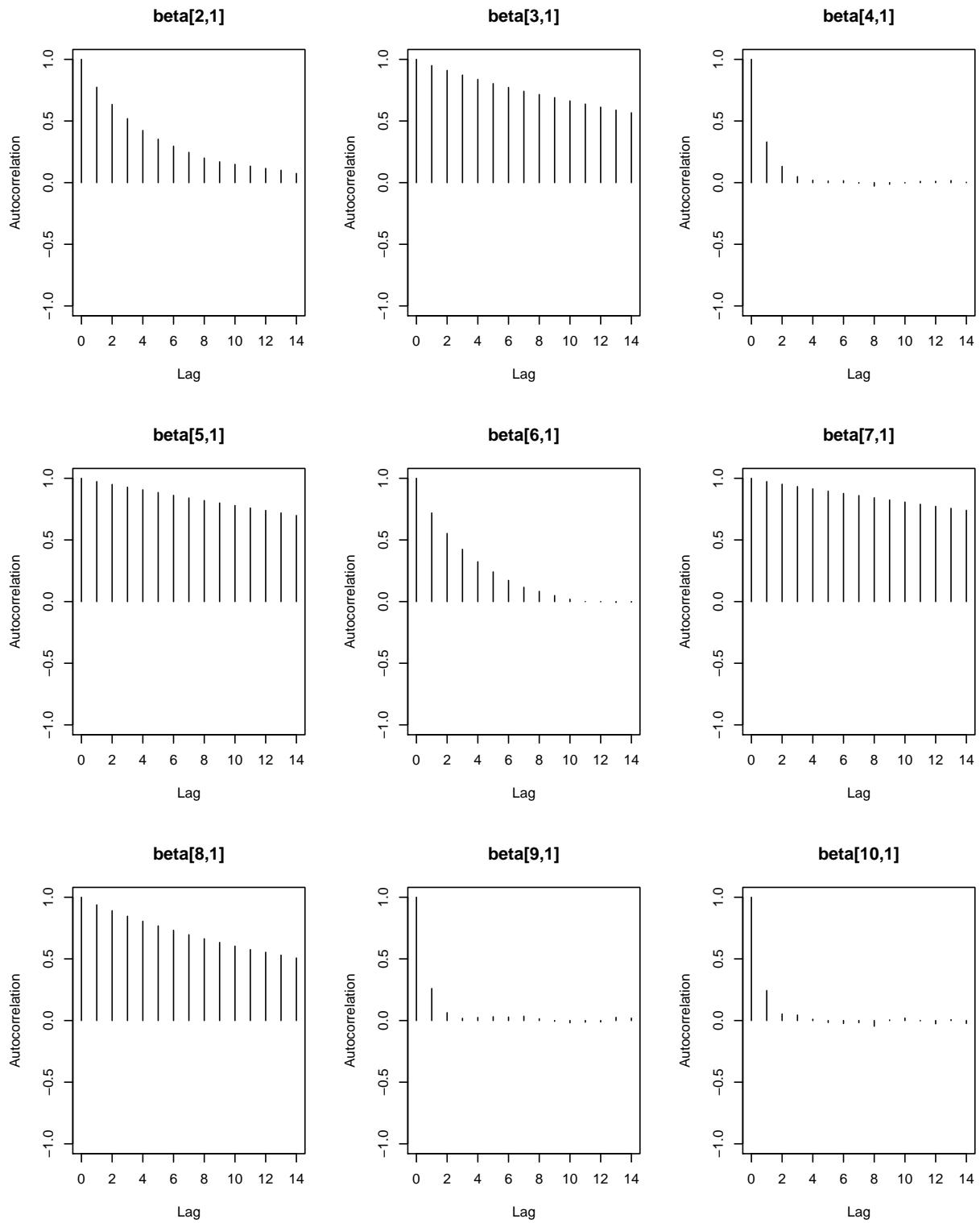


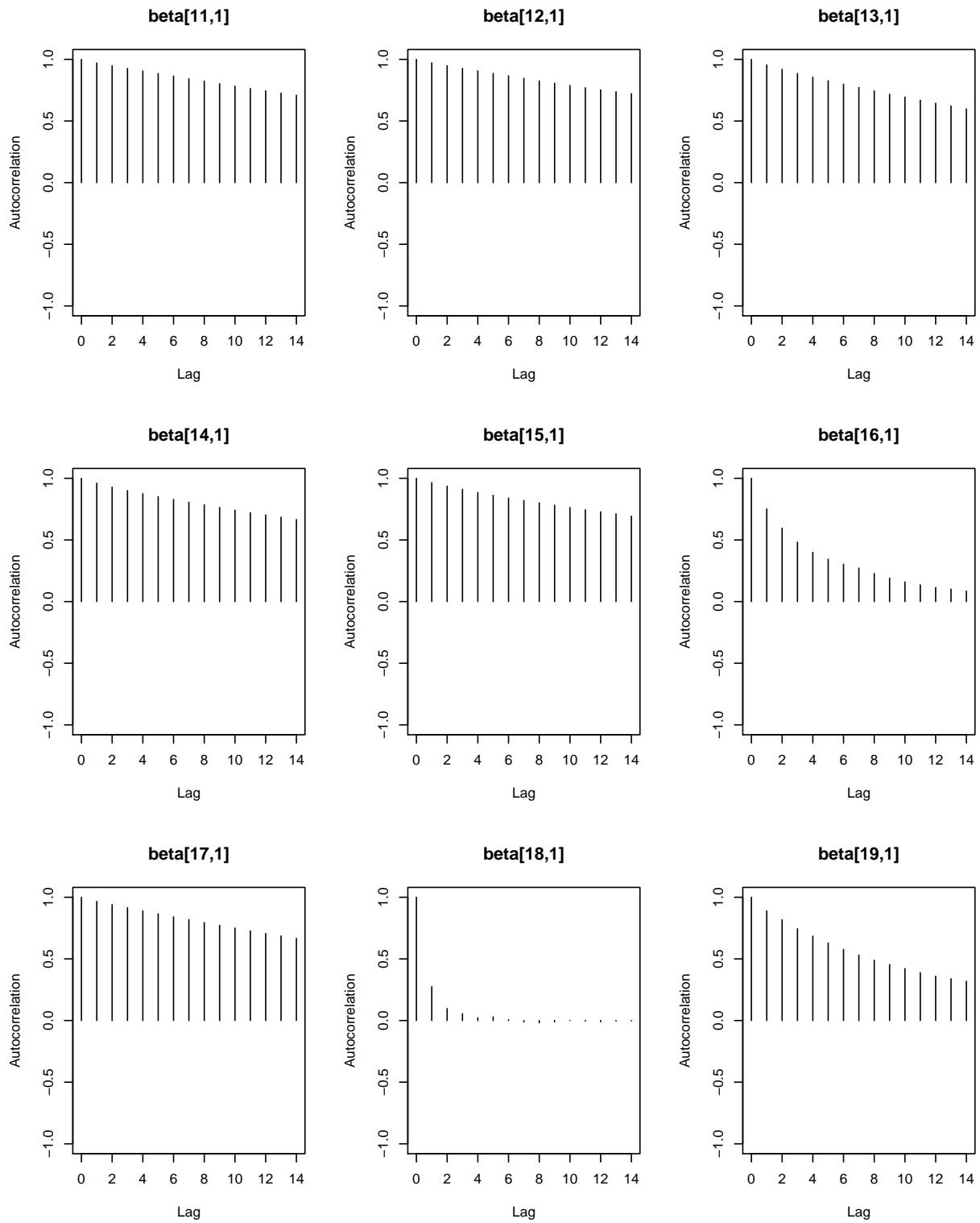


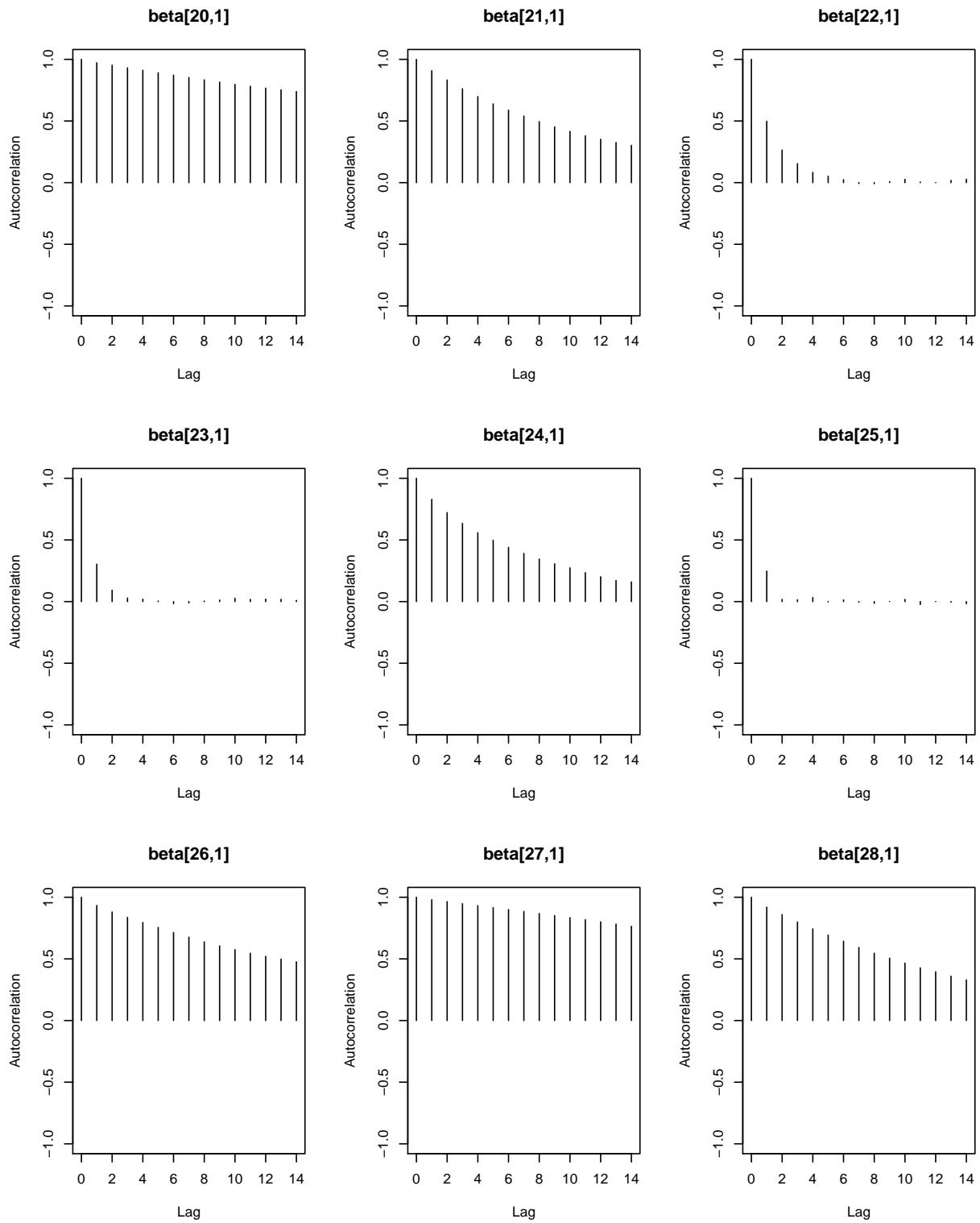


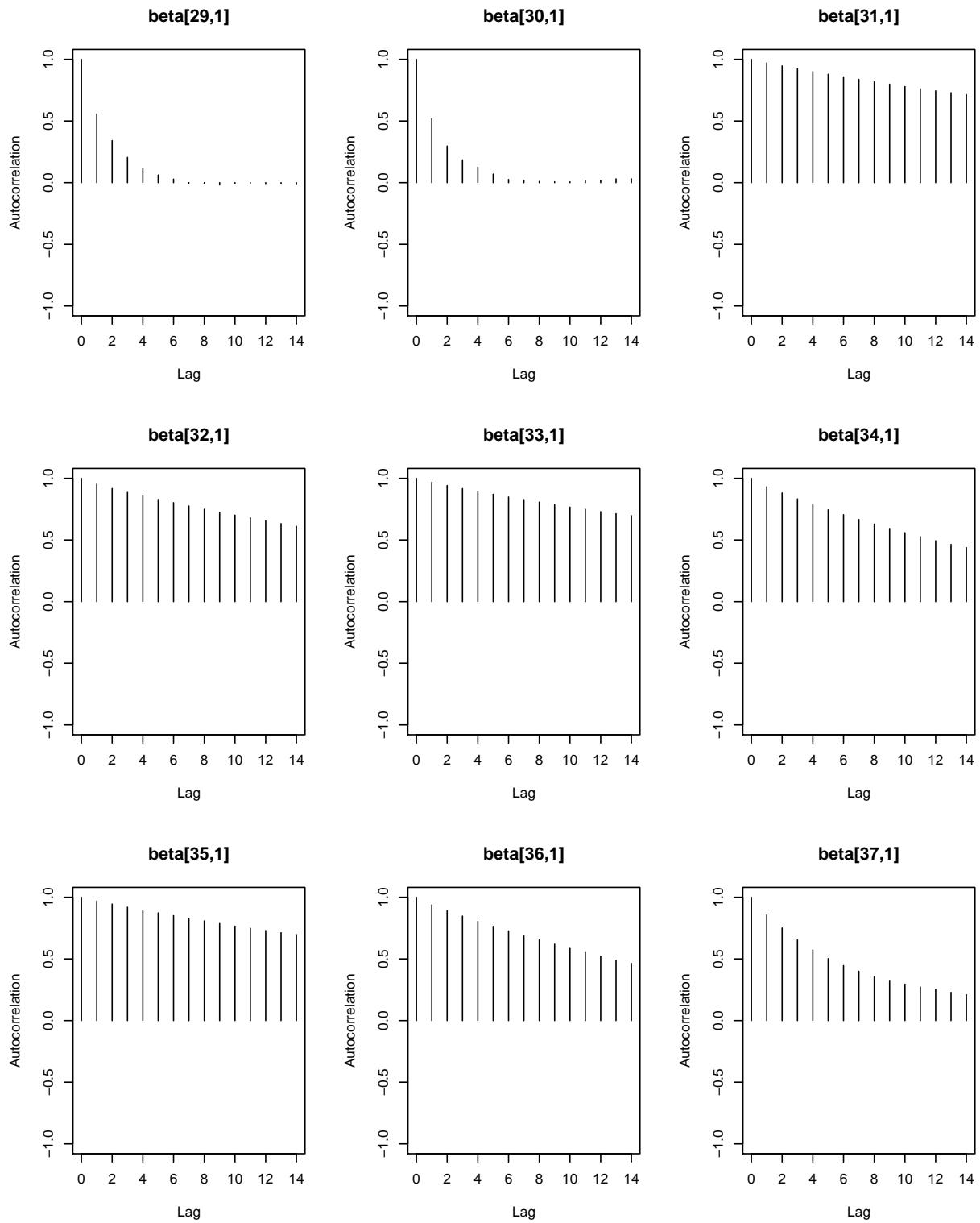


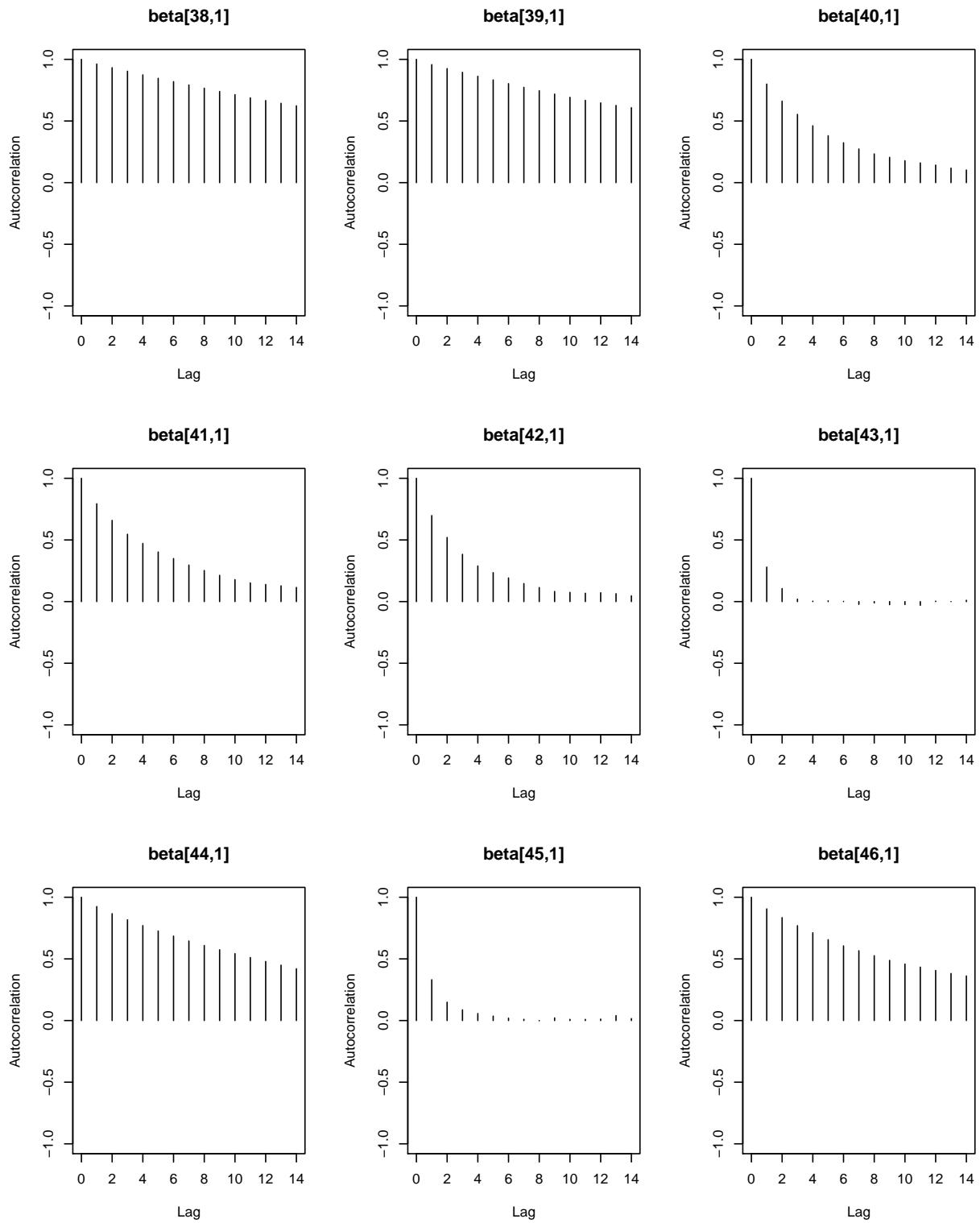


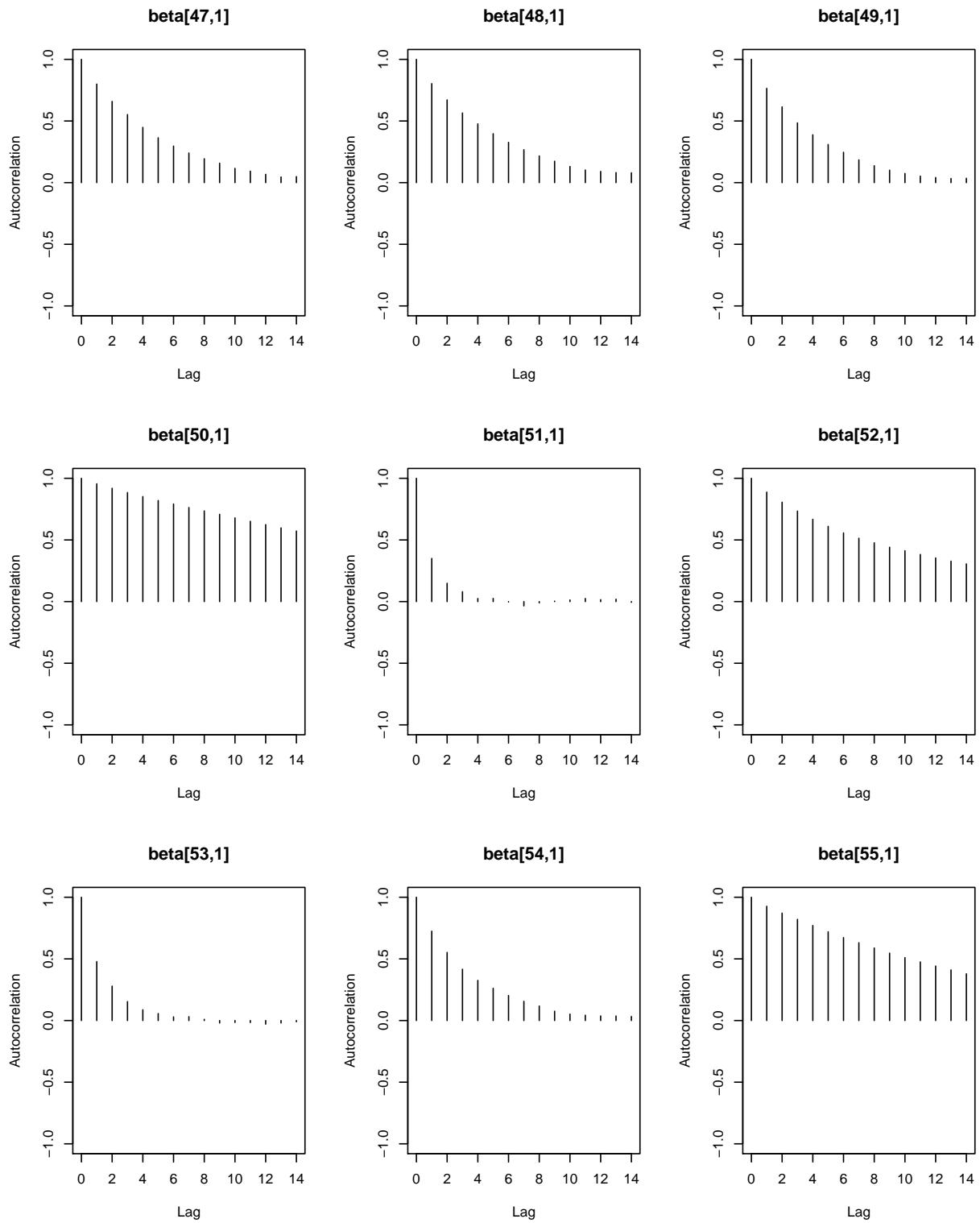


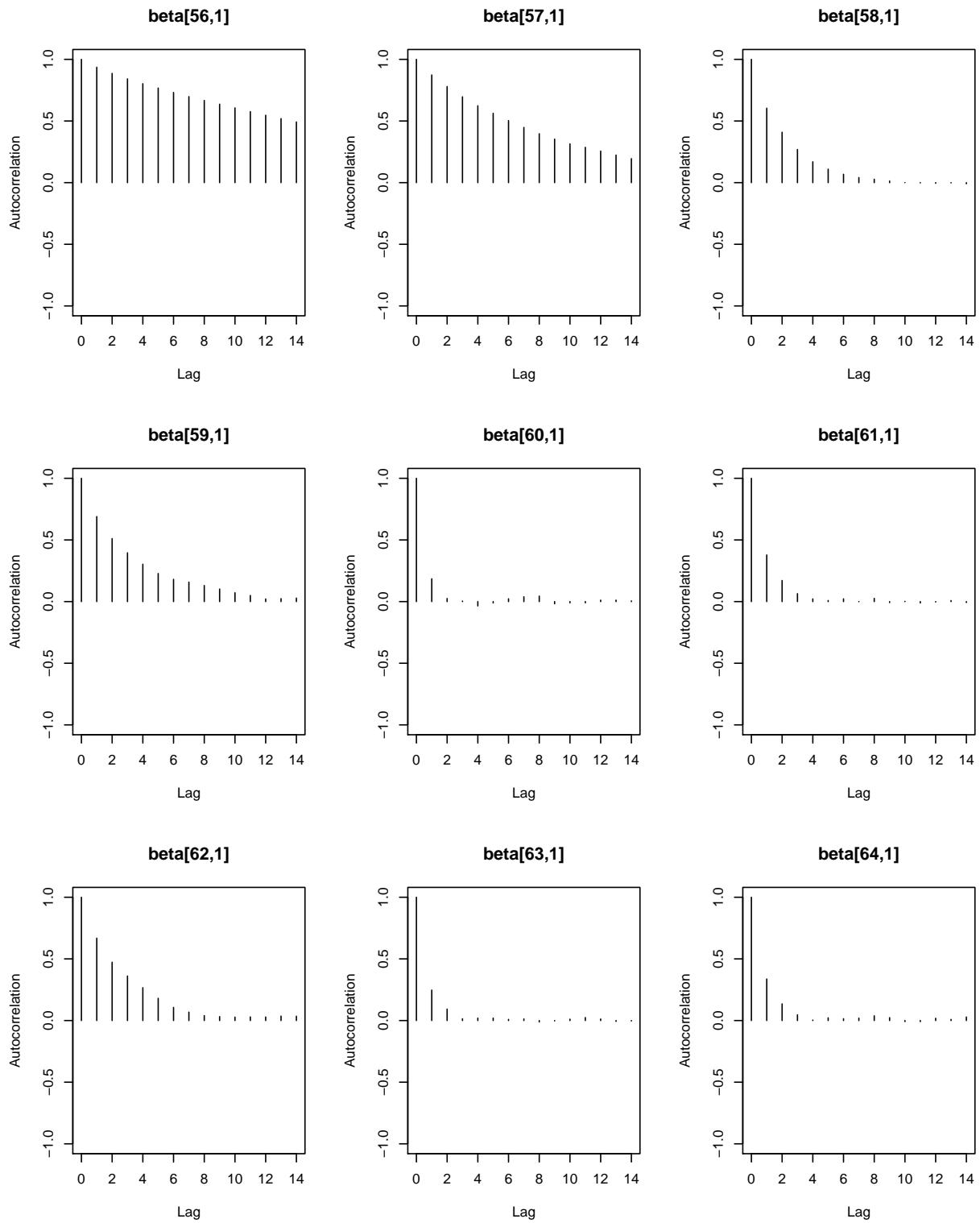


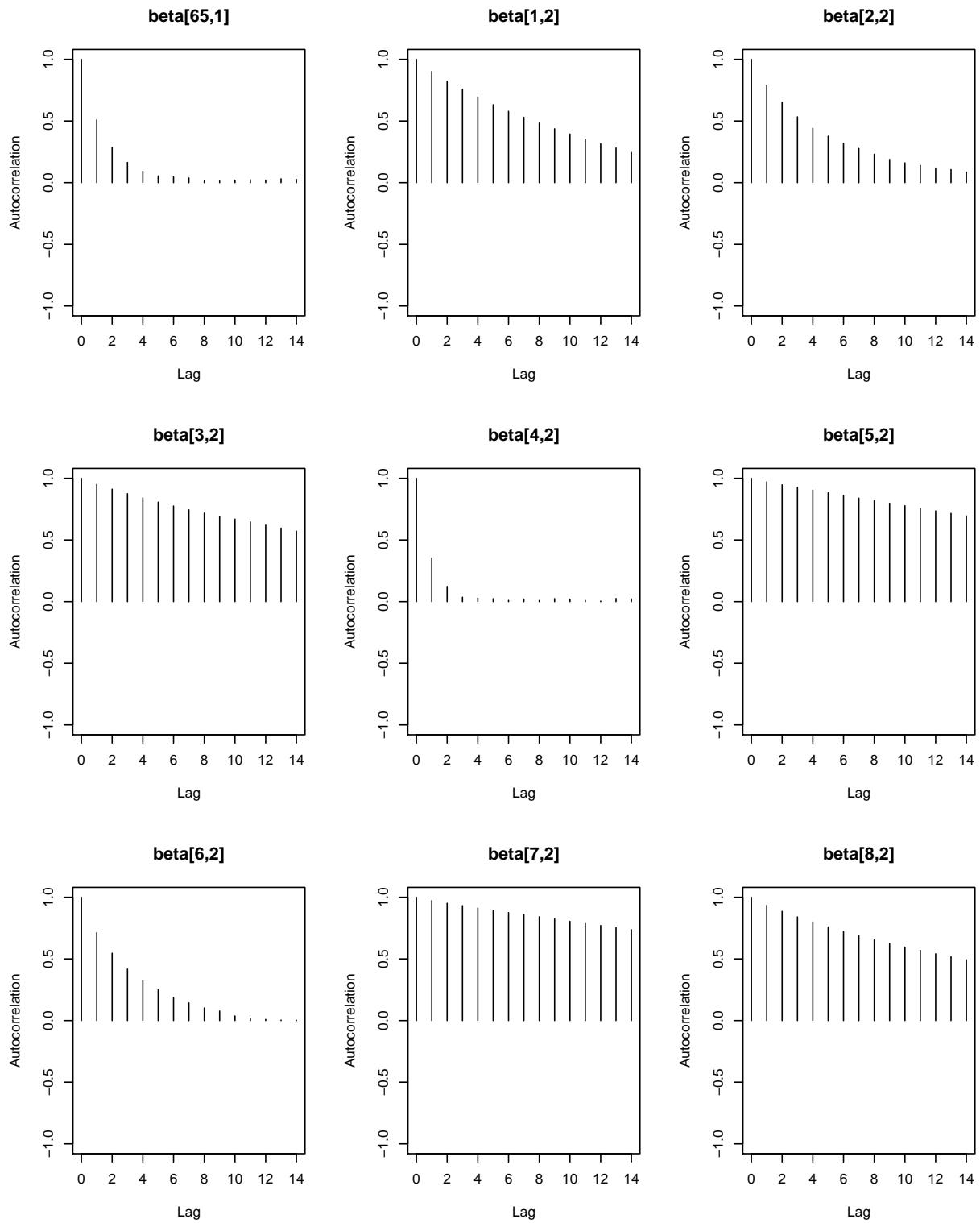


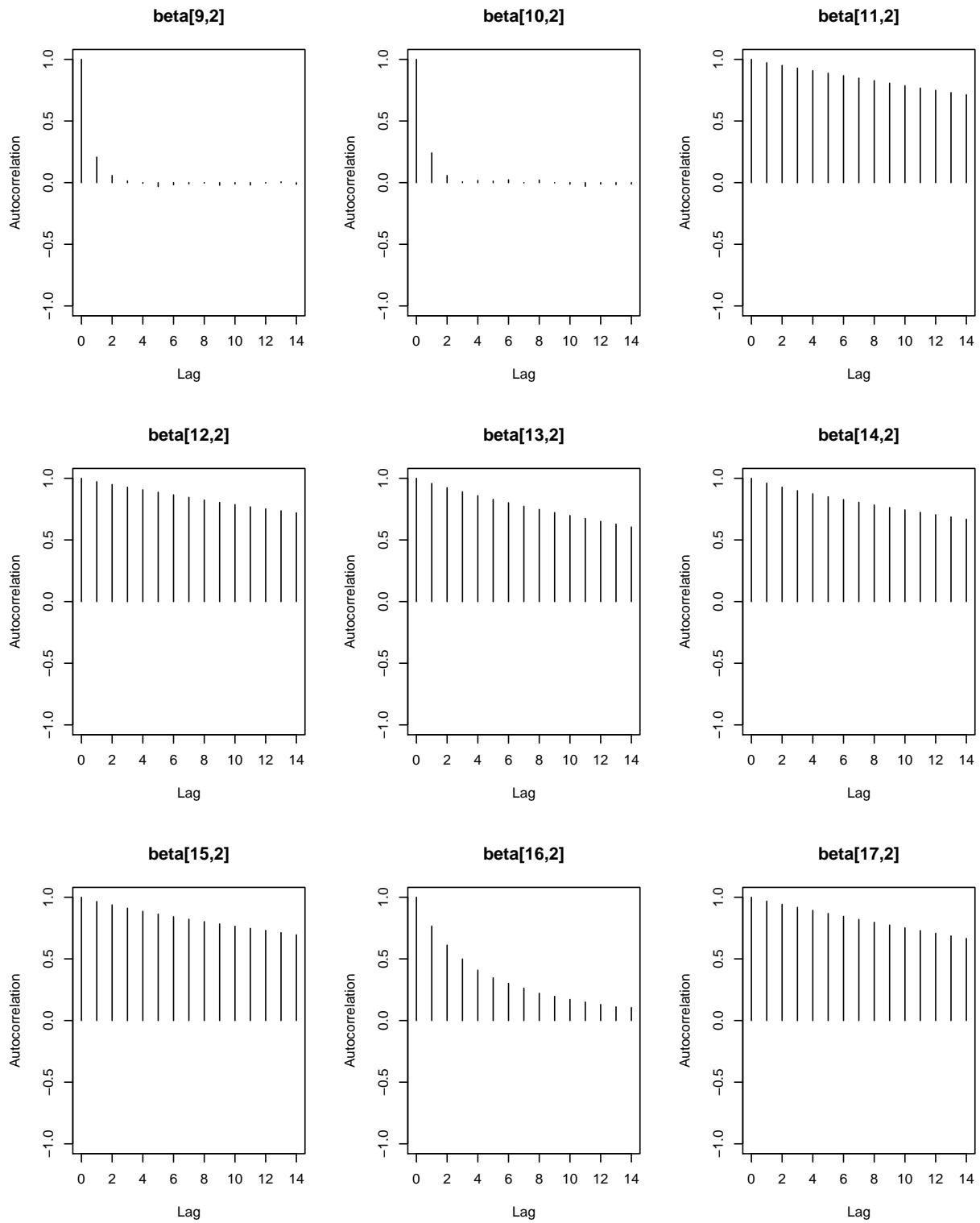


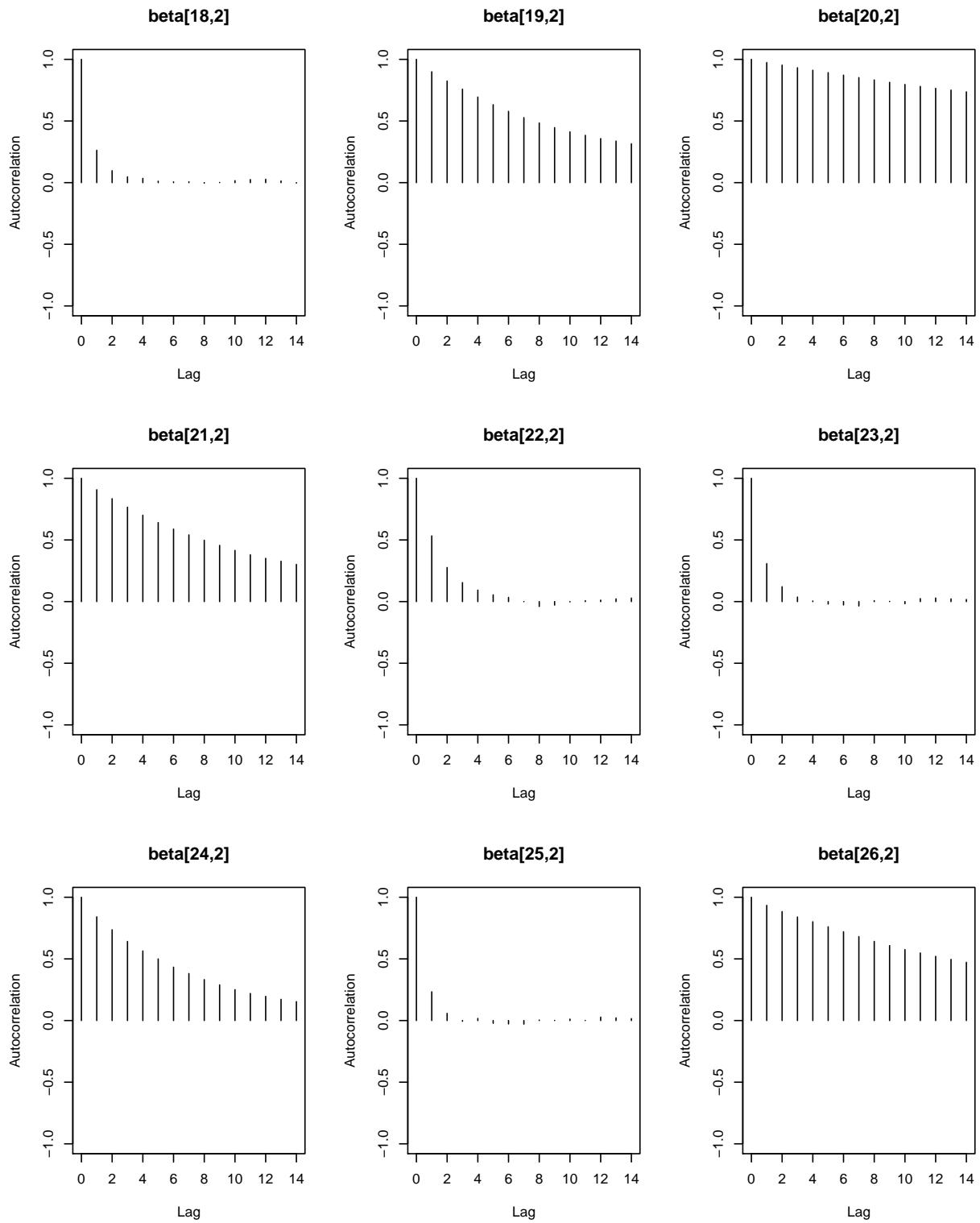


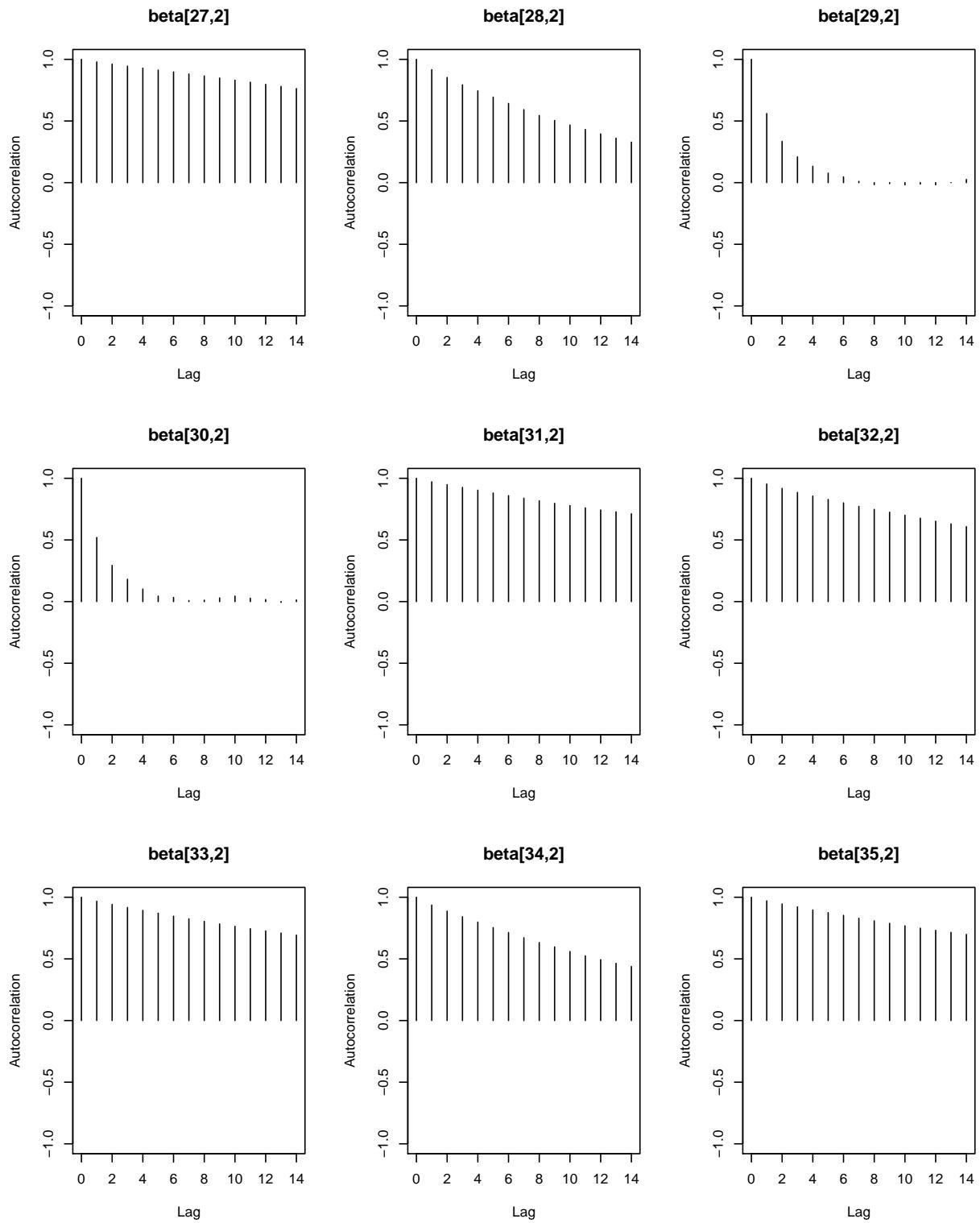


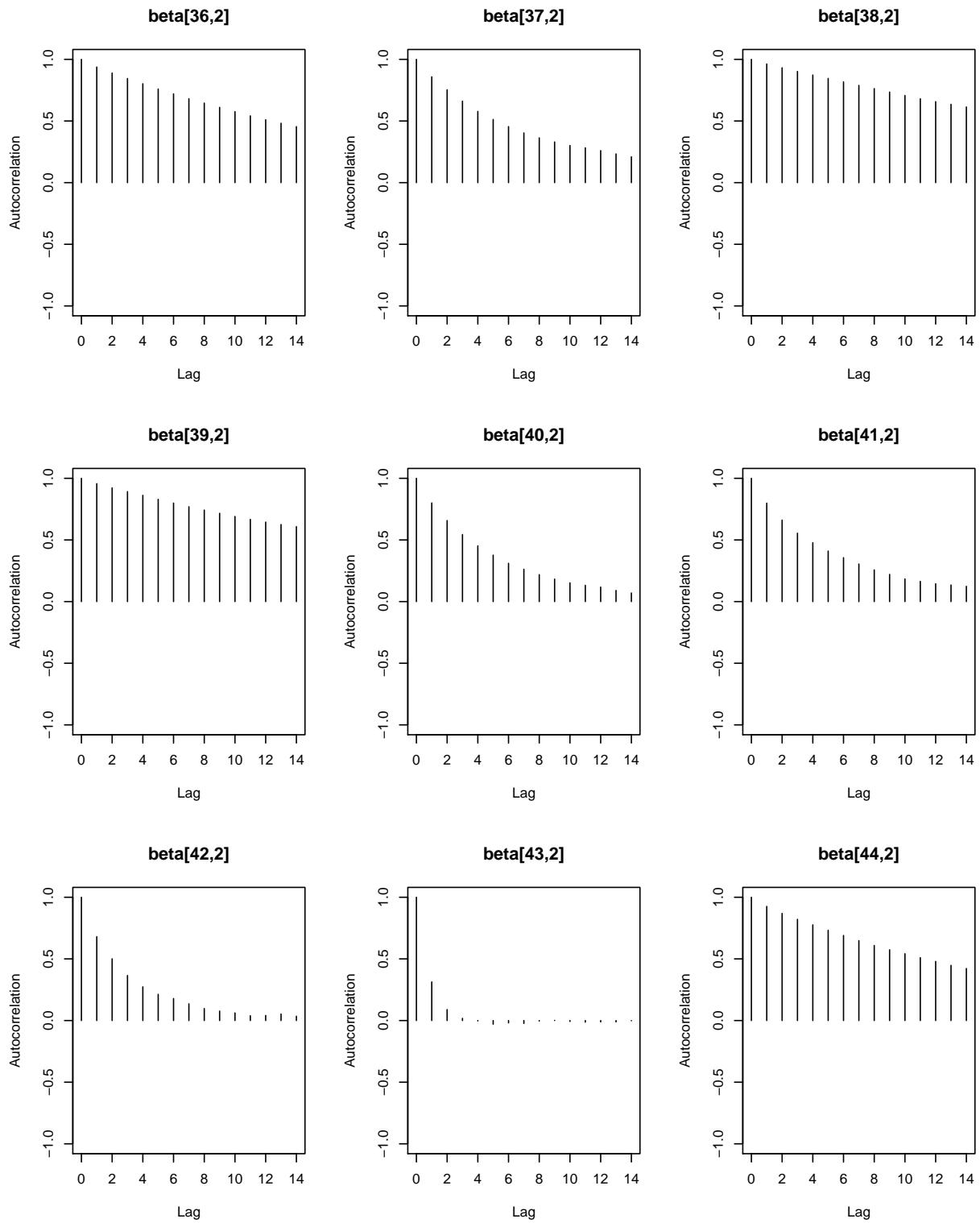


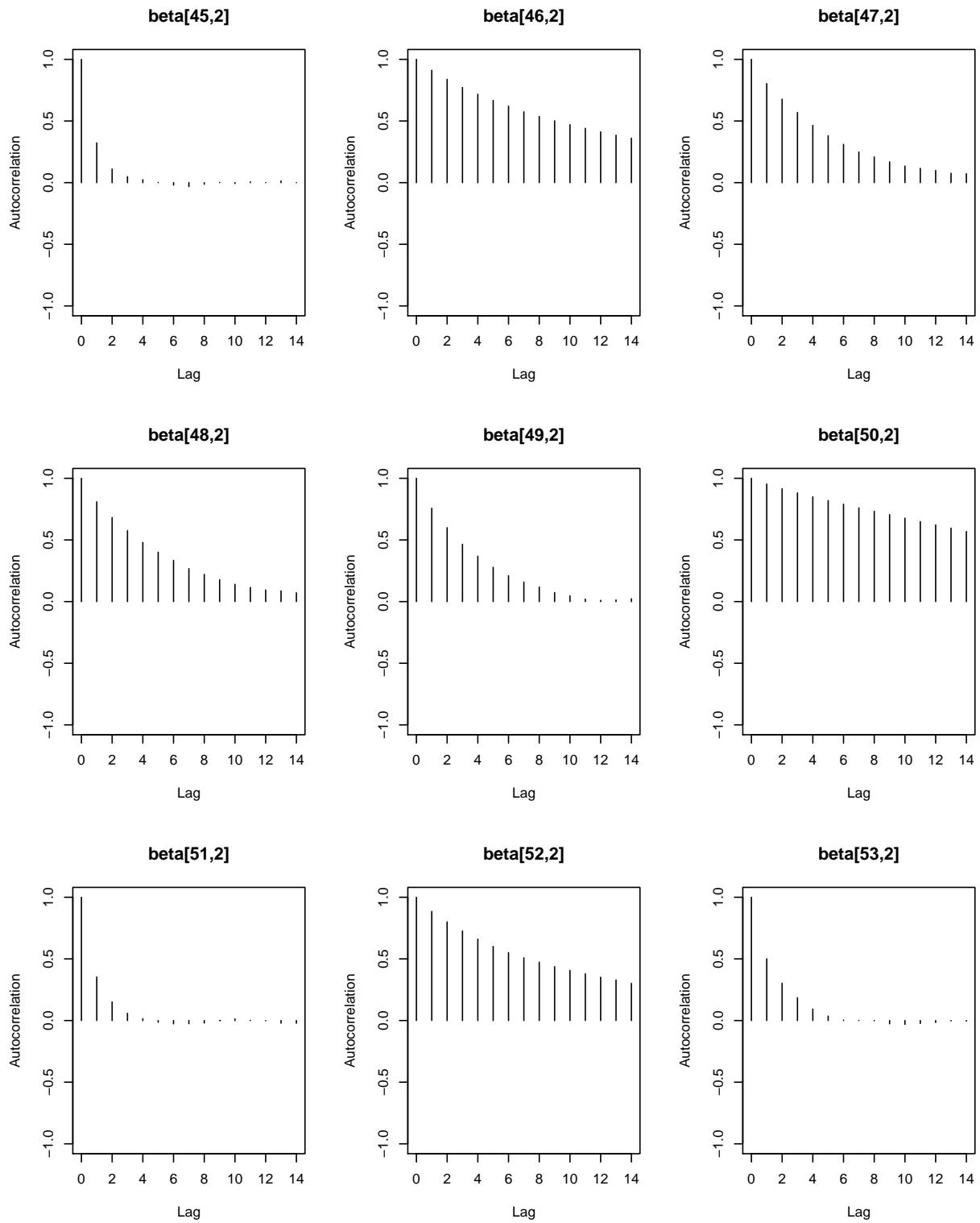


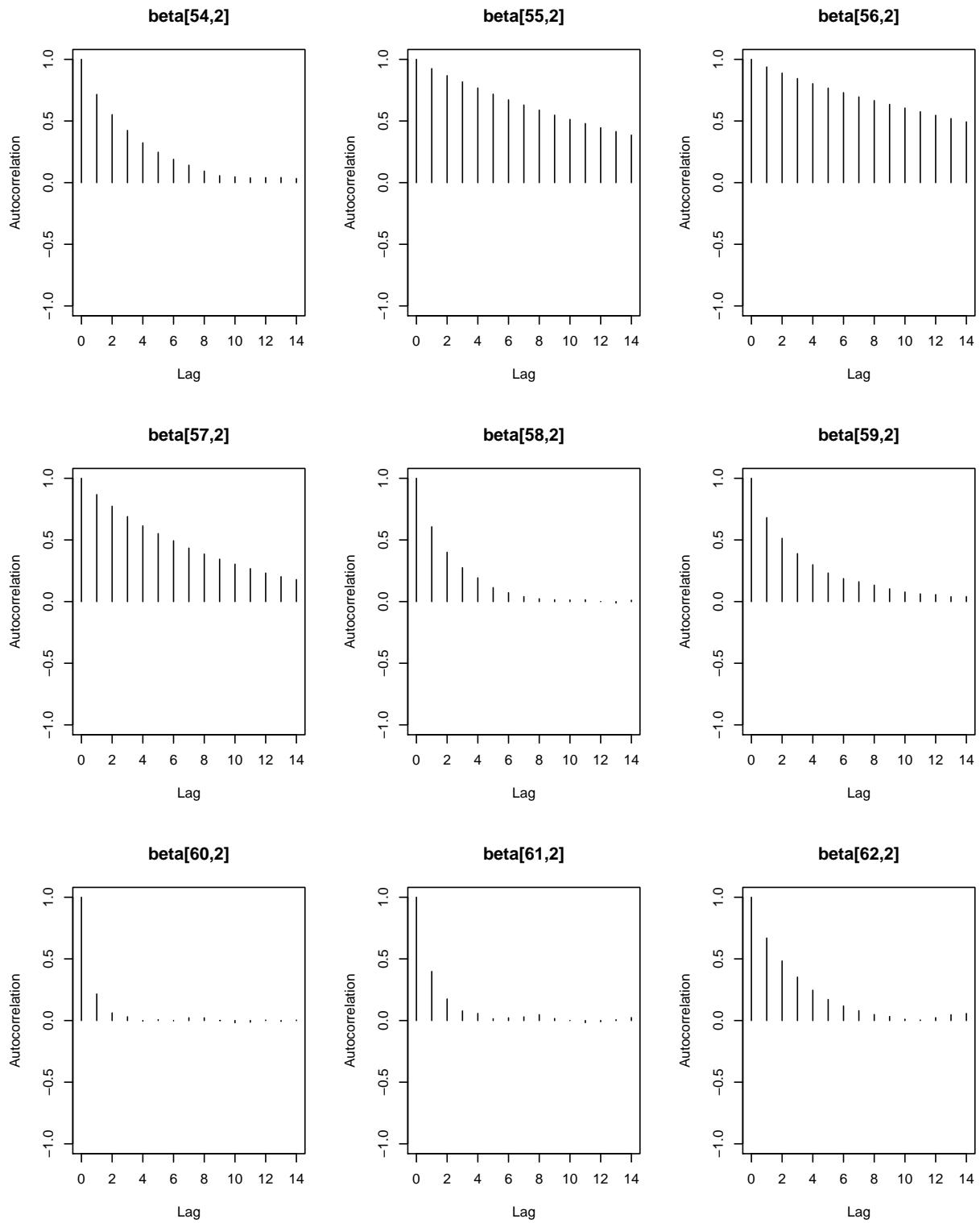


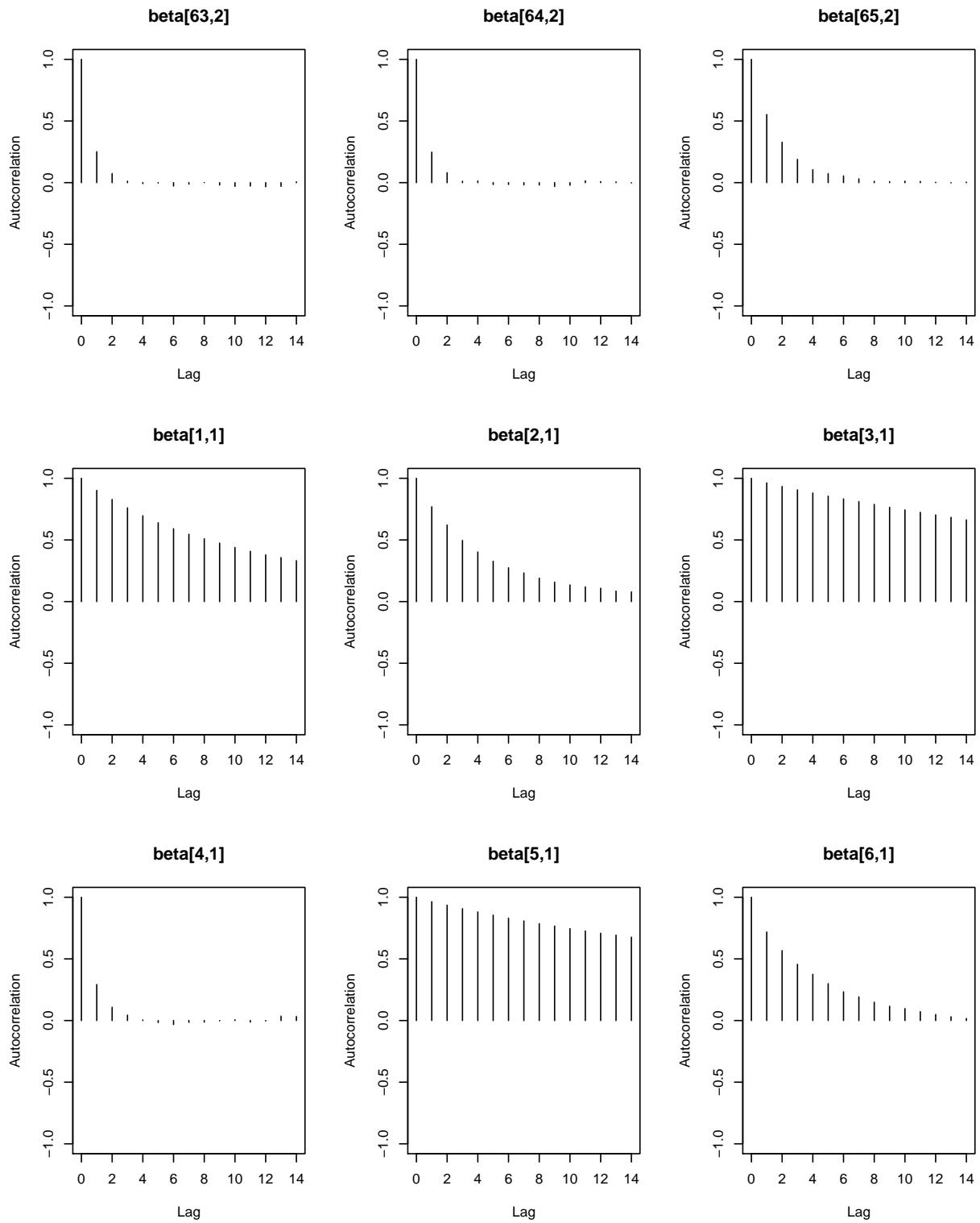


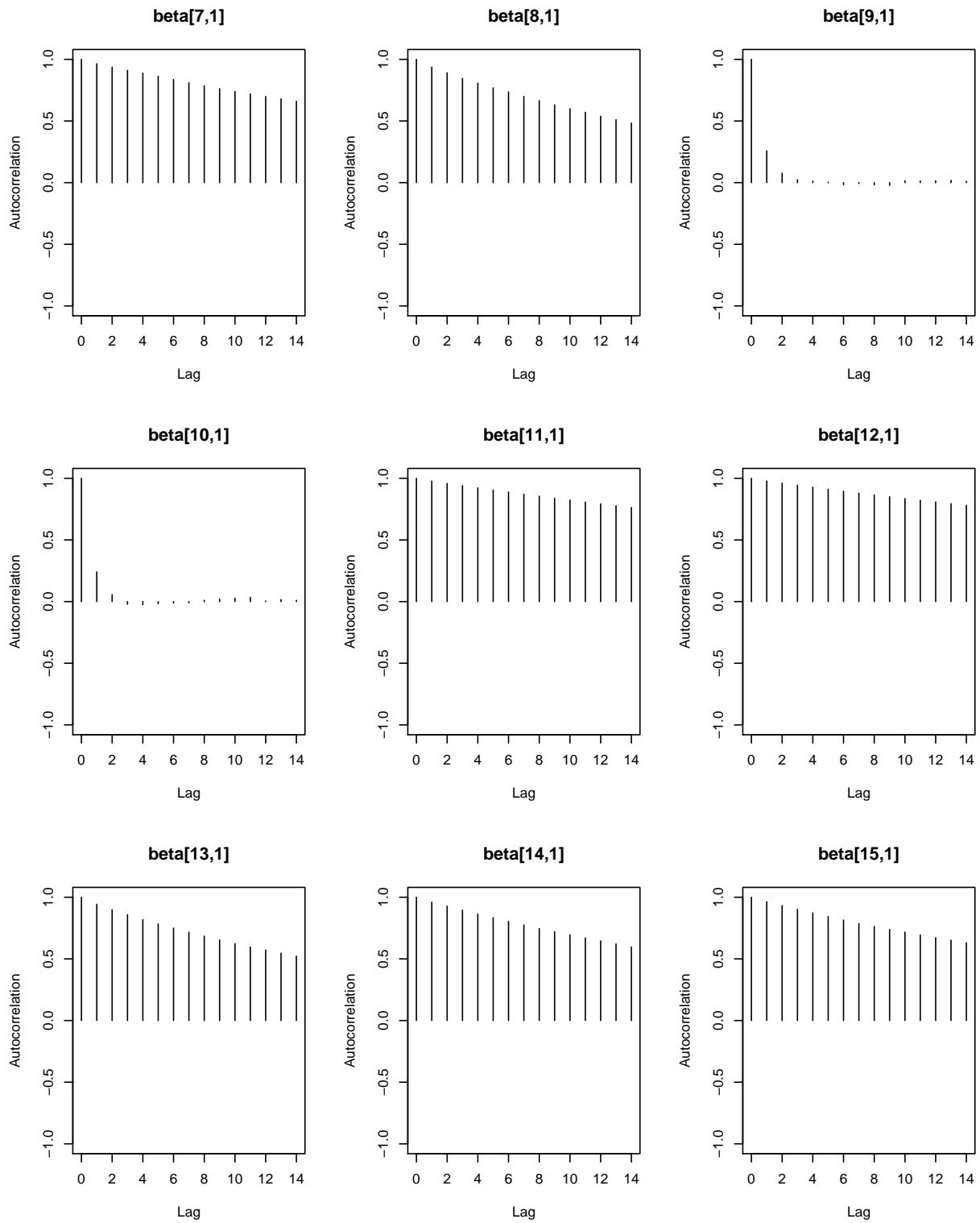


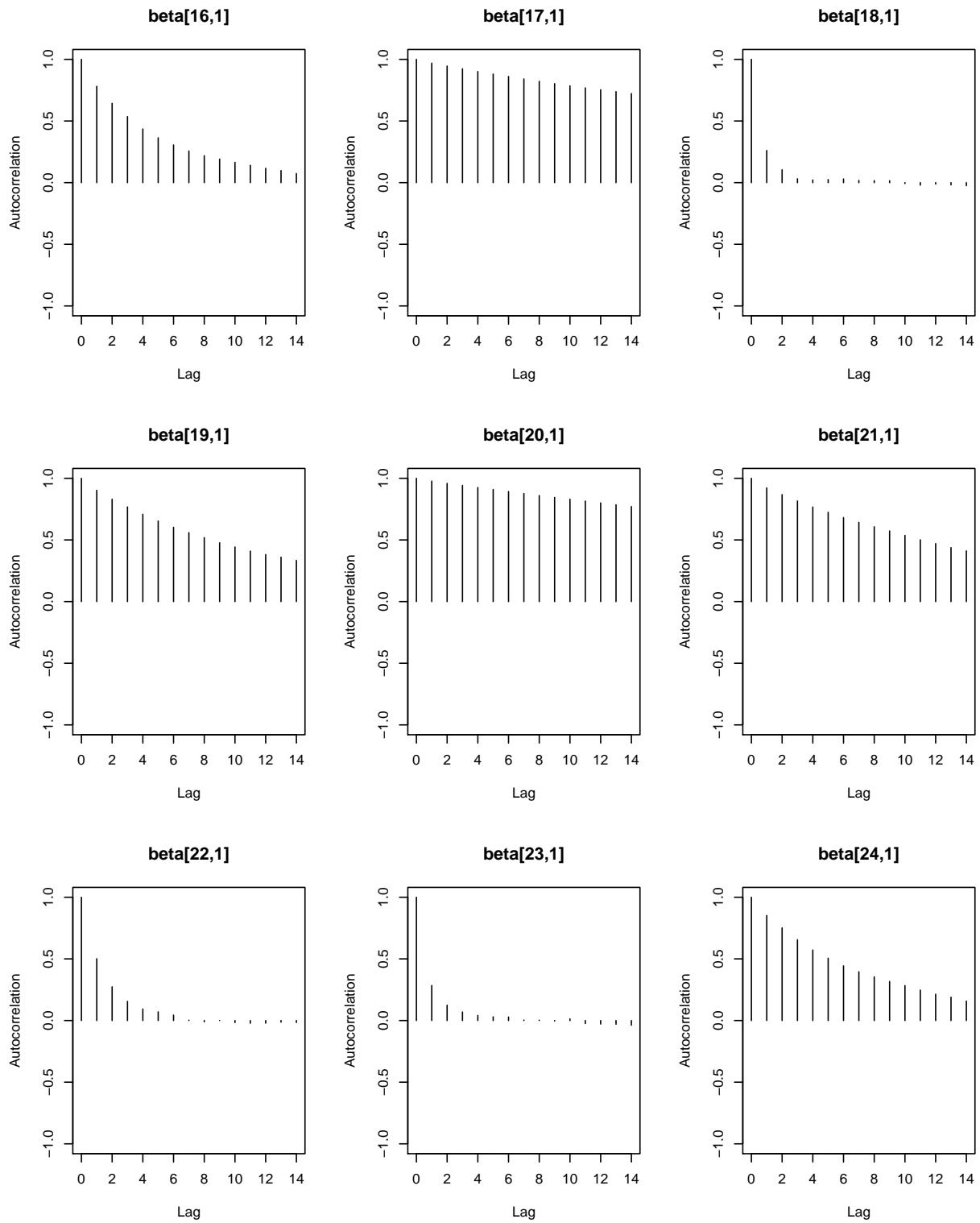


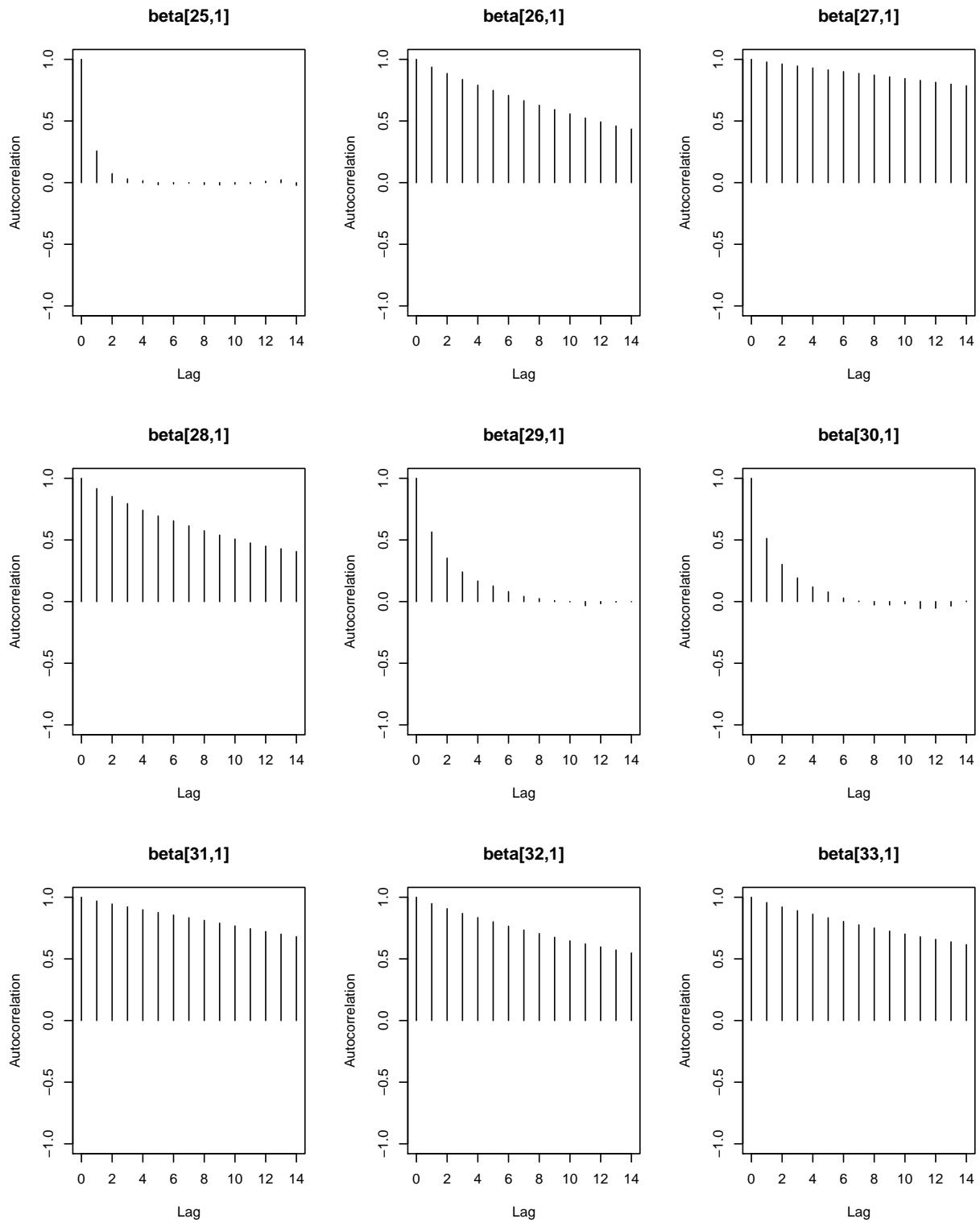


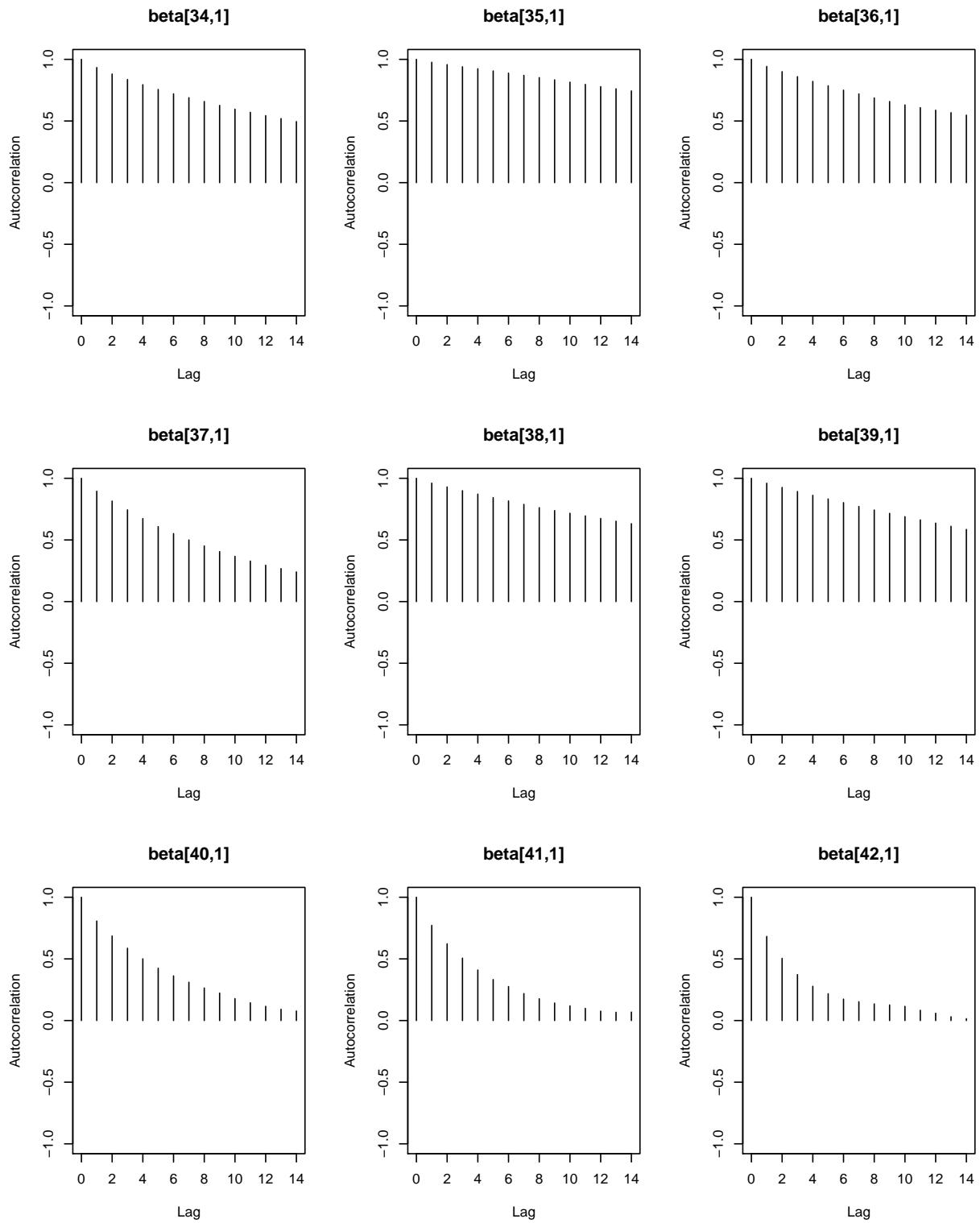


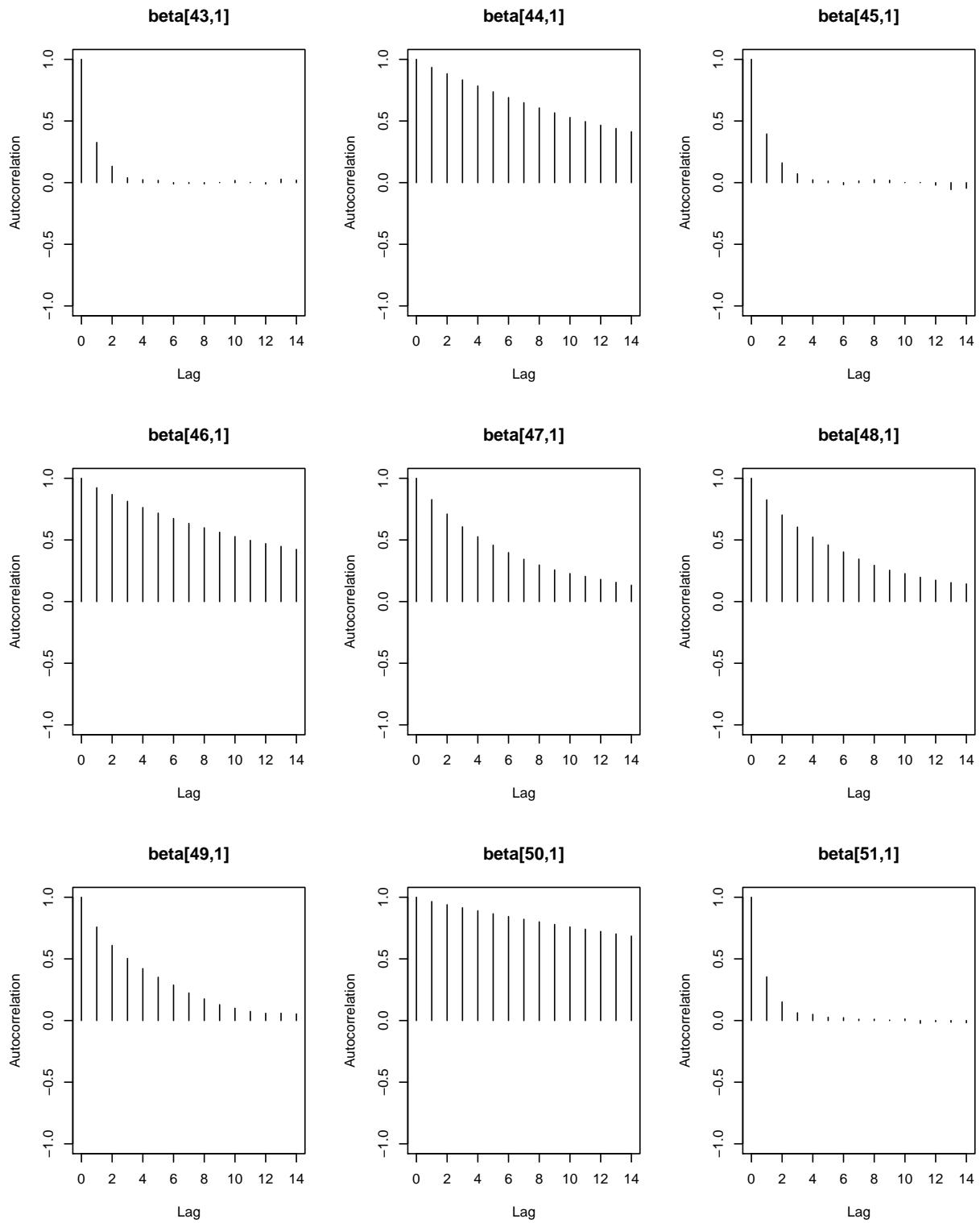


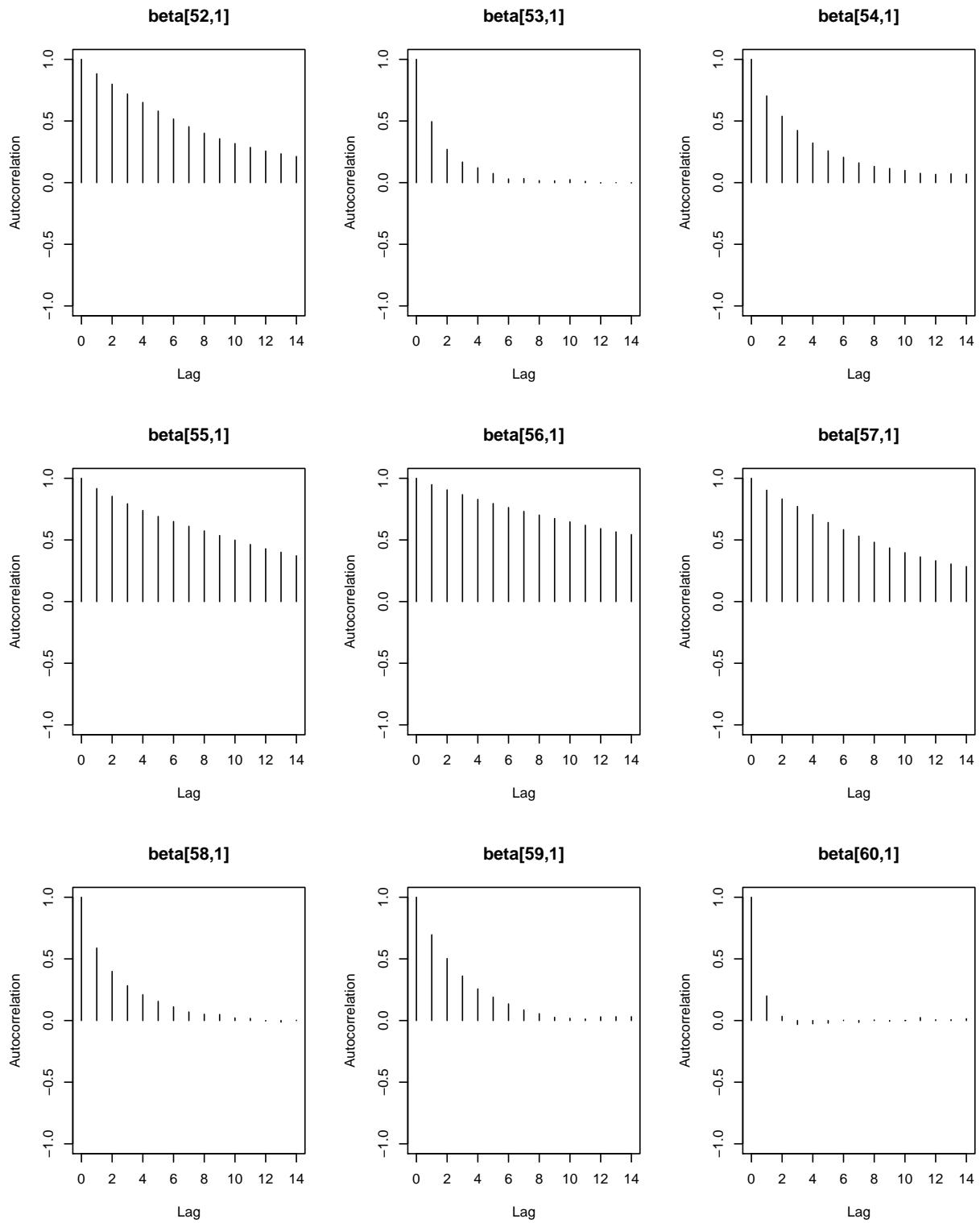


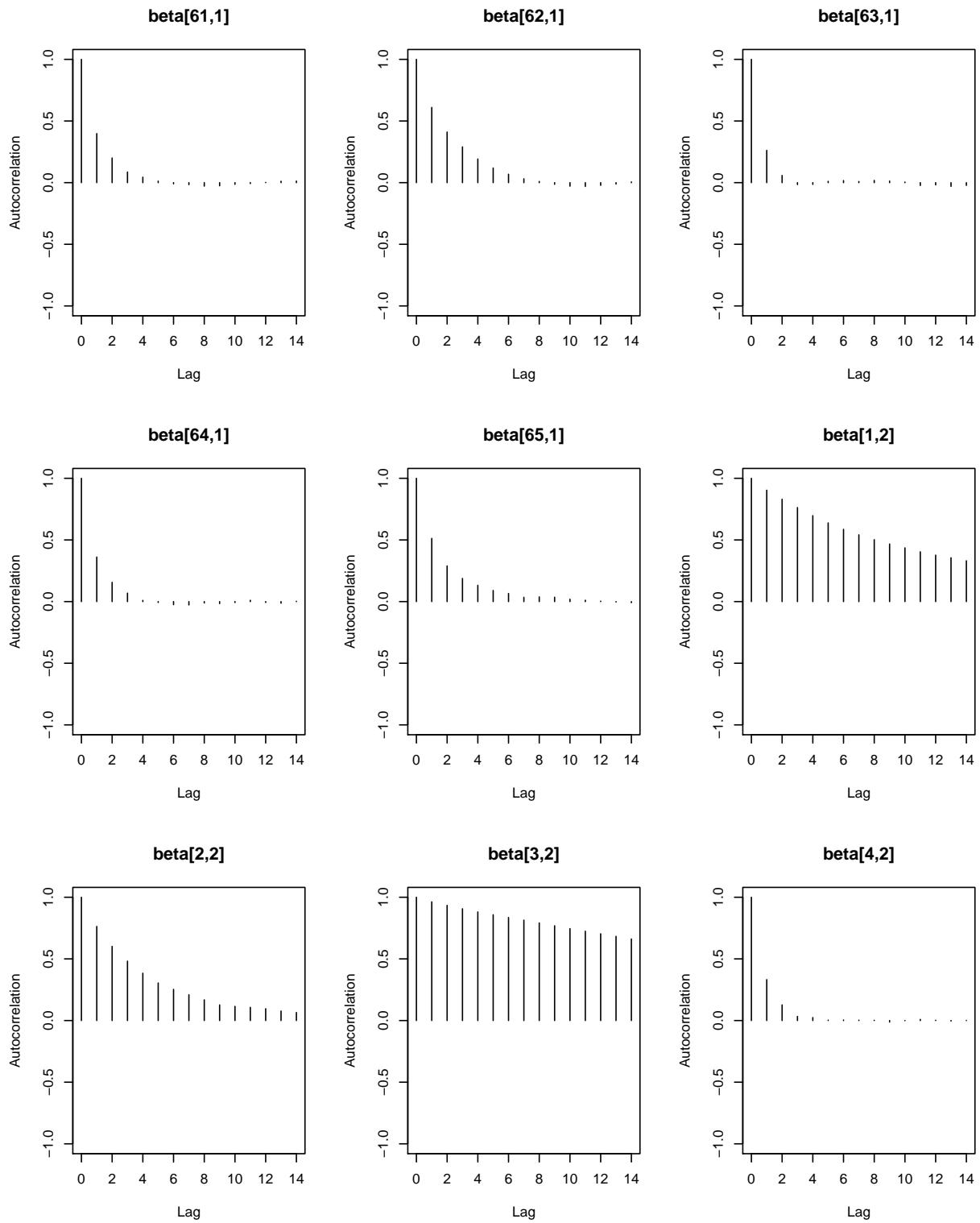


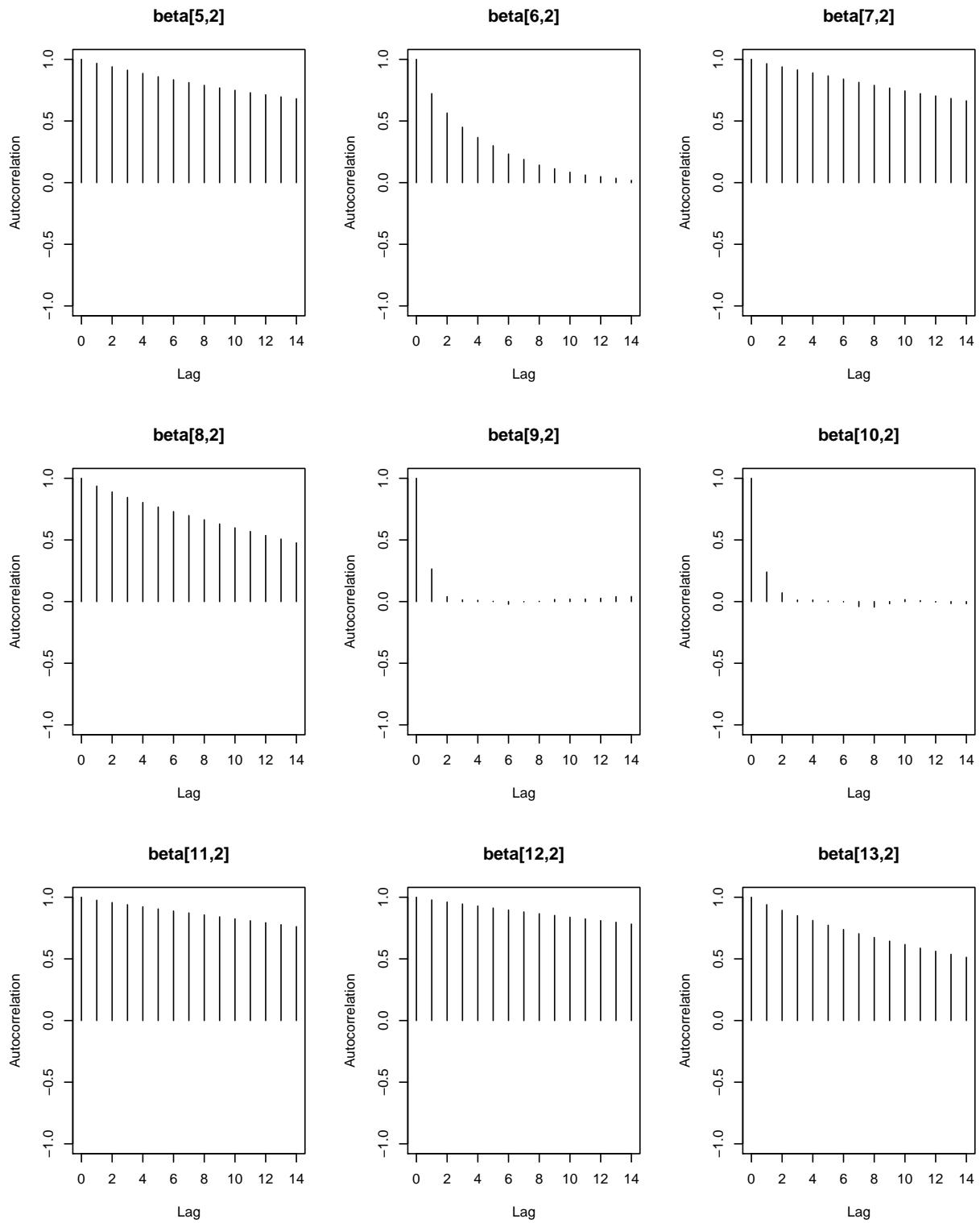


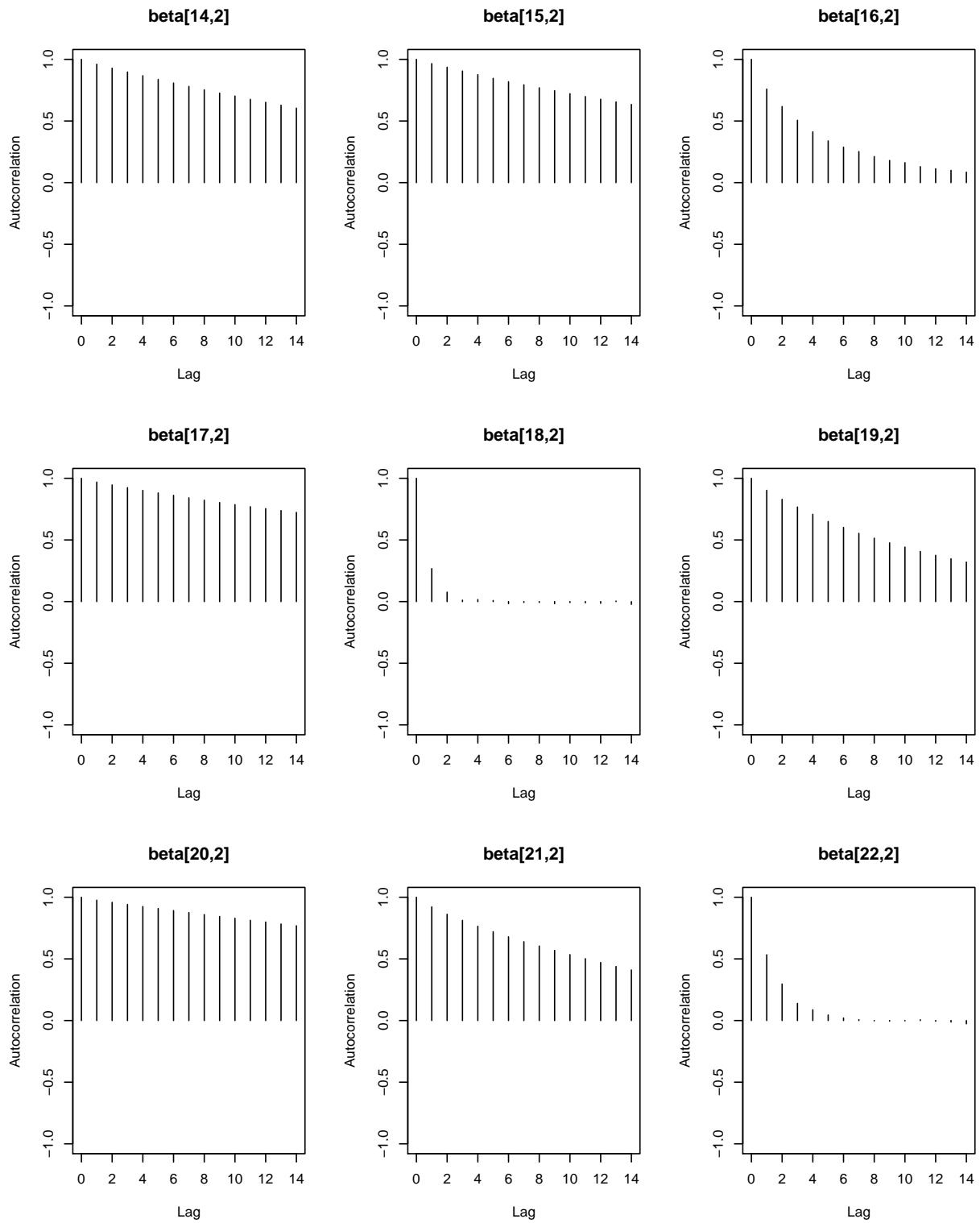


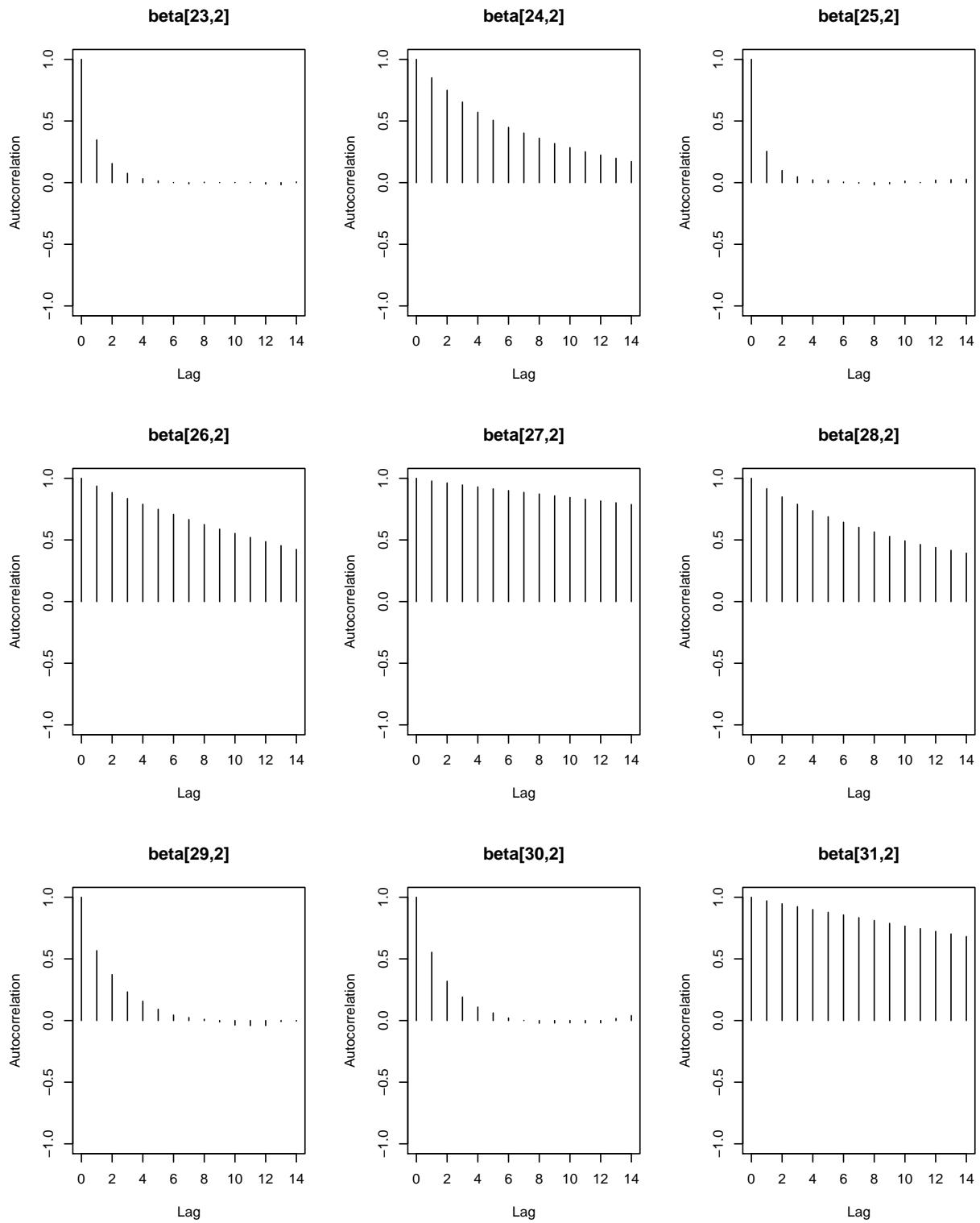


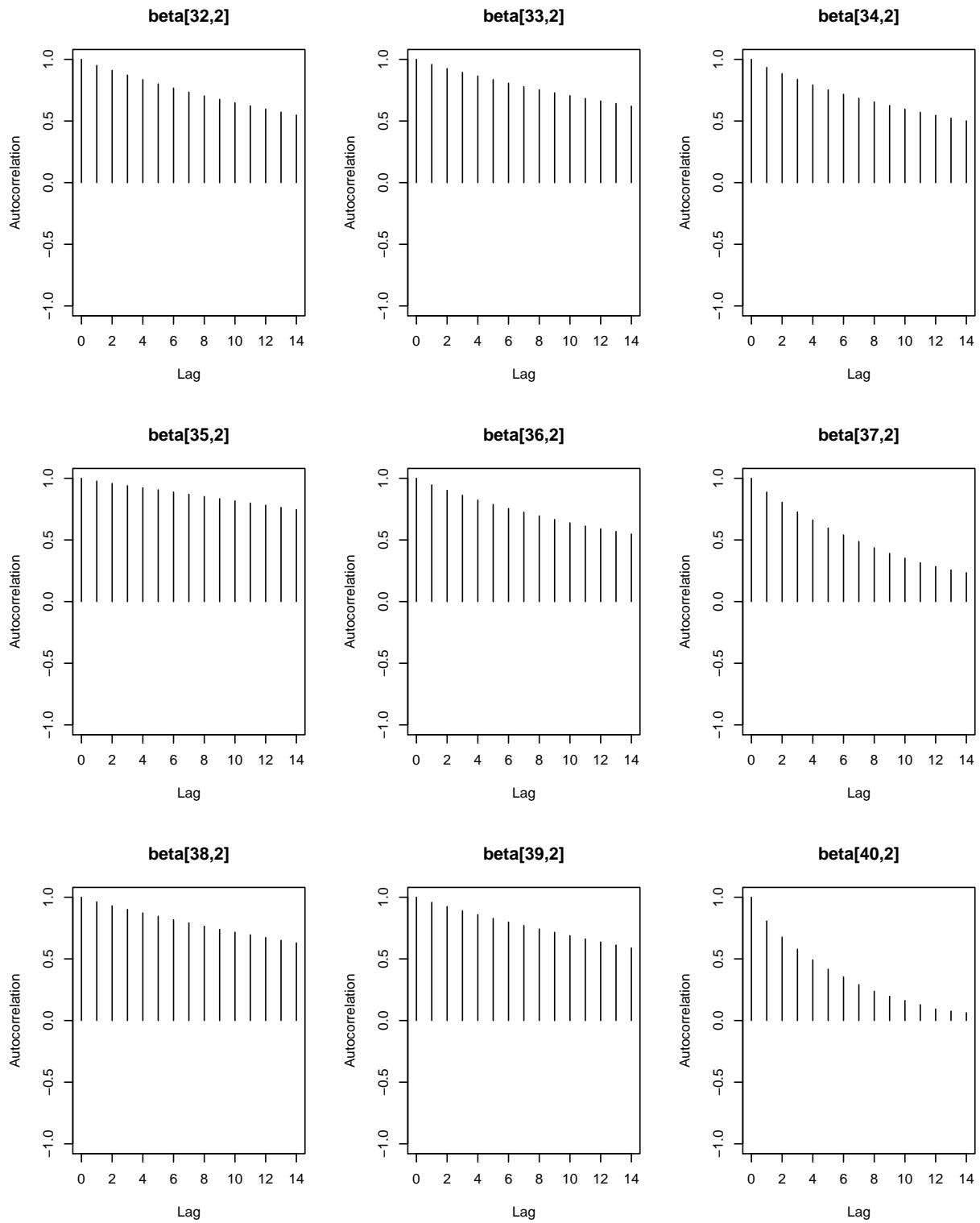


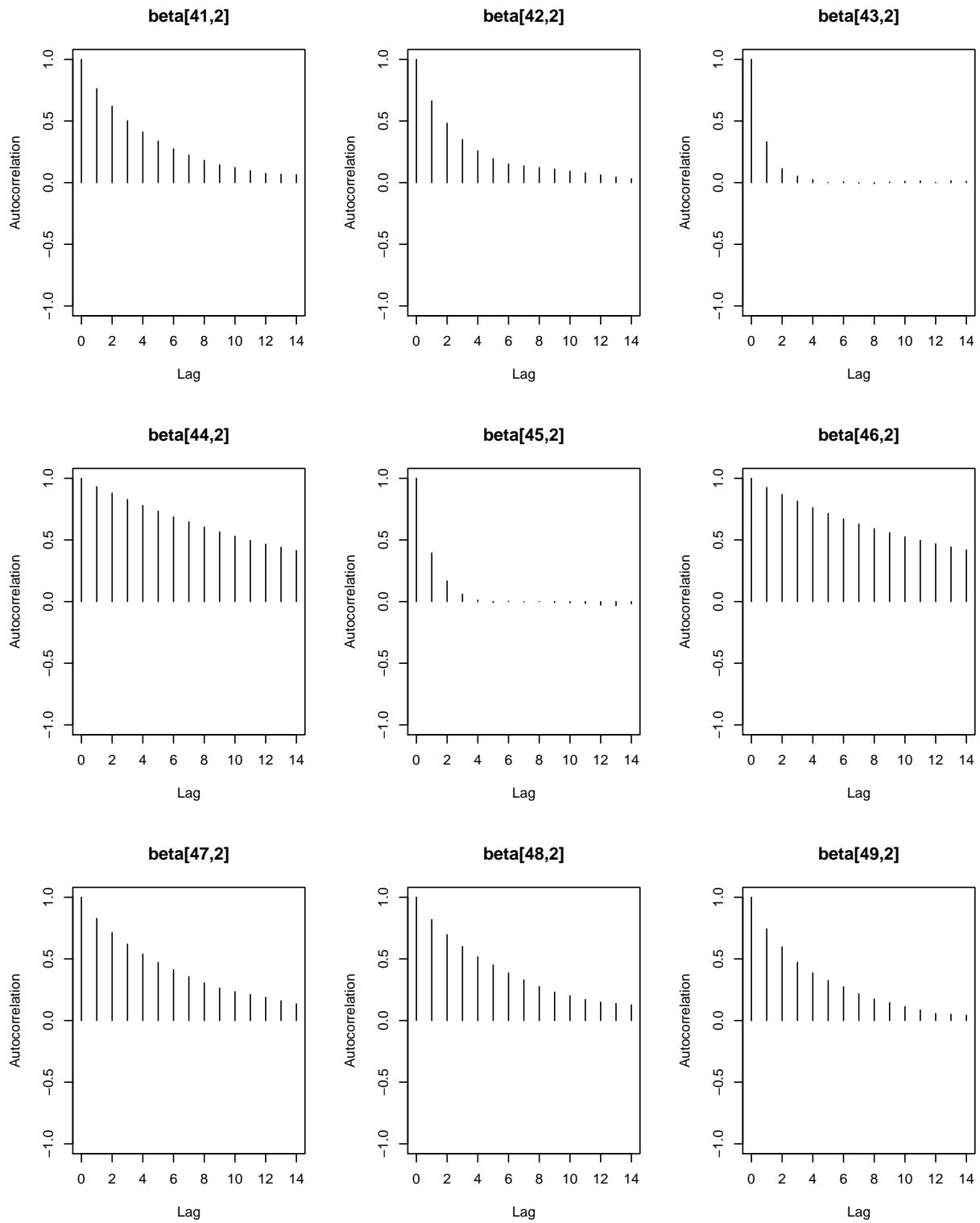


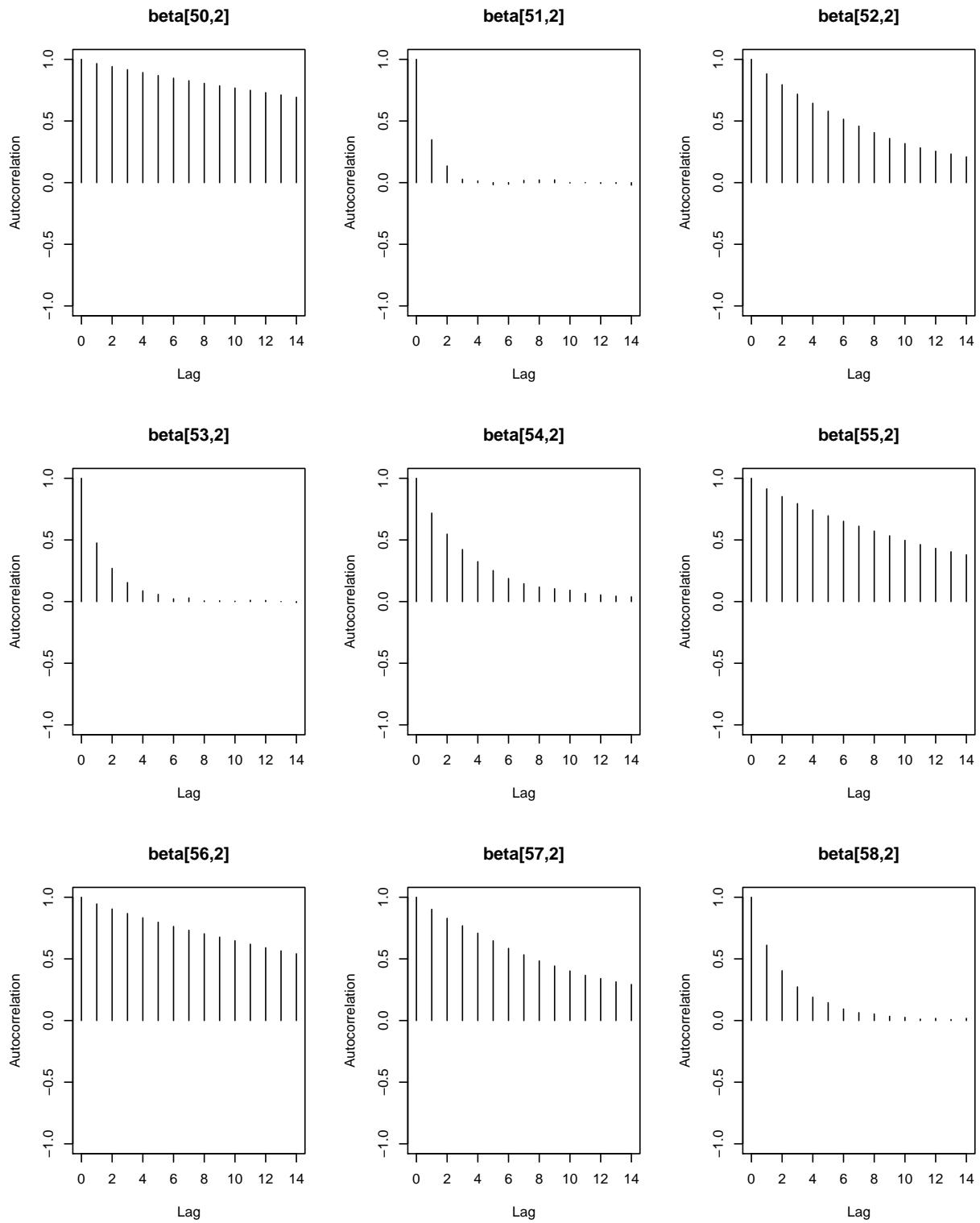


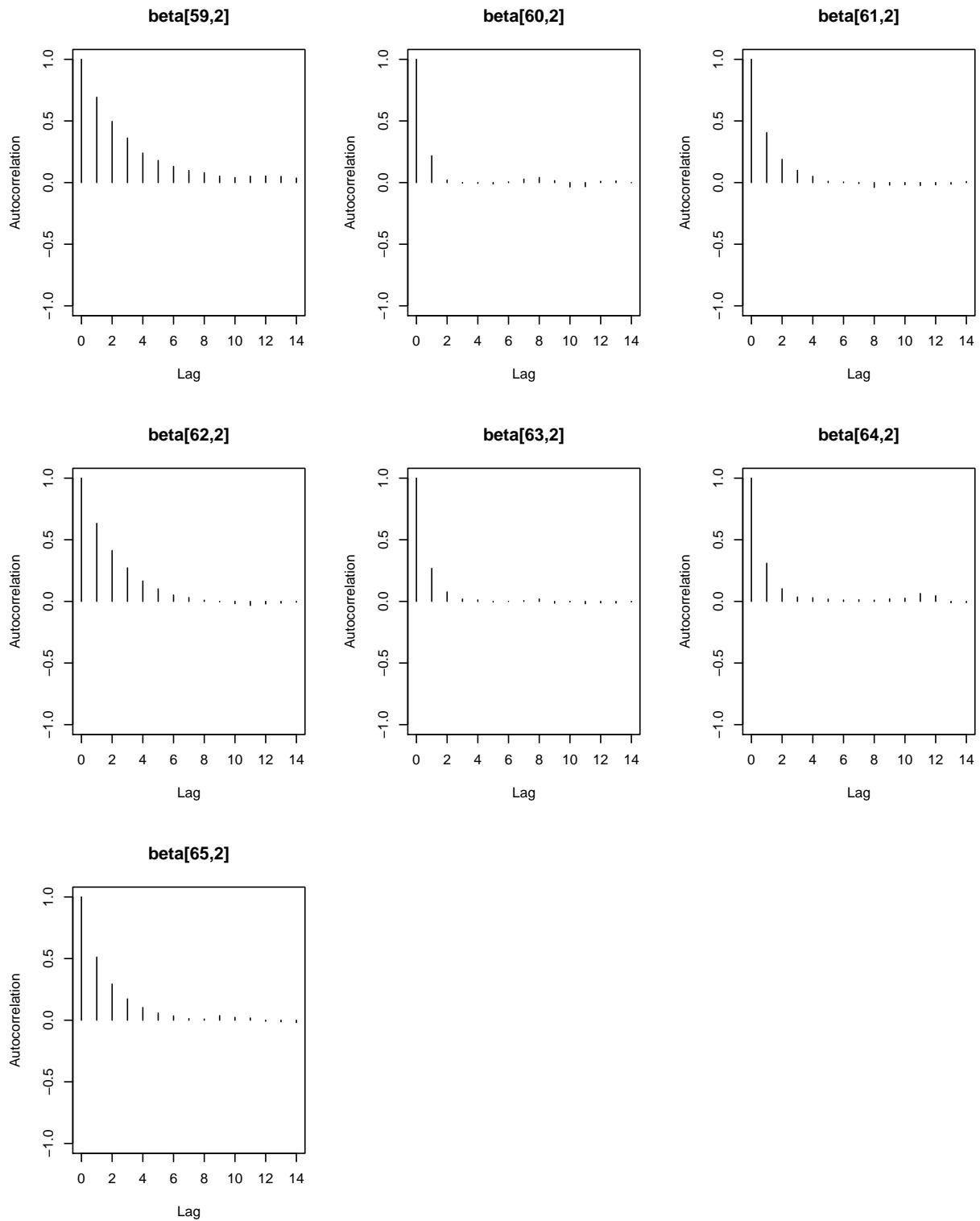




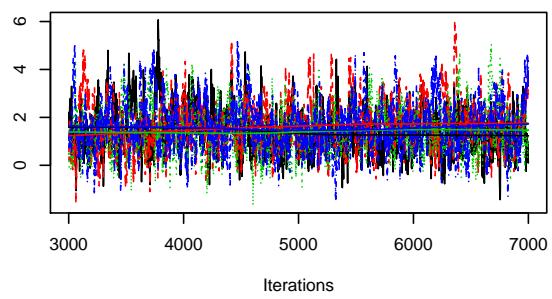




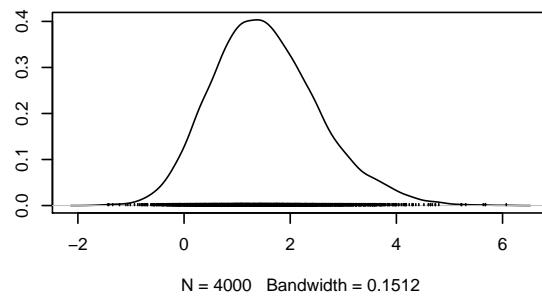




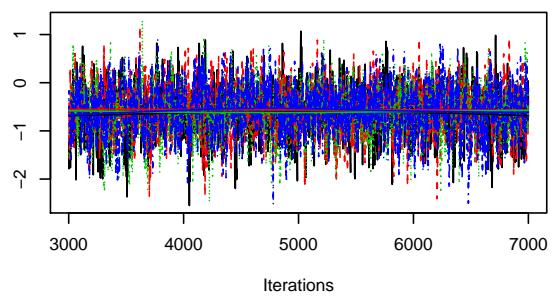
Trace of beta[1,1]



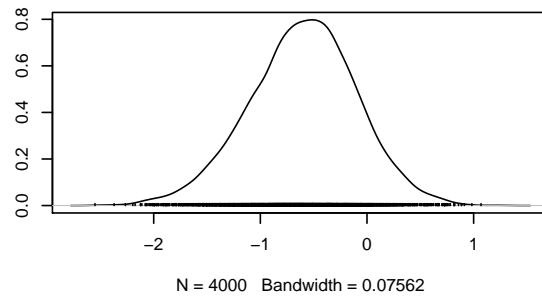
Density of beta[1,1]



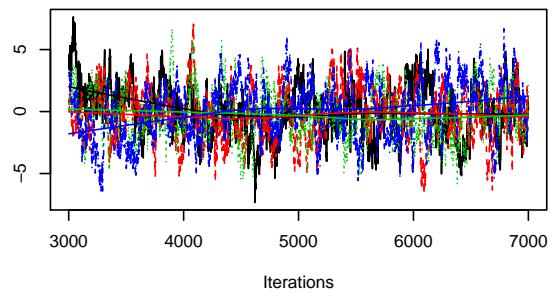
Trace of beta[2,1]



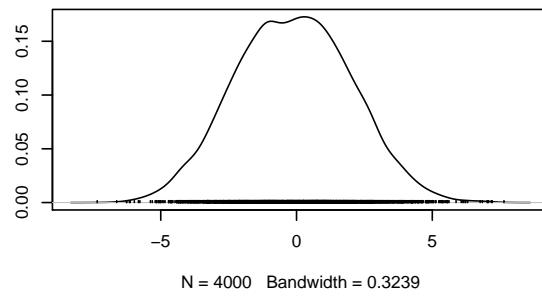
Density of beta[2,1]



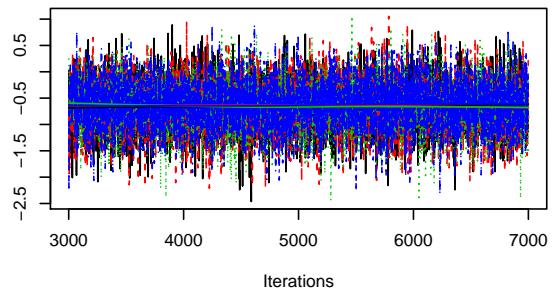
Trace of beta[3,1]



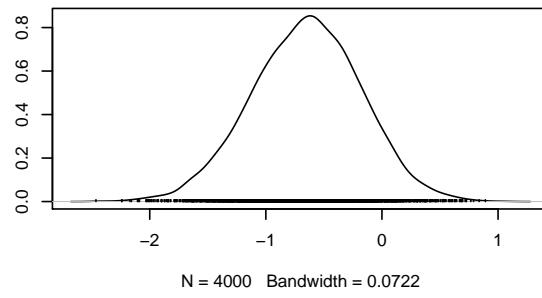
Density of beta[3,1]



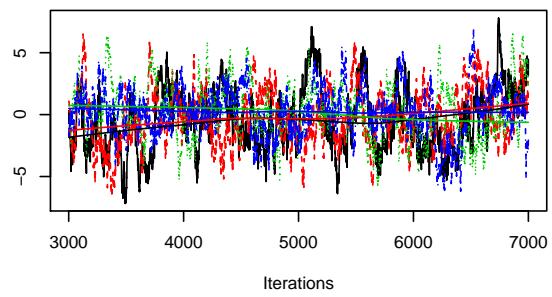
Trace of beta[4,1]



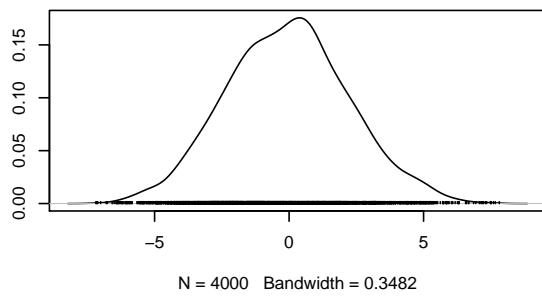
Density of beta[4,1]



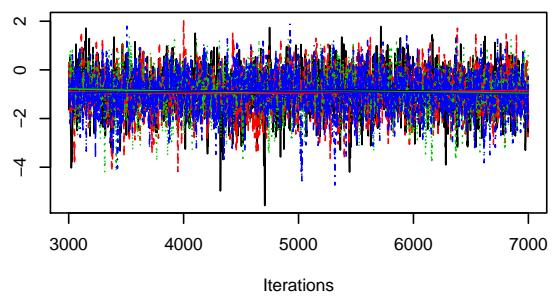
Trace of beta[5,1]



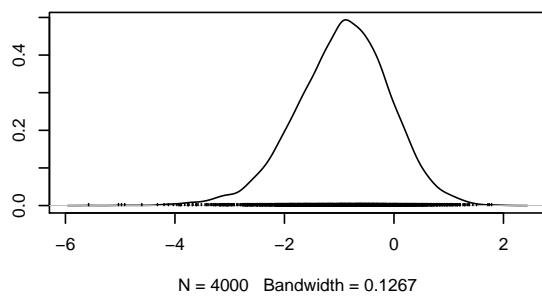
Density of beta[5,1]



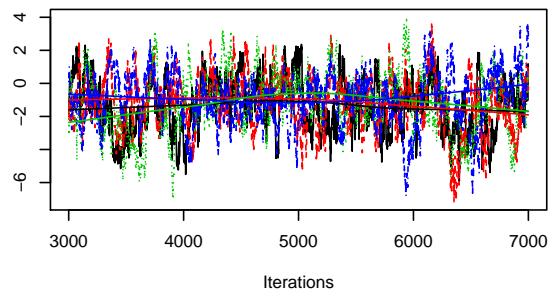
Trace of beta[6,1]



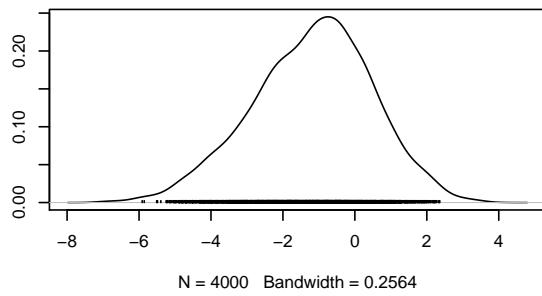
Density of beta[6,1]



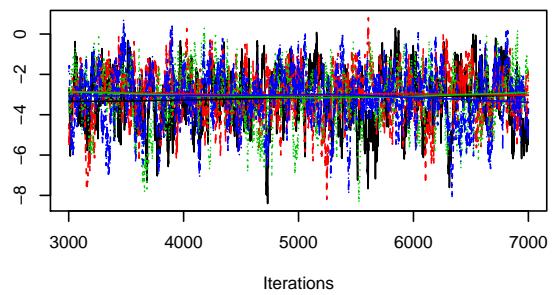
Trace of beta[7,1]



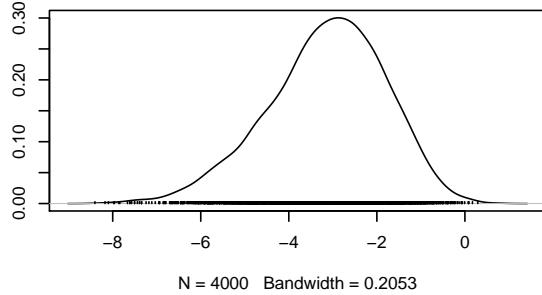
Density of beta[7,1]



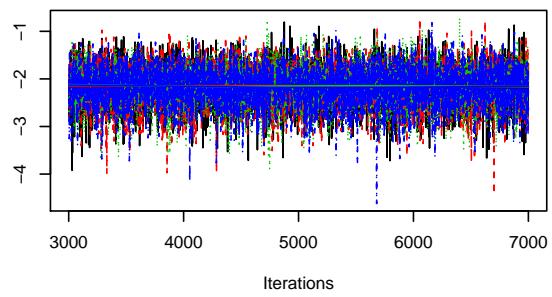
Trace of beta[8,1]



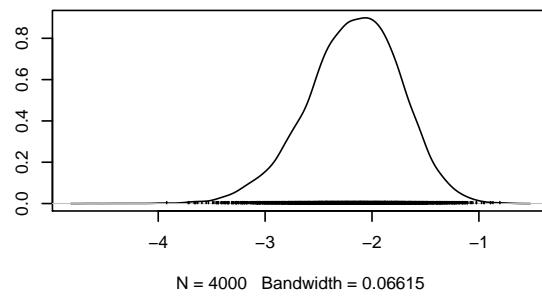
Density of beta[8,1]



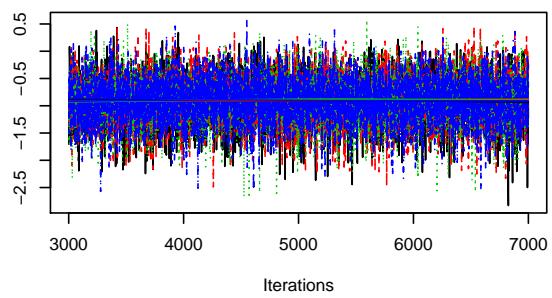
Trace of beta[9,1]



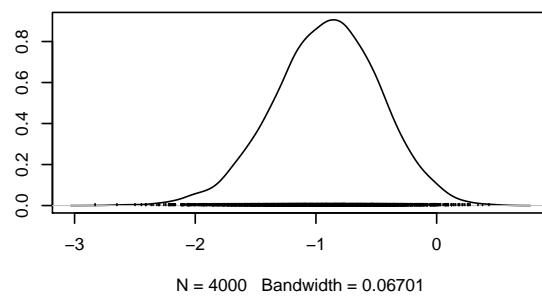
Density of beta[9,1]



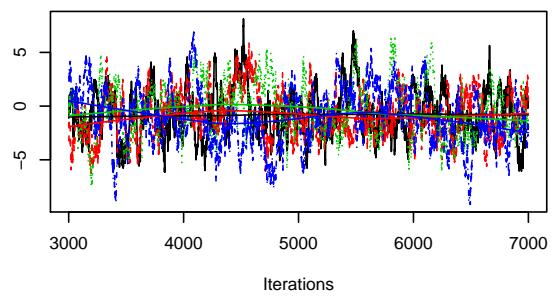
Trace of beta[10,1]



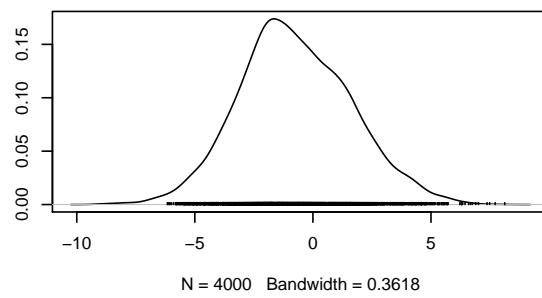
Density of beta[10,1]



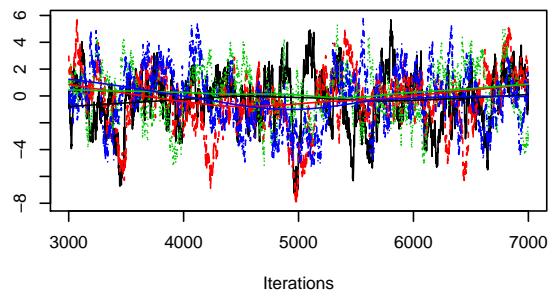
Trace of beta[11,1]



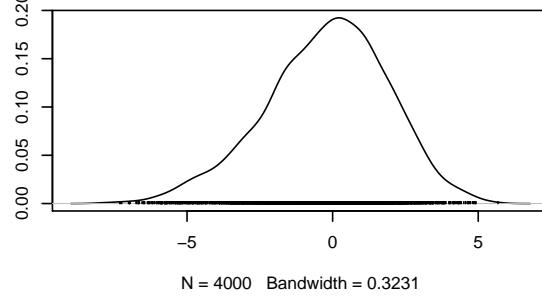
Density of beta[11,1]



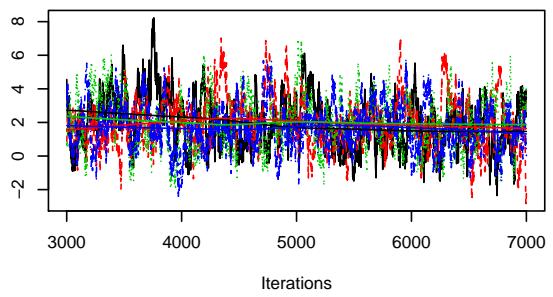
Trace of beta[12,1]



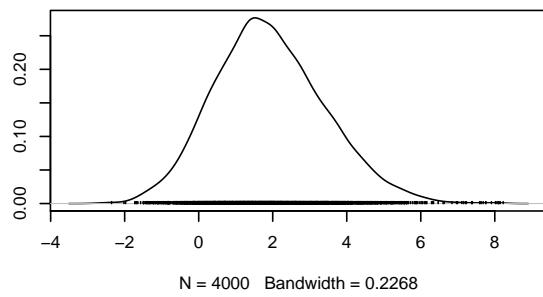
Density of beta[12,1]



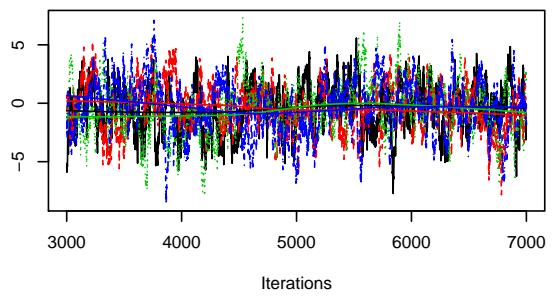
Trace of beta[13,1]



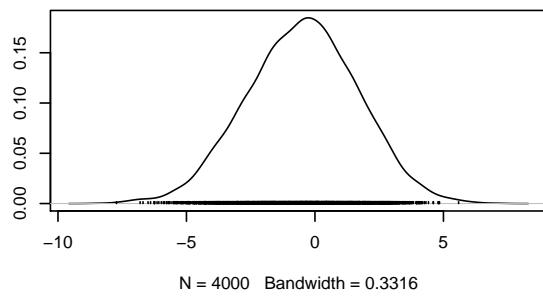
Density of beta[13,1]



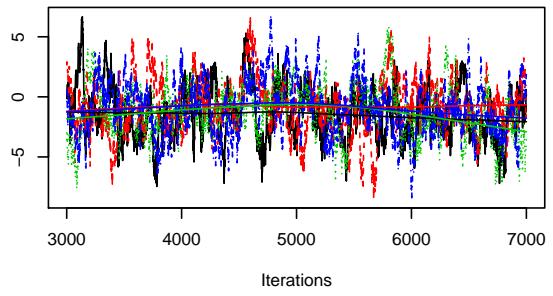
Trace of beta[14,1]



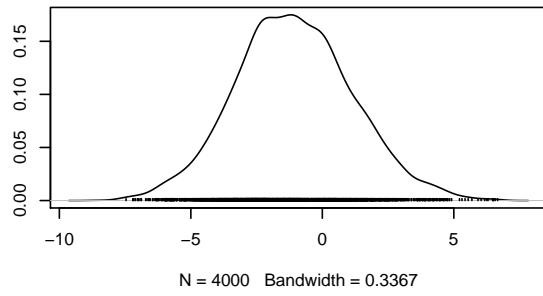
Density of beta[14,1]



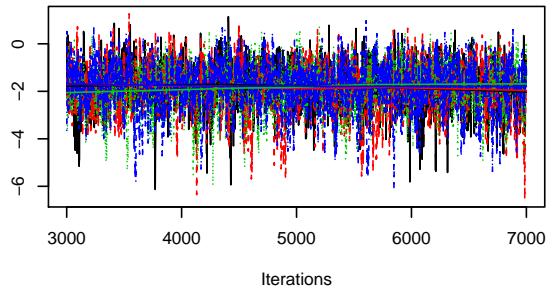
Trace of beta[15,1]



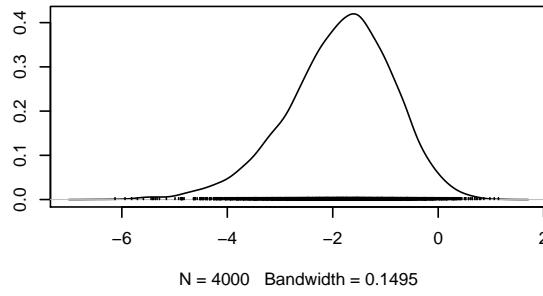
Density of beta[15,1]



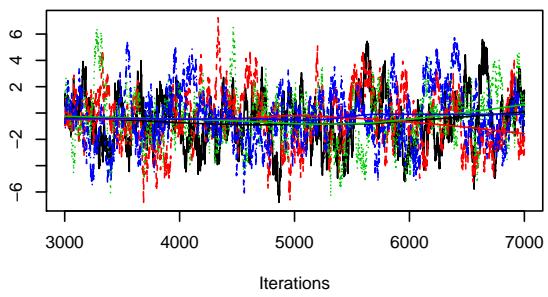
Trace of beta[16,1]



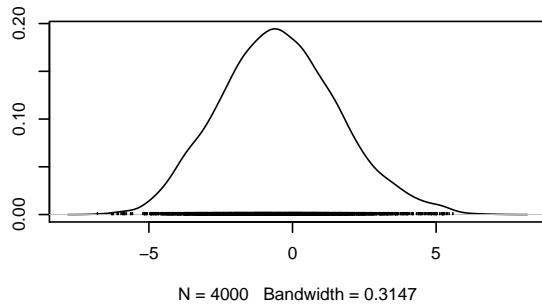
Density of beta[16,1]



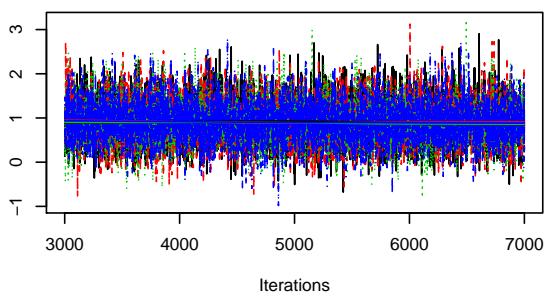
Trace of beta[17,1]



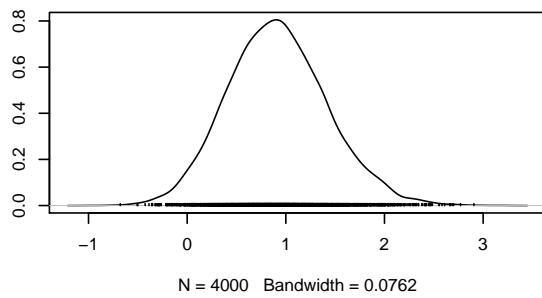
Density of beta[17,1]



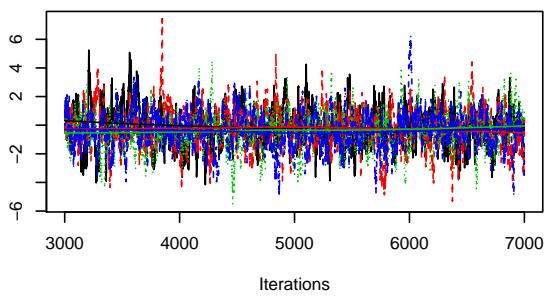
Trace of beta[18,1]



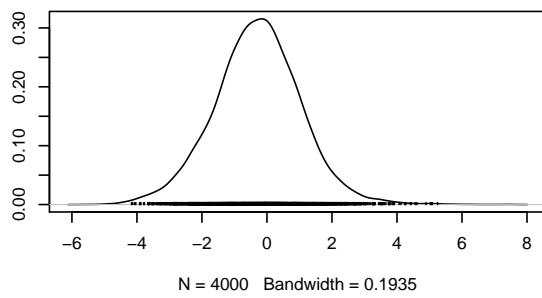
Density of beta[18,1]



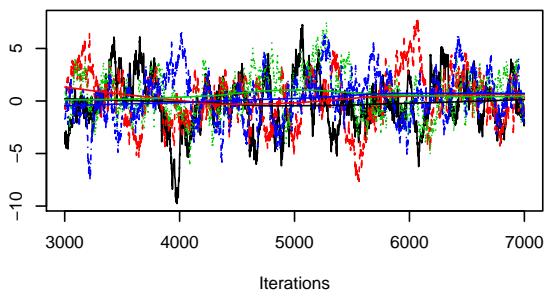
Trace of beta[19,1]



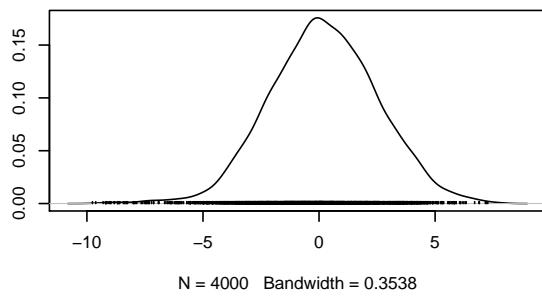
Density of beta[19,1]



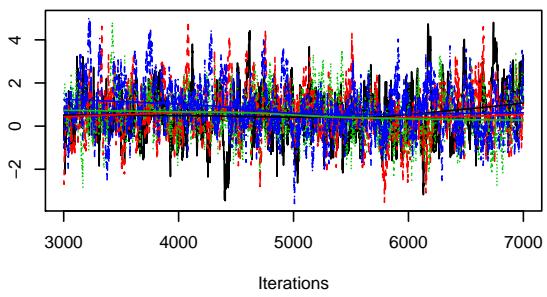
Trace of beta[20,1]



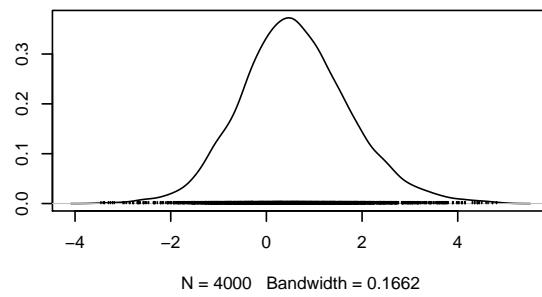
Density of beta[20,1]



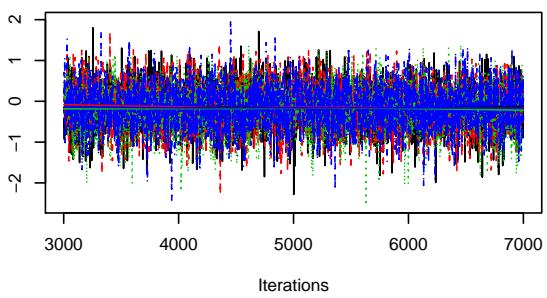
Trace of beta[21,1]



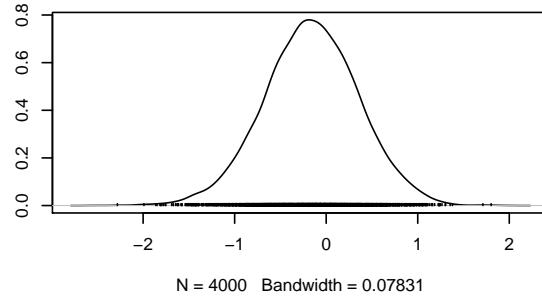
Density of beta[21,1]



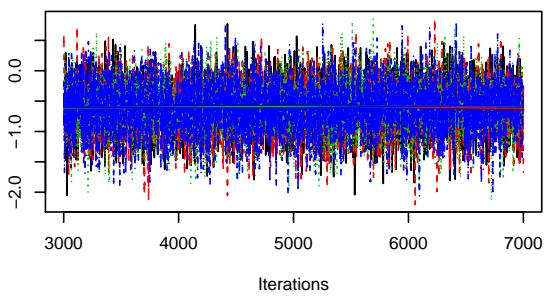
Trace of beta[22,1]



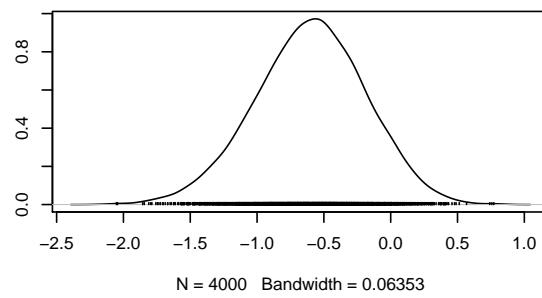
Density of beta[22,1]



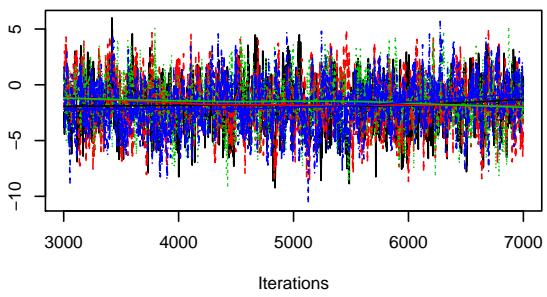
Trace of beta[23,1]



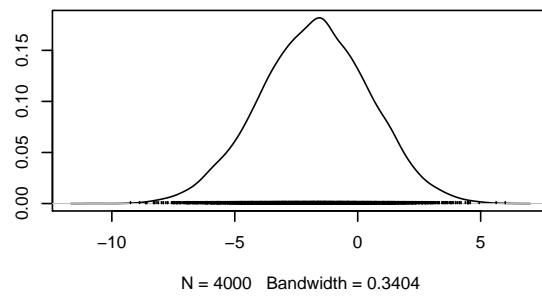
Density of beta[23,1]



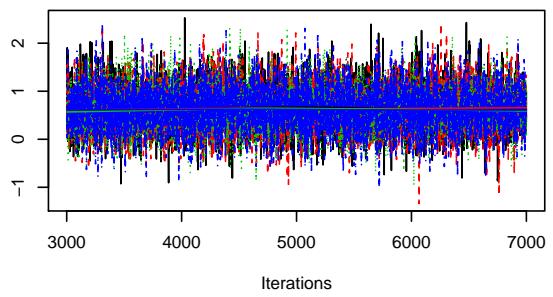
Trace of beta[24,1]



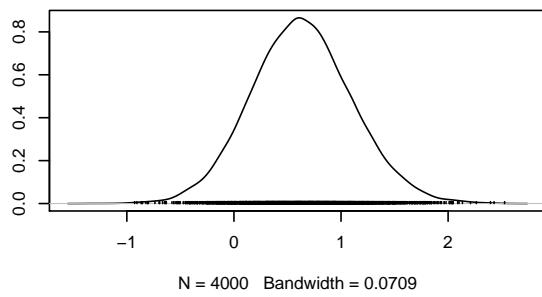
Density of beta[24,1]



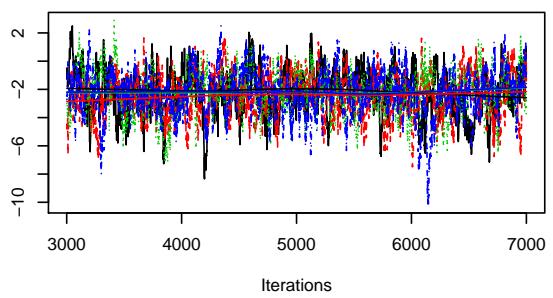
Trace of beta[25,1]



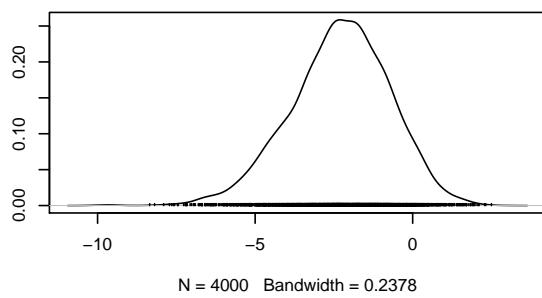
Density of beta[25,1]



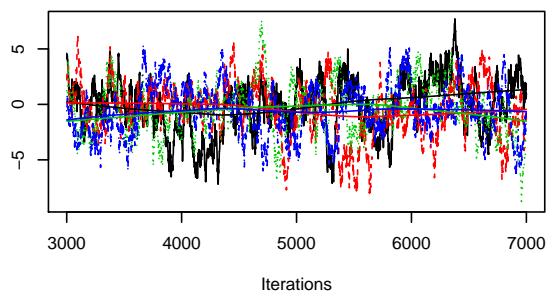
Trace of beta[26,1]



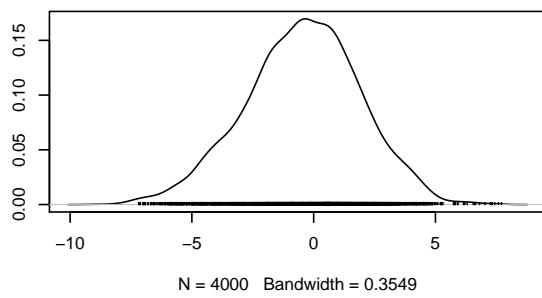
Density of beta[26,1]



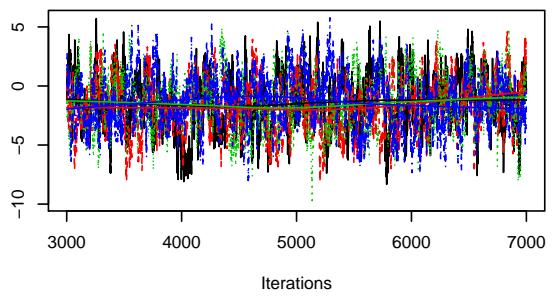
Trace of beta[27,1]



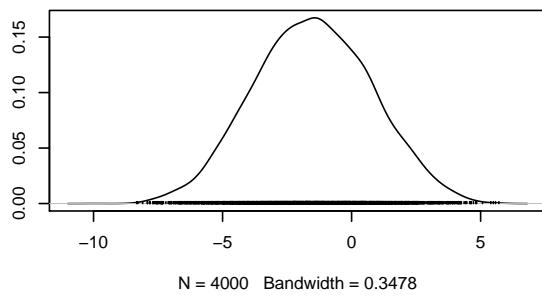
Density of beta[27,1]



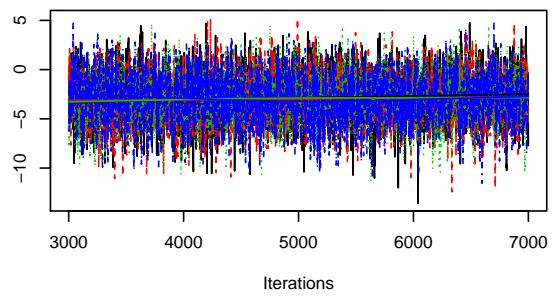
Trace of beta[28,1]



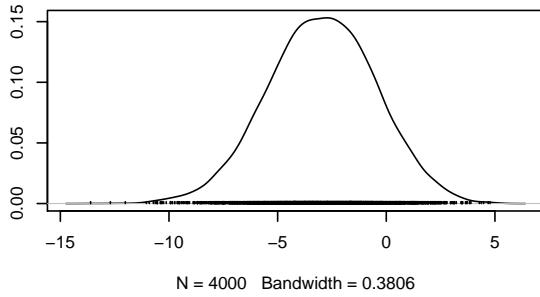
Density of beta[28,1]



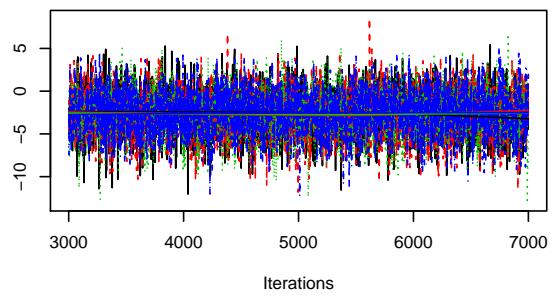
Trace of beta[29,1]



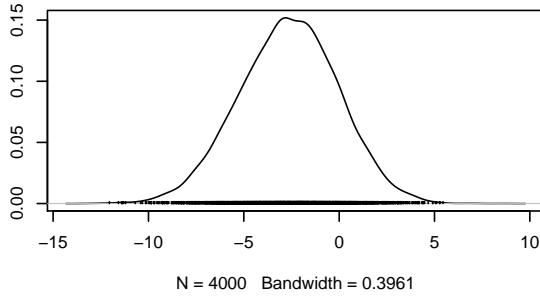
Density of beta[29,1]



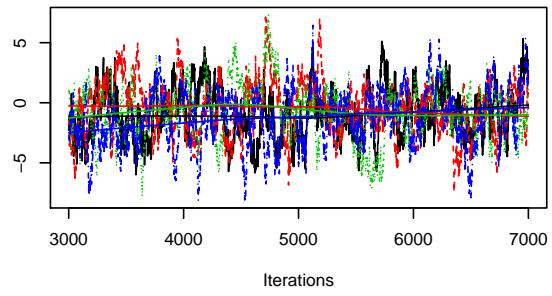
Trace of beta[30,1]



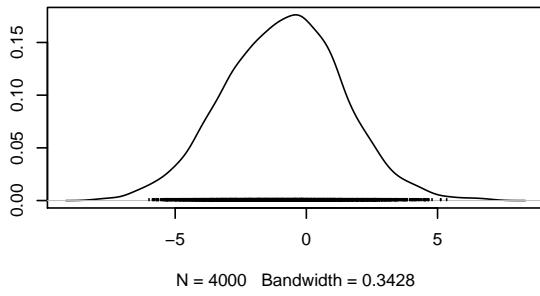
Density of beta[30,1]



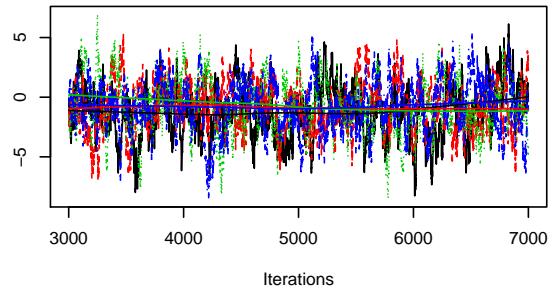
Trace of beta[31,1]



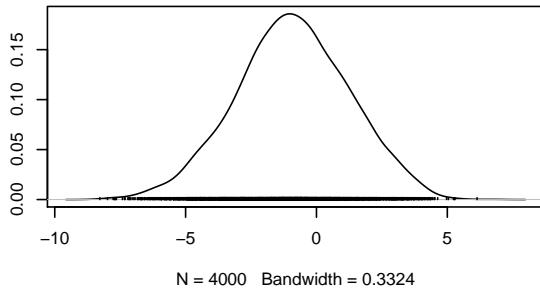
Density of beta[31,1]



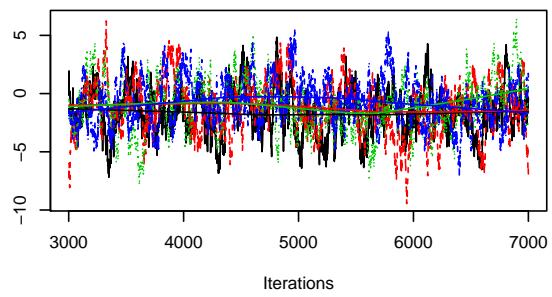
Trace of beta[32,1]



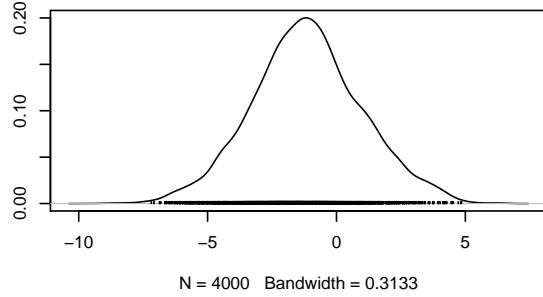
Density of beta[32,1]



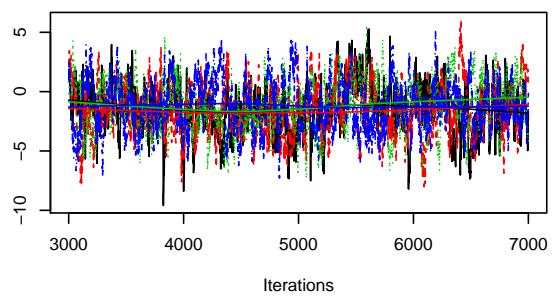
Trace of beta[33,1]



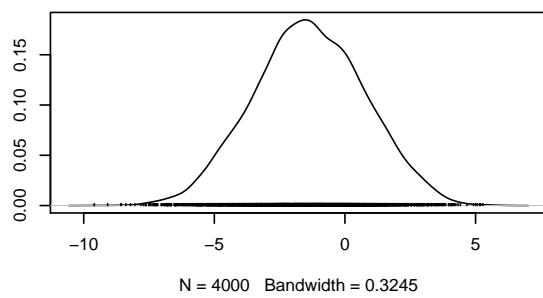
Density of beta[33,1]



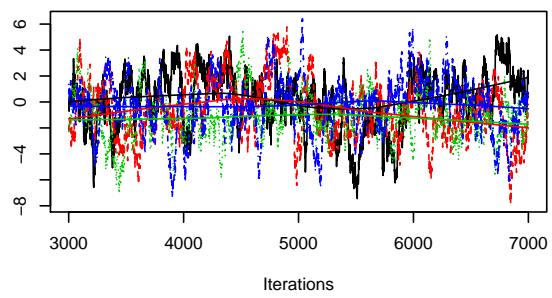
Trace of beta[34,1]



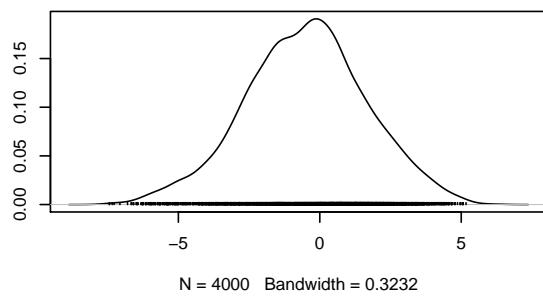
Density of beta[34,1]



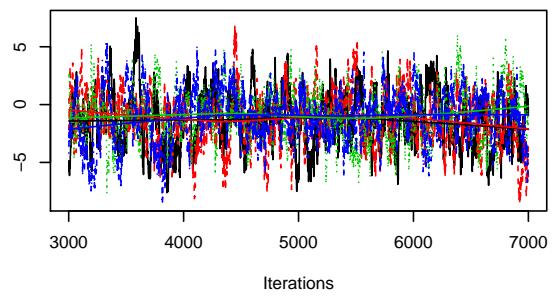
Trace of beta[35,1]



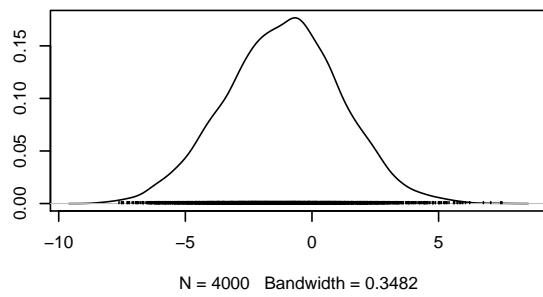
Density of beta[35,1]



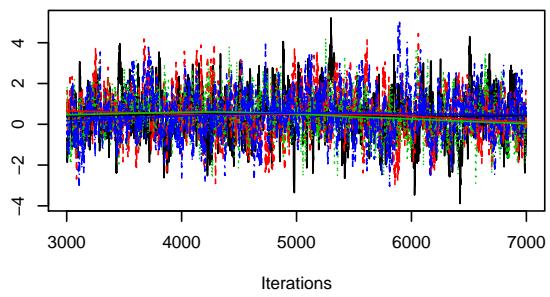
Trace of beta[36,1]



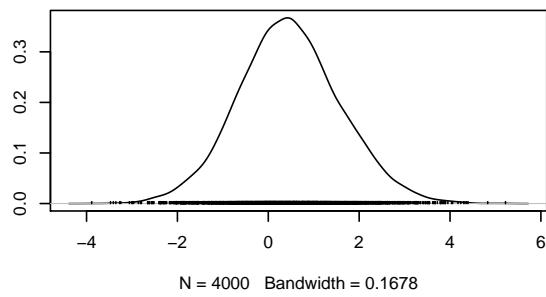
Density of beta[36,1]



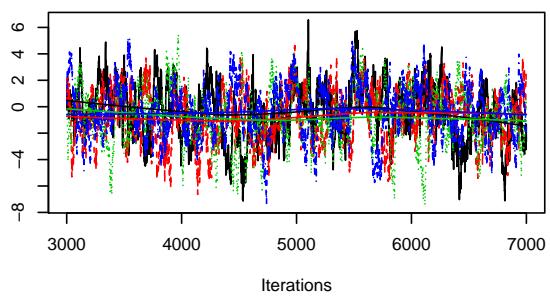
Trace of beta[37,1]



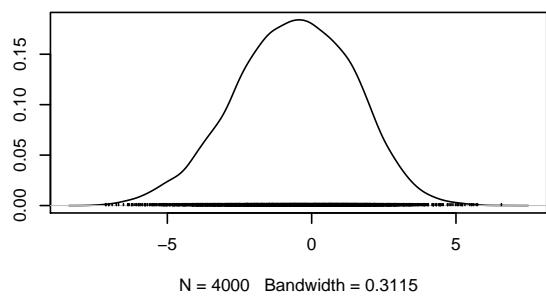
Density of beta[37,1]



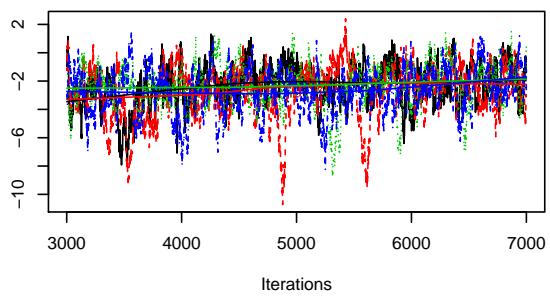
Trace of beta[38,1]



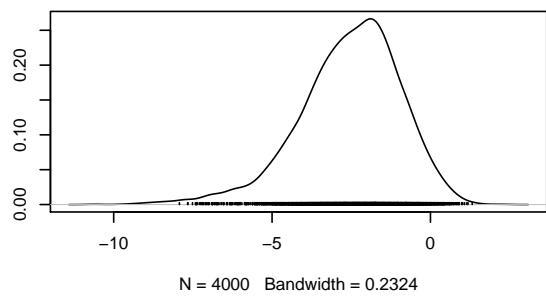
Density of beta[38,1]



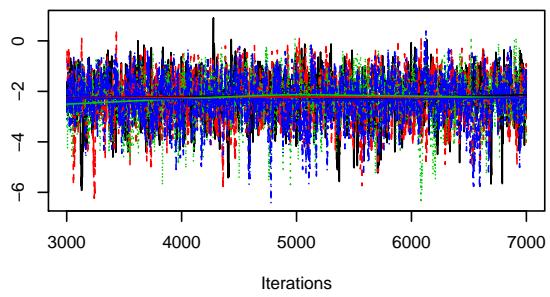
Trace of beta[39,1]



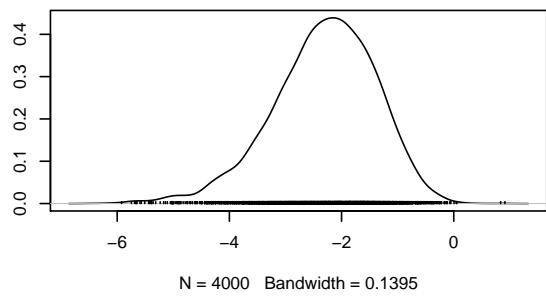
Density of beta[39,1]



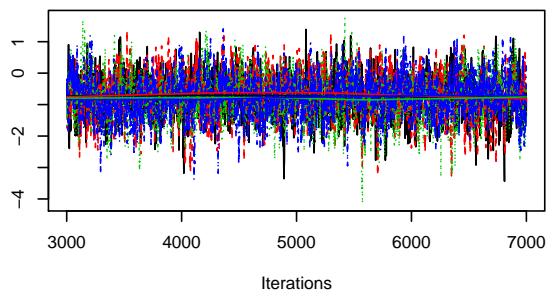
Trace of beta[40,1]



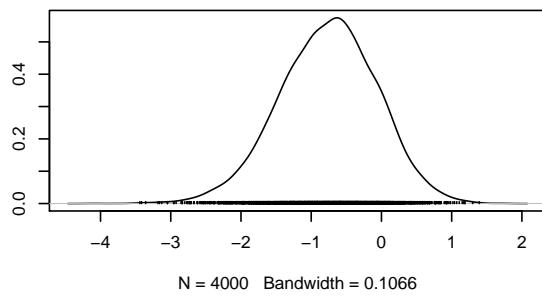
Density of beta[40,1]



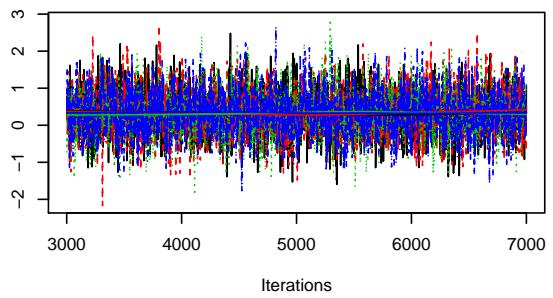
Trace of beta[41,1]



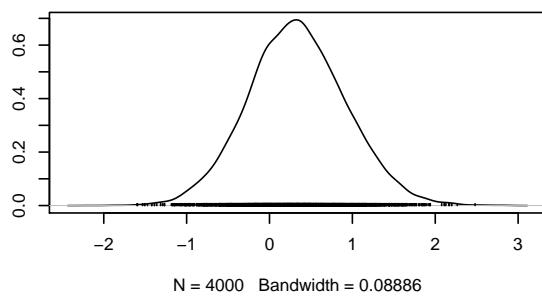
Density of beta[41,1]



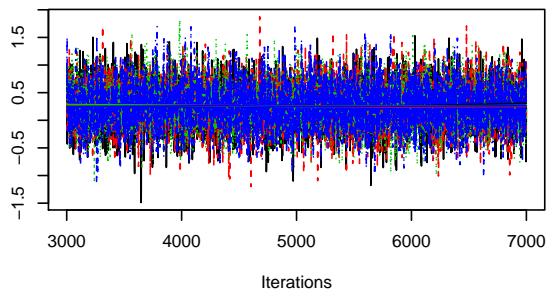
Trace of beta[42,1]



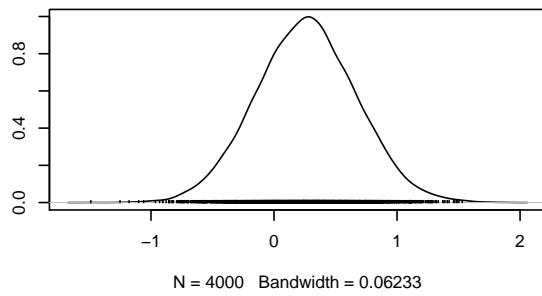
Density of beta[42,1]



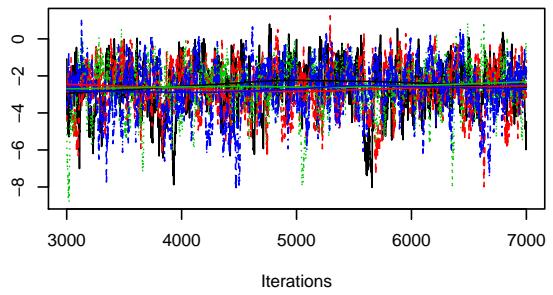
Trace of beta[43,1]



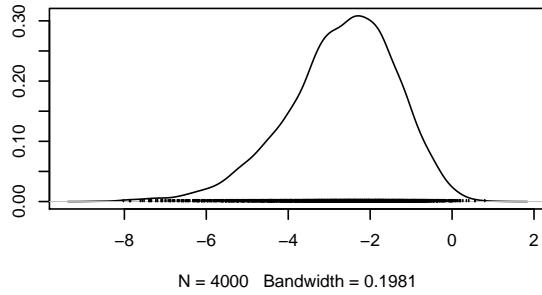
Density of beta[43,1]

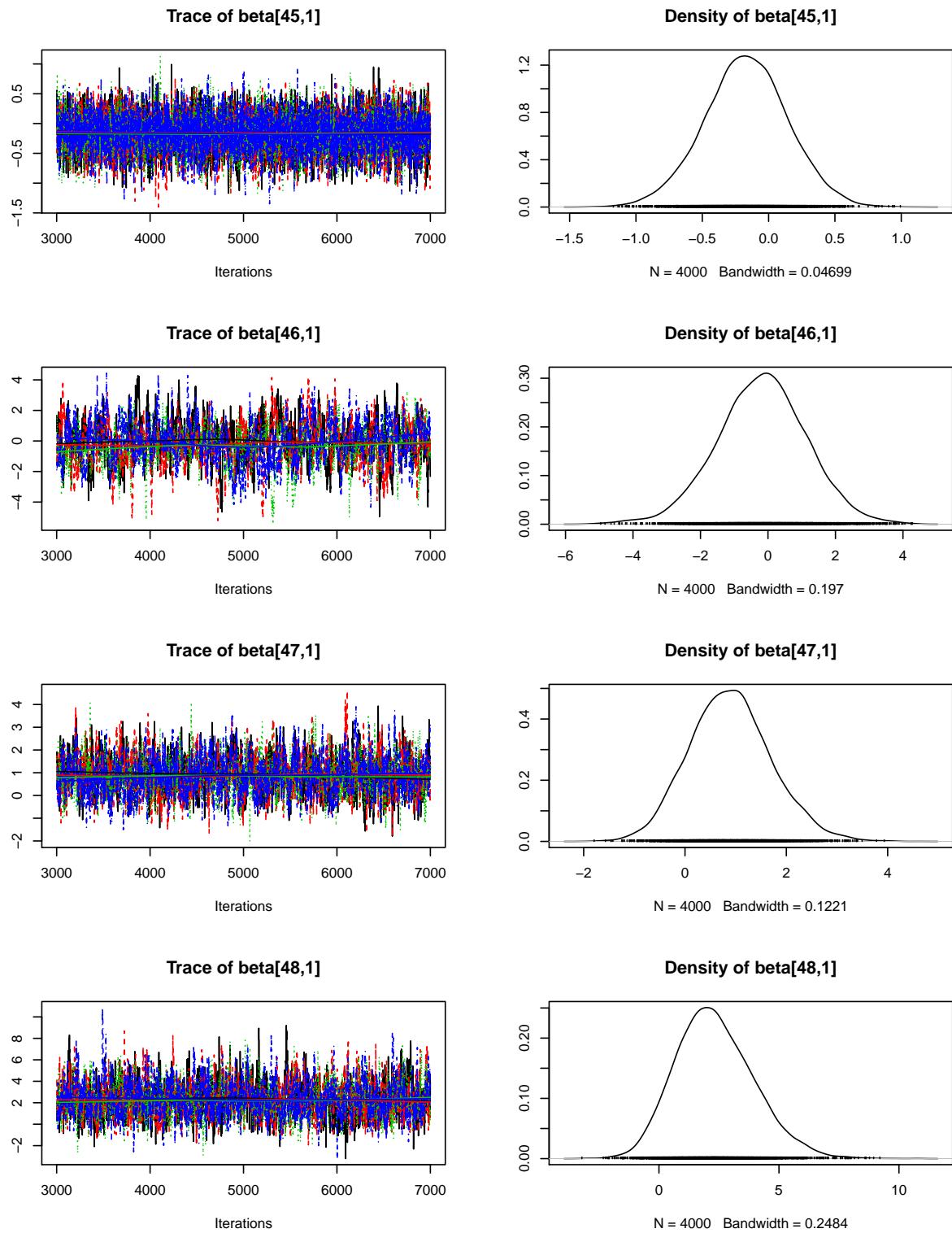


Trace of beta[44,1]

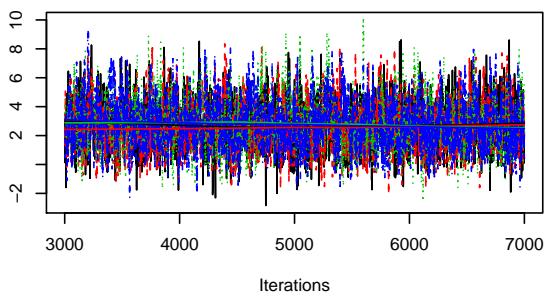


Density of beta[44,1]

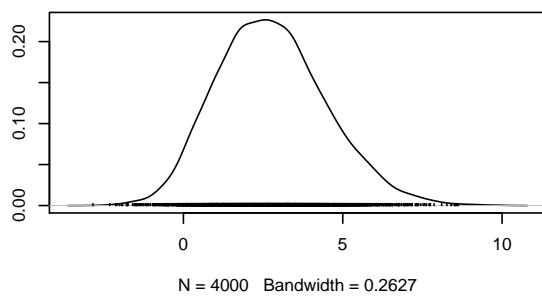




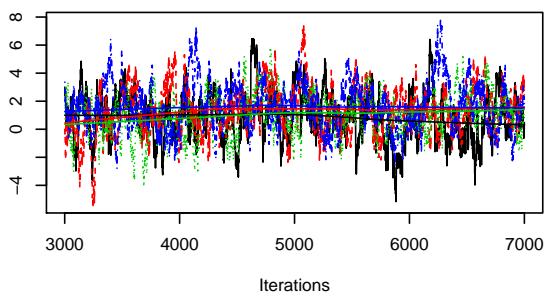
Trace of beta[49,1]



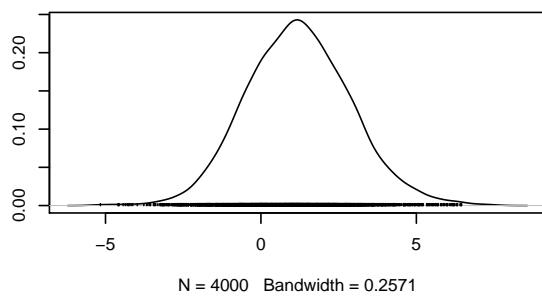
Density of beta[49,1]



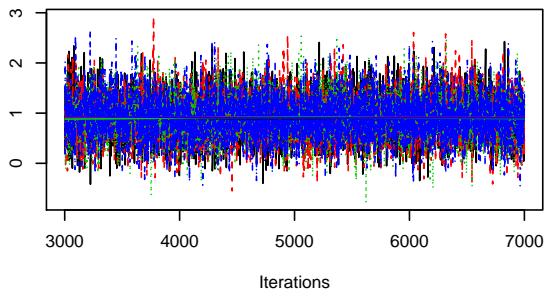
Trace of beta[50,1]



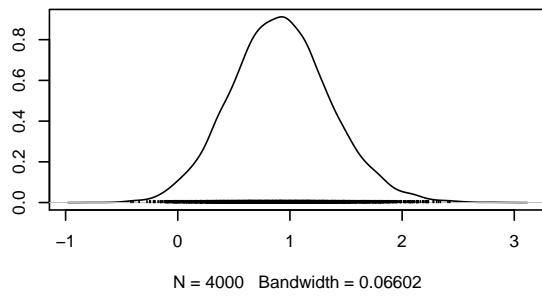
Density of beta[50,1]



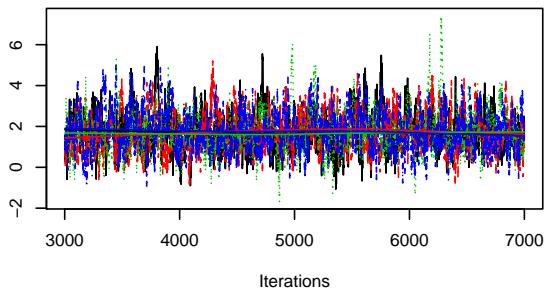
Trace of beta[51,1]



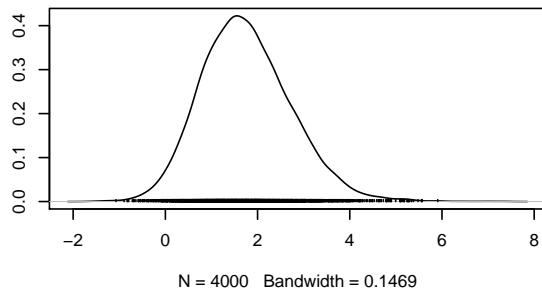
Density of beta[51,1]

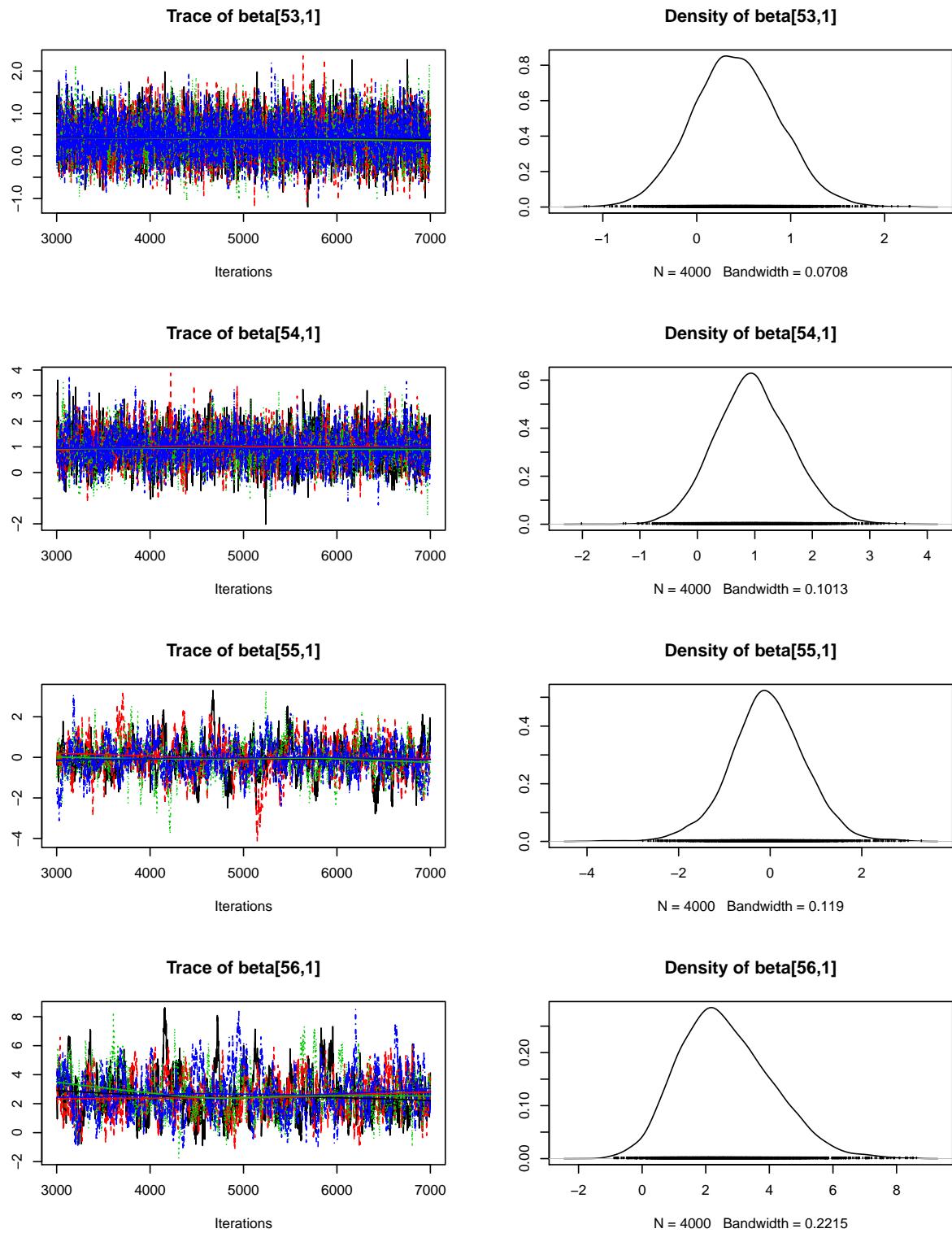


Trace of beta[52,1]

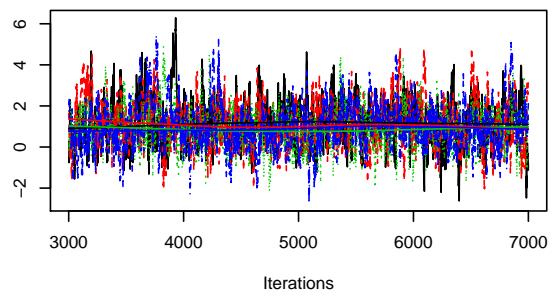


Density of beta[52,1]

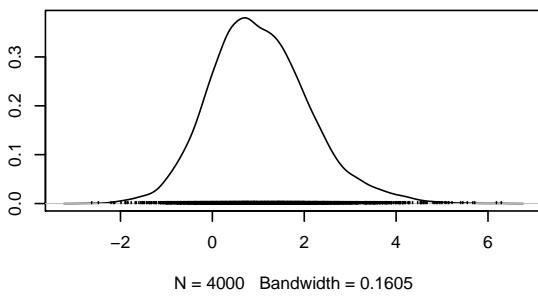




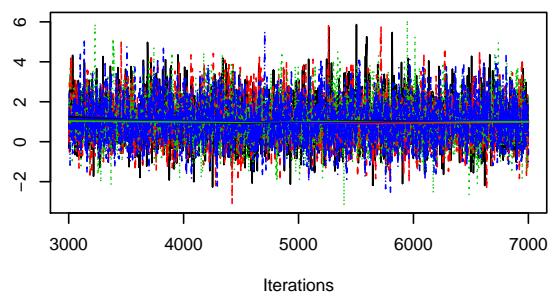
Trace of beta[57,1]



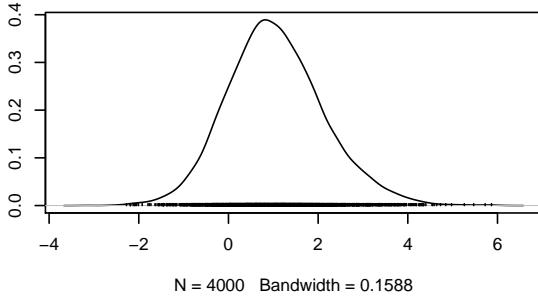
Density of beta[57,1]



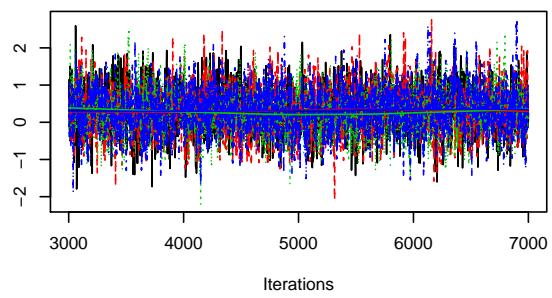
Trace of beta[58,1]



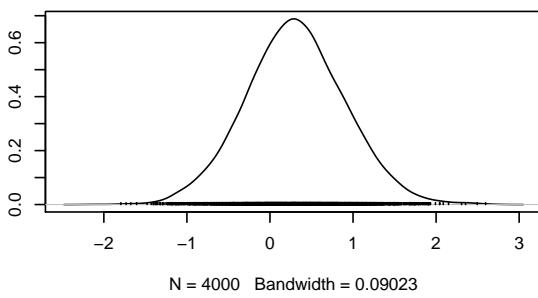
Density of beta[58,1]



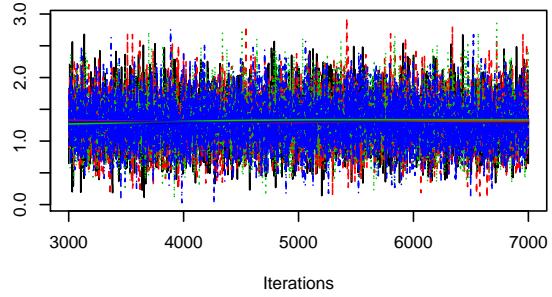
Trace of beta[59,1]



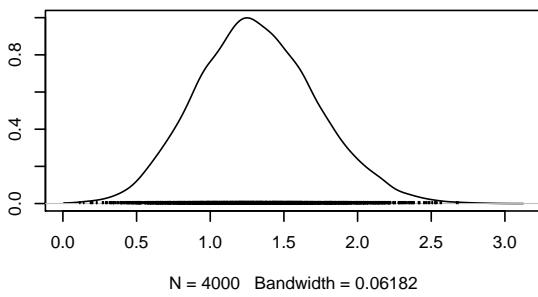
Density of beta[59,1]



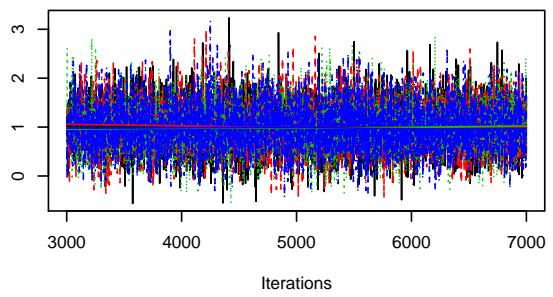
Trace of beta[60,1]



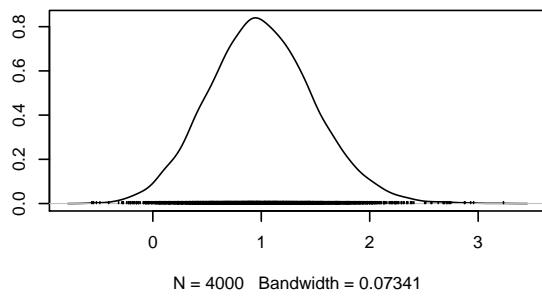
Density of beta[60,1]



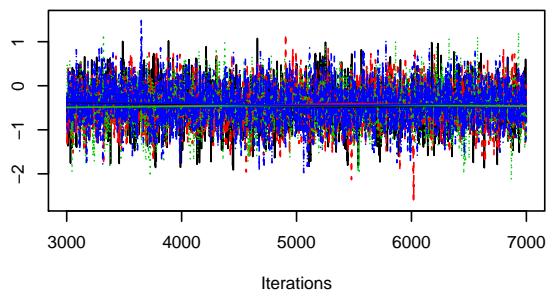
Trace of beta[61,1]



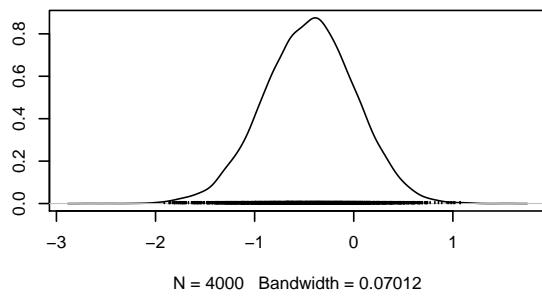
Density of beta[61,1]



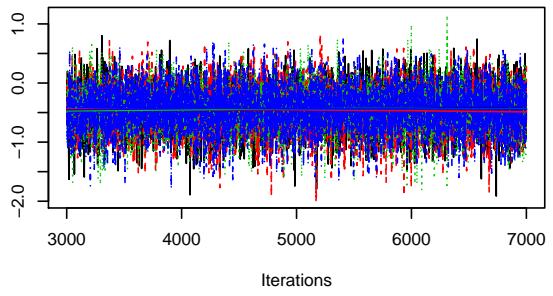
Trace of beta[62,1]



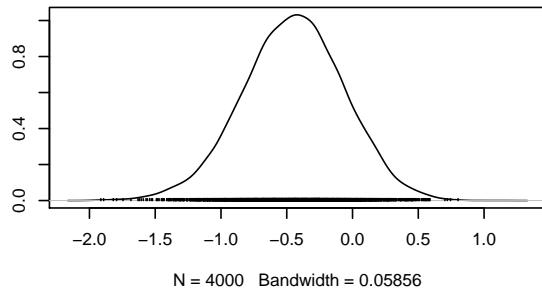
Density of beta[62,1]



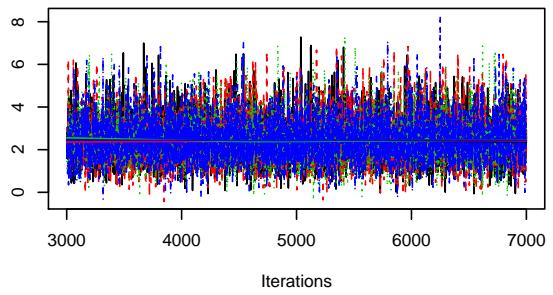
Trace of beta[63,1]



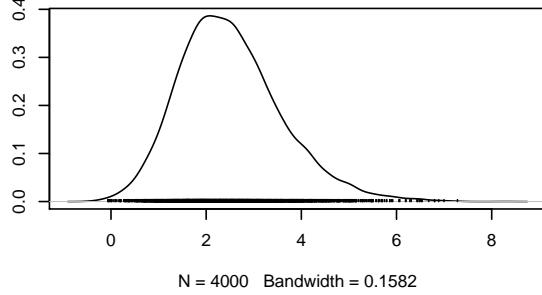
Density of beta[63,1]



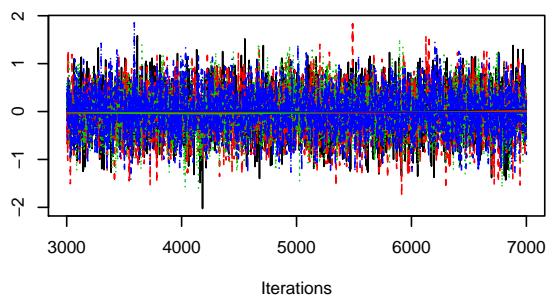
Trace of beta[64,1]



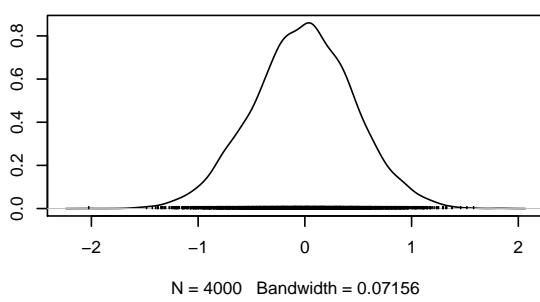
Density of beta[64,1]



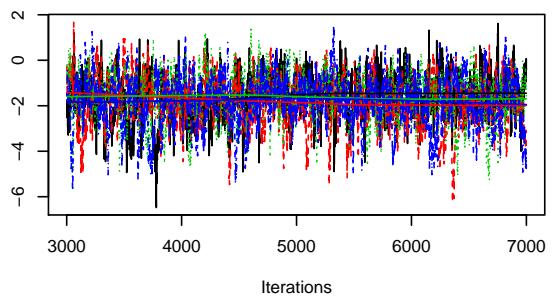
Trace of beta[65,1]



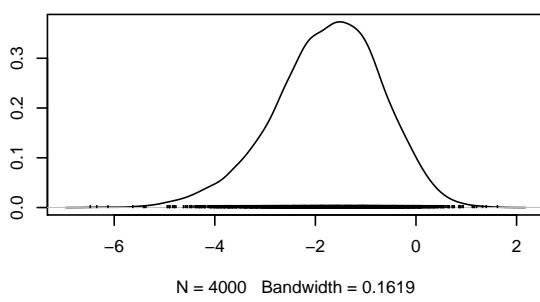
Density of beta[65,1]



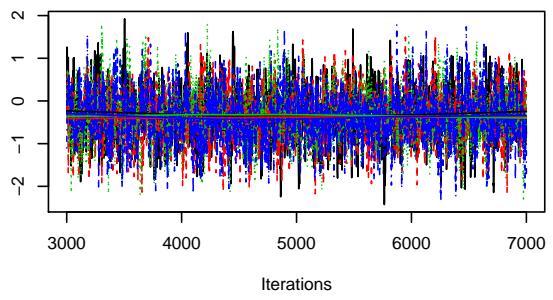
Trace of beta[1,2]



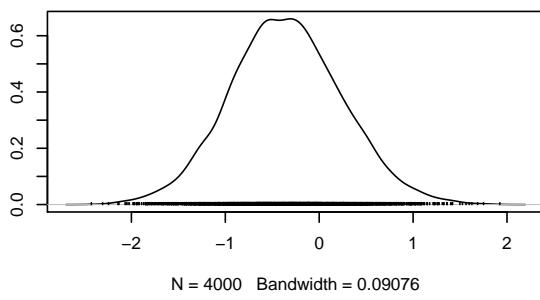
Density of beta[1,2]



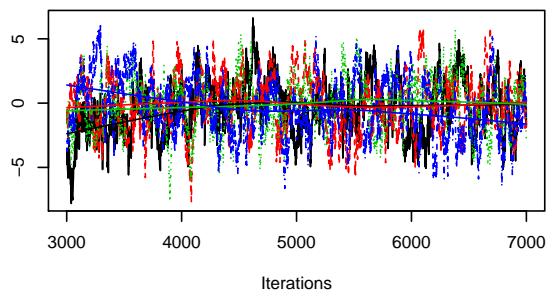
Trace of beta[2,2]



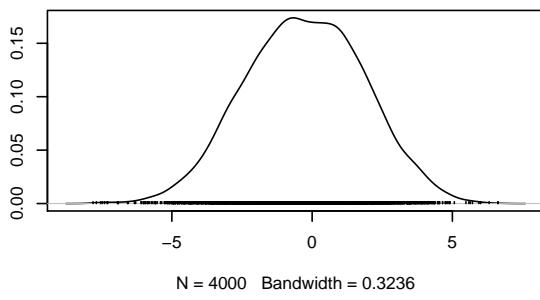
Density of beta[2,2]



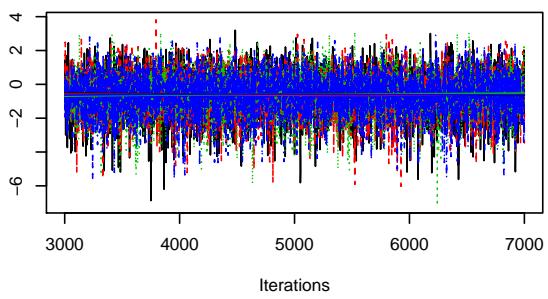
Trace of beta[3,2]



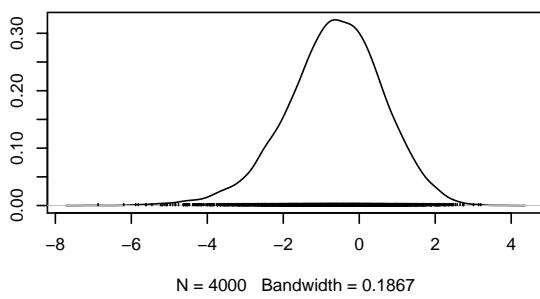
Density of beta[3,2]



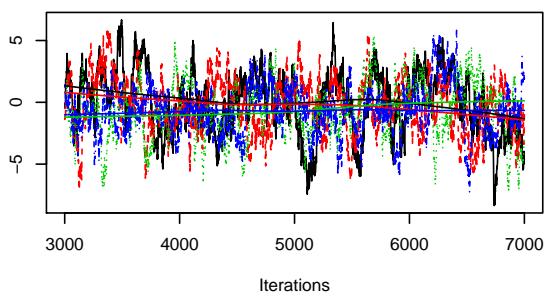
Trace of beta[4,2]



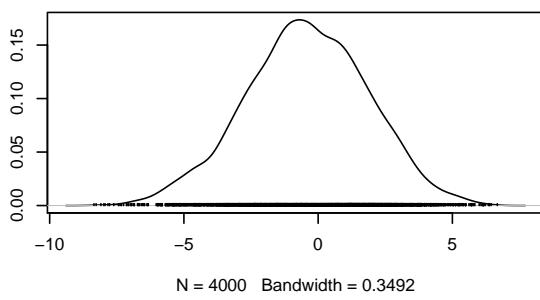
Density of beta[4,2]



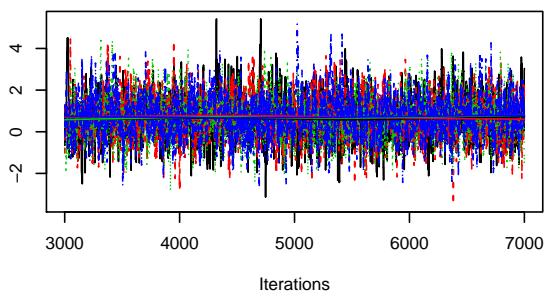
Trace of beta[5,2]



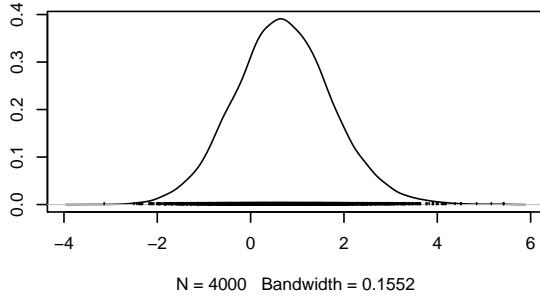
Density of beta[5,2]



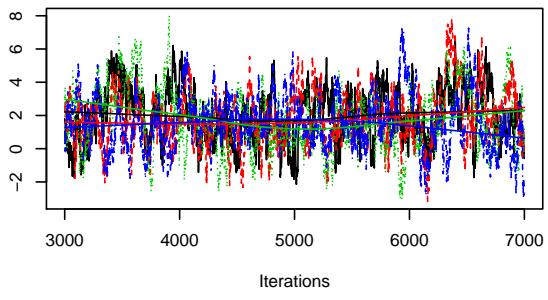
Trace of beta[6,2]



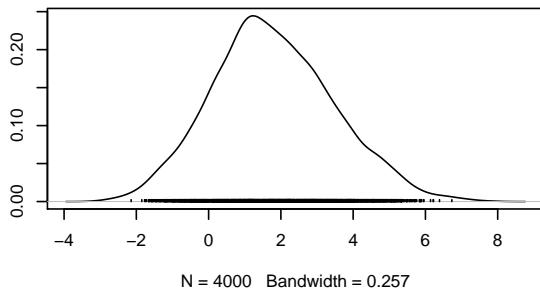
Density of beta[6,2]



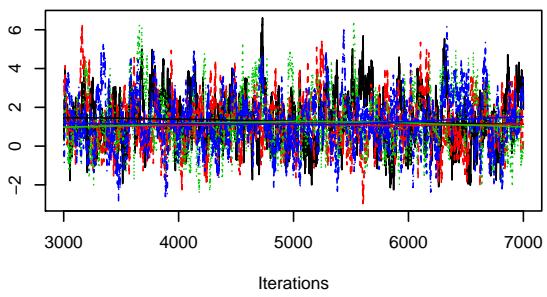
Trace of beta[7,2]



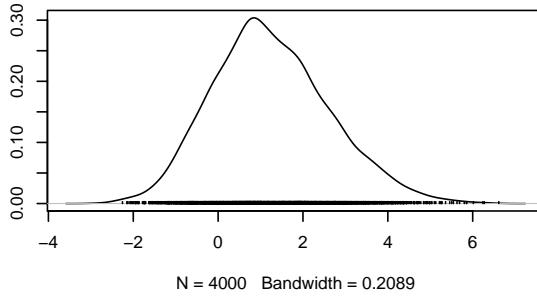
Density of beta[7,2]



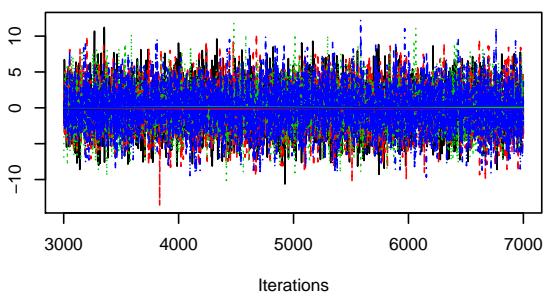
Trace of beta[8,2]



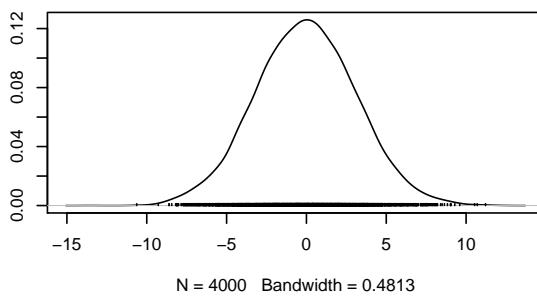
Density of beta[8,2]



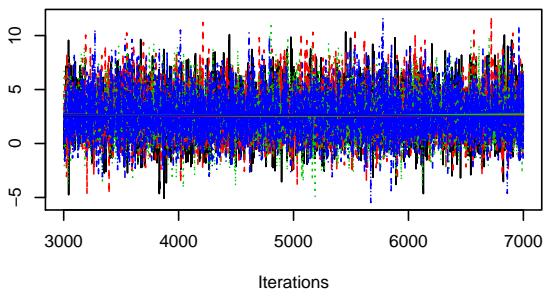
Trace of beta[9,2]



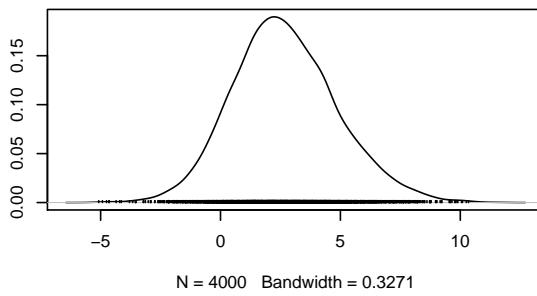
Density of beta[9,2]



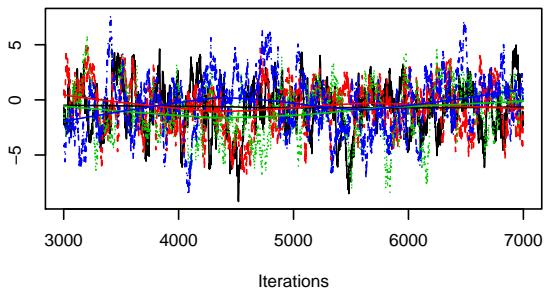
Trace of beta[10,2]



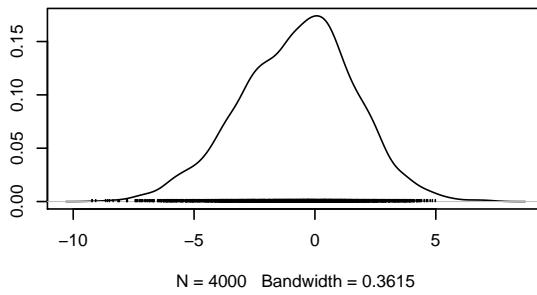
Density of beta[10,2]



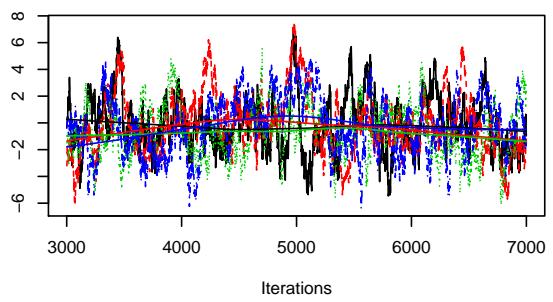
Trace of beta[11,2]



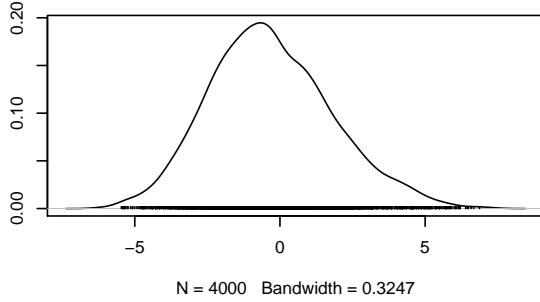
Density of beta[11,2]



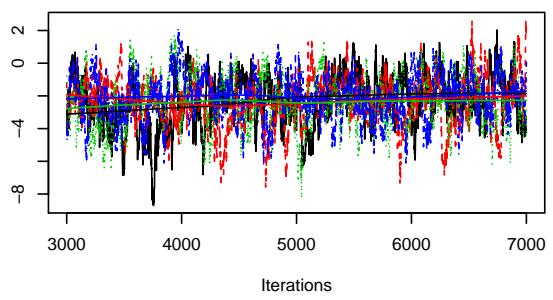
Trace of beta[12,2]



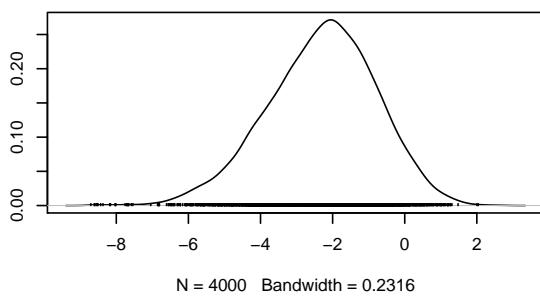
Density of beta[12,2]



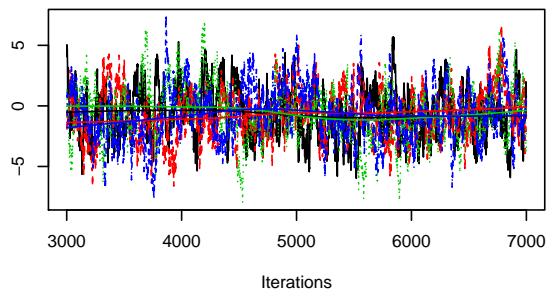
Trace of beta[13,2]



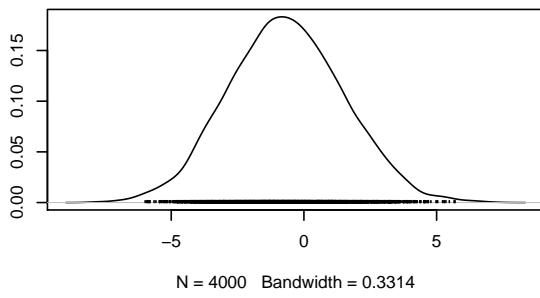
Density of beta[13,2]



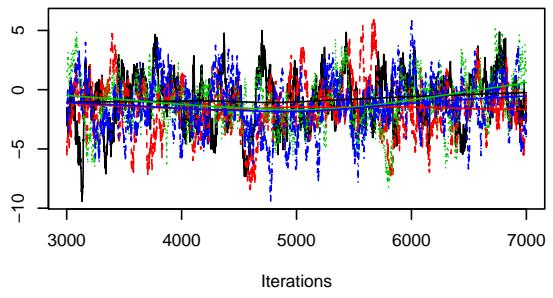
Trace of beta[14,2]



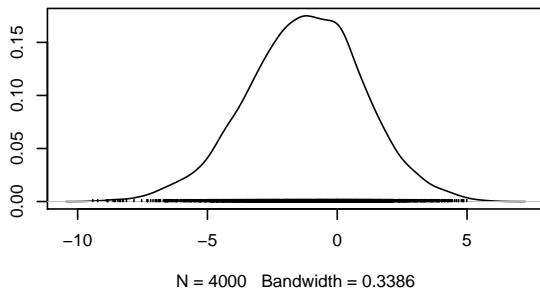
Density of beta[14,2]



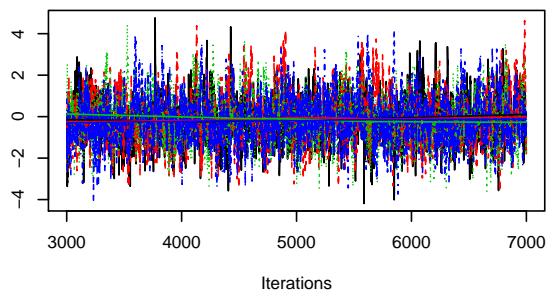
Trace of beta[15,2]



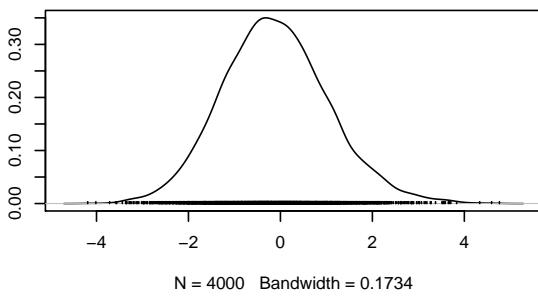
Density of beta[15,2]



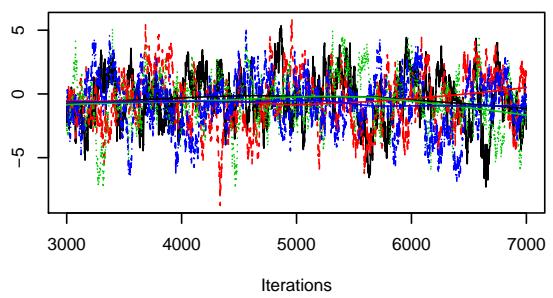
Trace of beta[16,2]



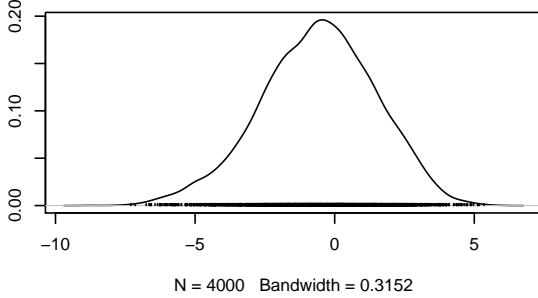
Density of beta[16,2]



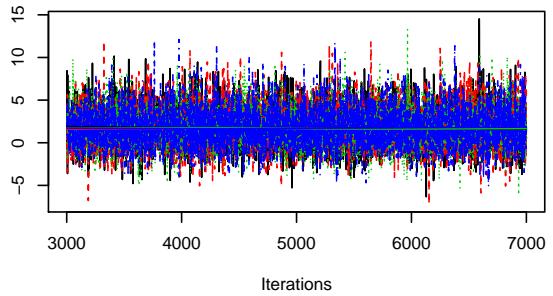
Trace of beta[17,2]



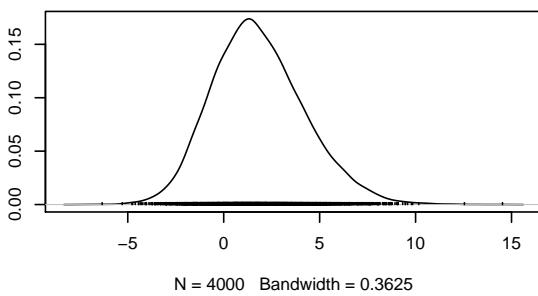
Density of beta[17,2]



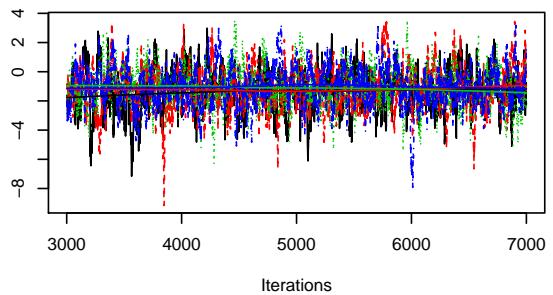
Trace of beta[18,2]



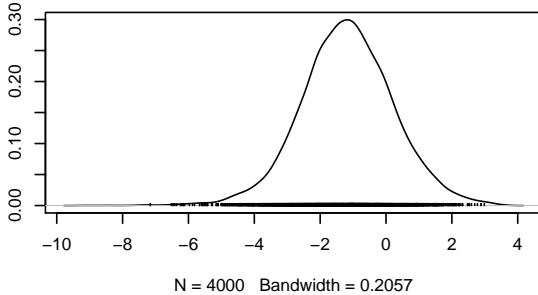
Density of beta[18,2]



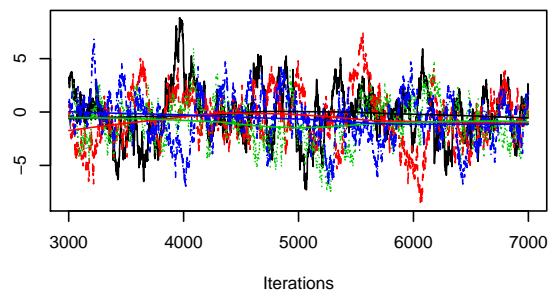
Trace of beta[19,2]



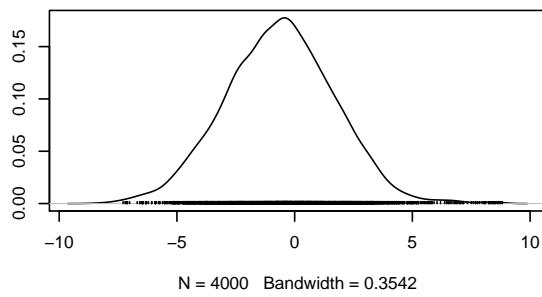
Density of beta[19,2]



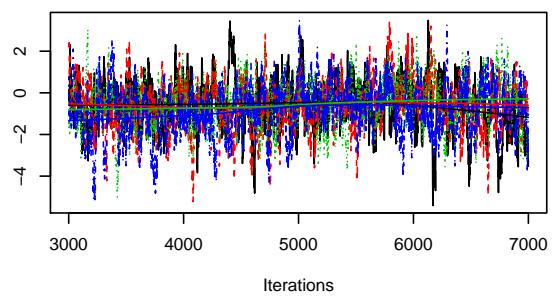
Trace of beta[20,2]



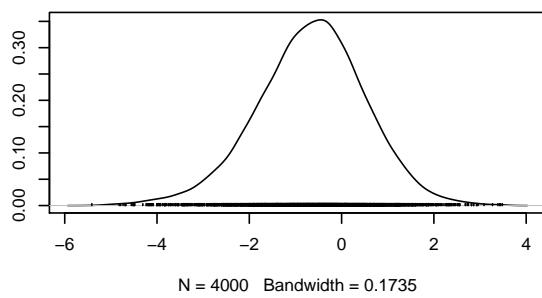
Density of beta[20,2]



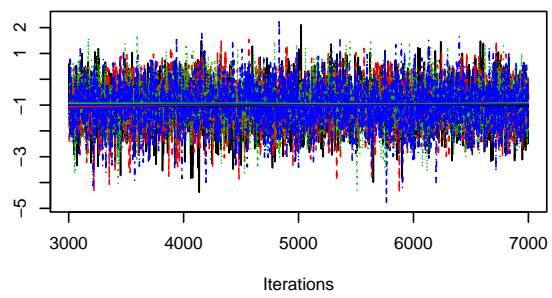
Trace of beta[21,2]



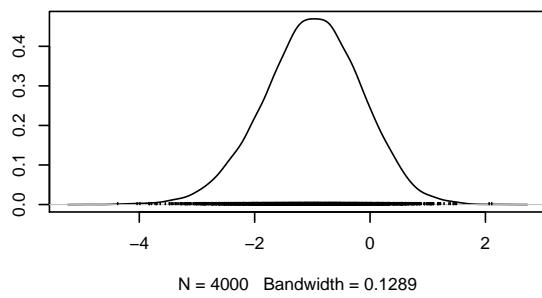
Density of beta[21,2]



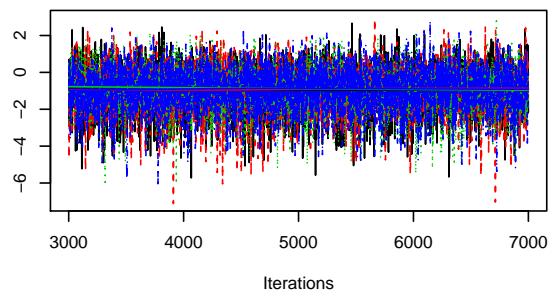
Trace of beta[22,2]



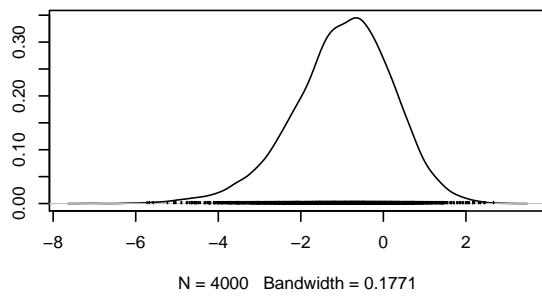
Density of beta[22,2]



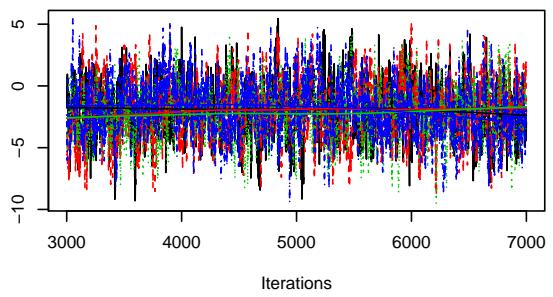
Trace of beta[23,2]



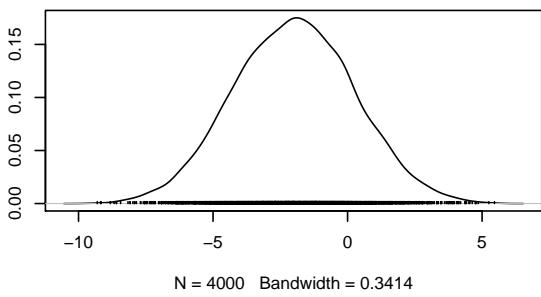
Density of beta[23,2]



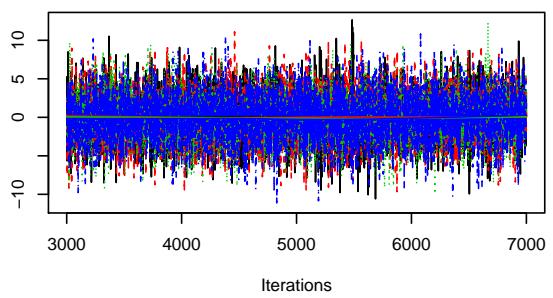
Trace of beta[24,2]



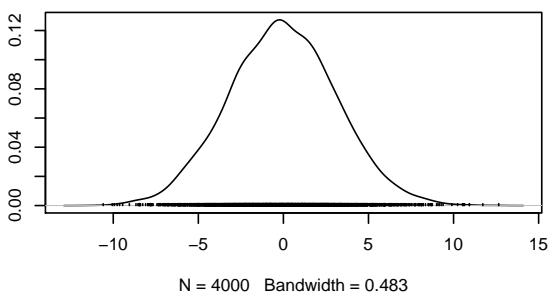
Density of beta[24,2]



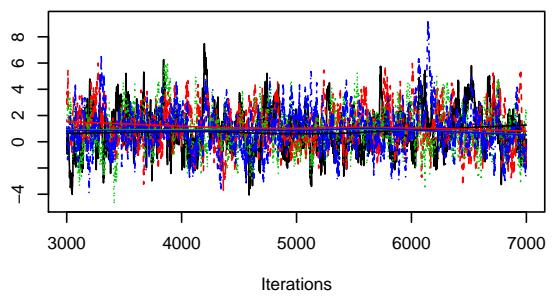
Trace of beta[25,2]



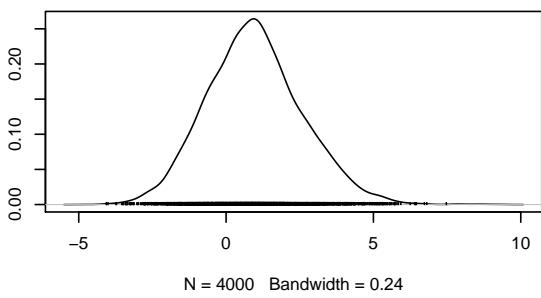
Density of beta[25,2]



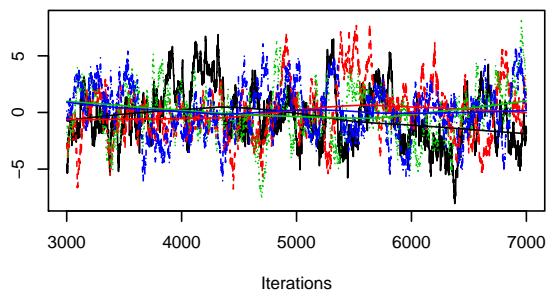
Trace of beta[26,2]



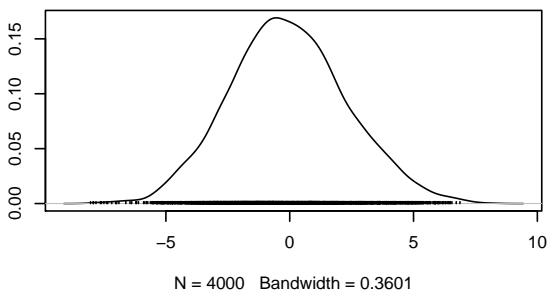
Density of beta[26,2]



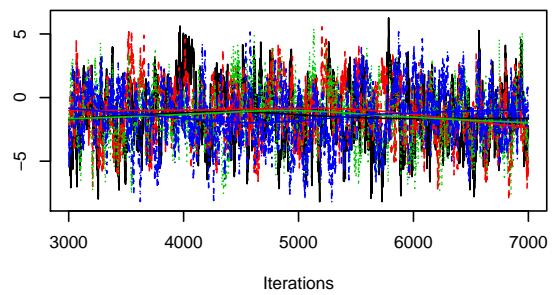
Trace of beta[27,2]



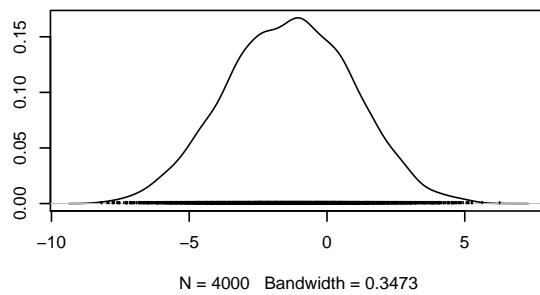
Density of beta[27,2]



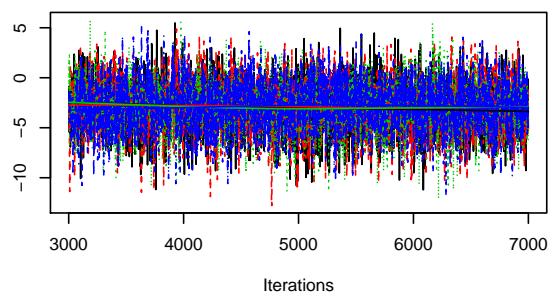
Trace of beta[28,2]



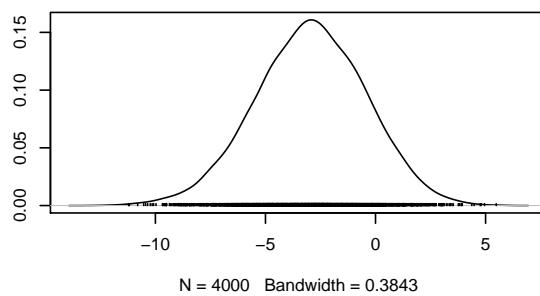
Density of beta[28,2]



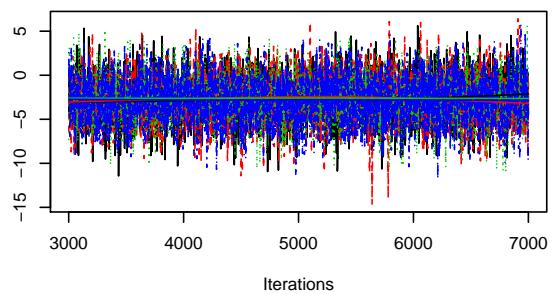
Trace of beta[29,2]



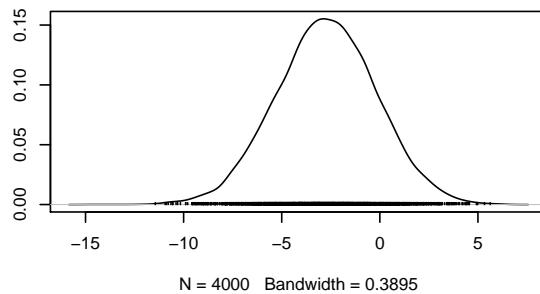
Density of beta[29,2]



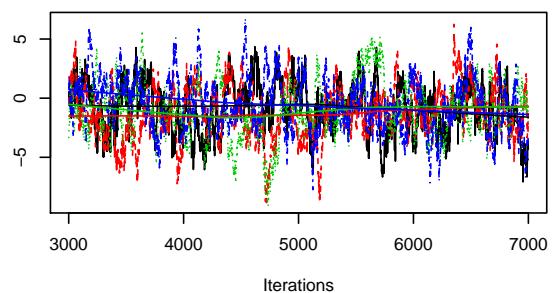
Trace of beta[30,2]



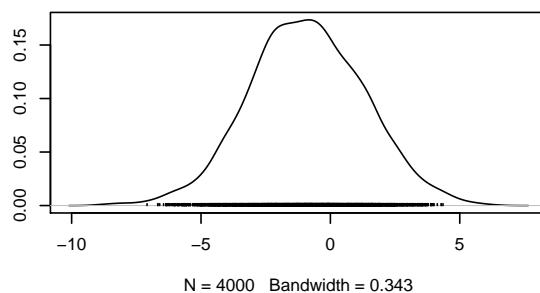
Density of beta[30,2]



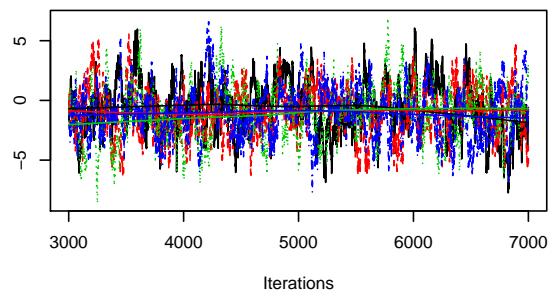
Trace of beta[31,2]



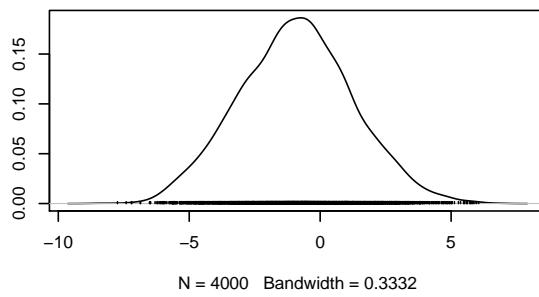
Density of beta[31,2]



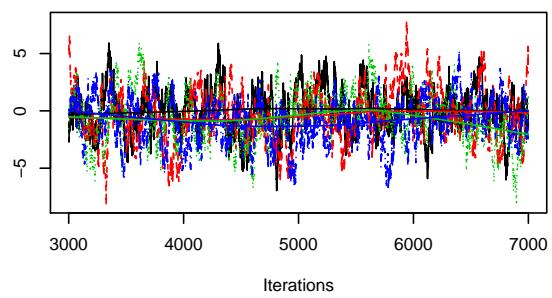
Trace of beta[32,2]



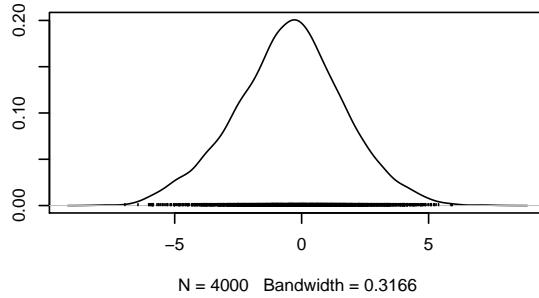
Density of beta[32,2]



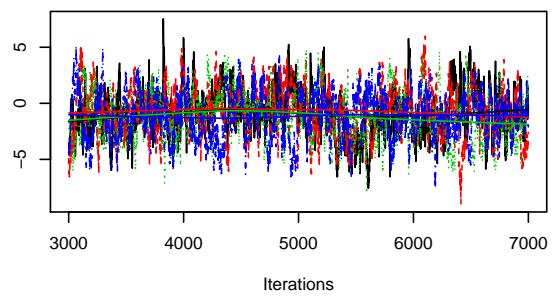
Trace of beta[33,2]



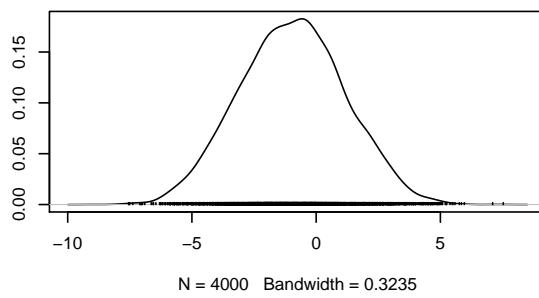
Density of beta[33,2]



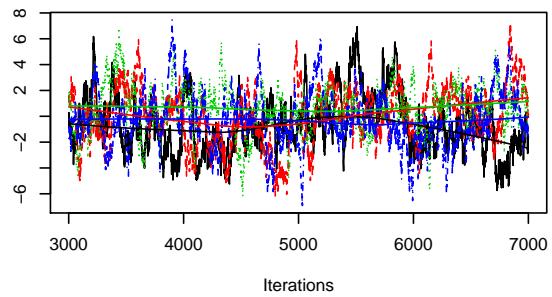
Trace of beta[34,2]



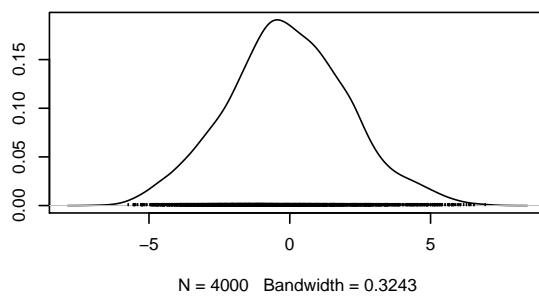
Density of beta[34,2]



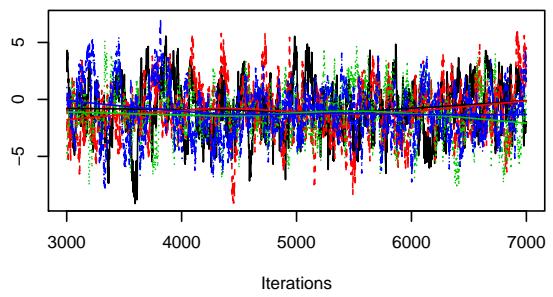
Trace of beta[35,2]



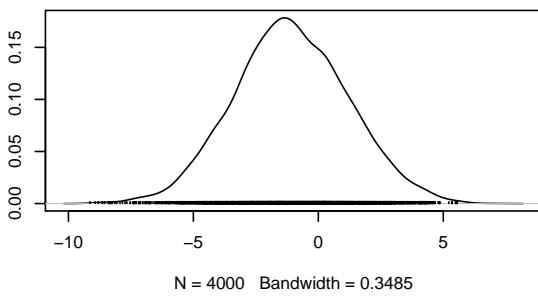
Density of beta[35,2]



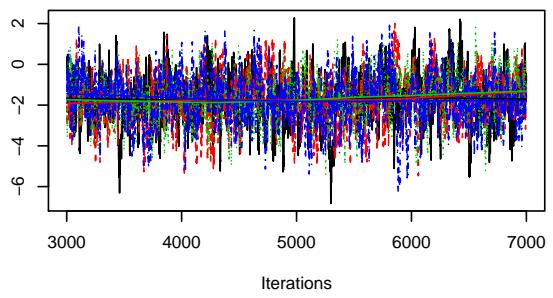
Trace of beta[36,2]



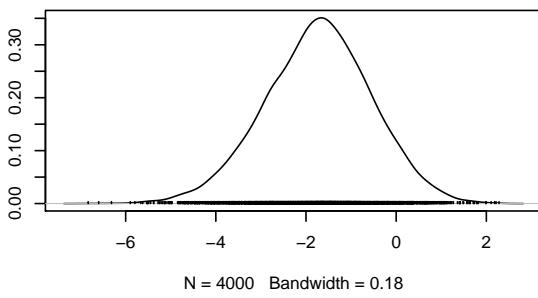
Density of beta[36,2]



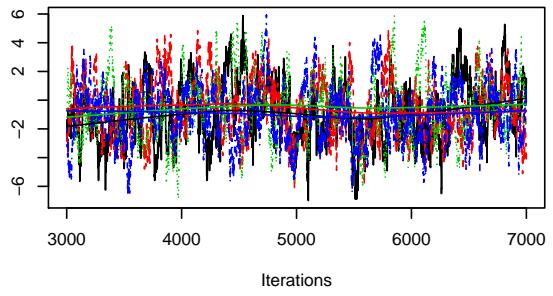
Trace of beta[37,2]



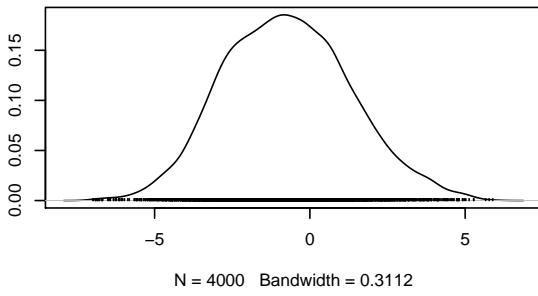
Density of beta[37,2]



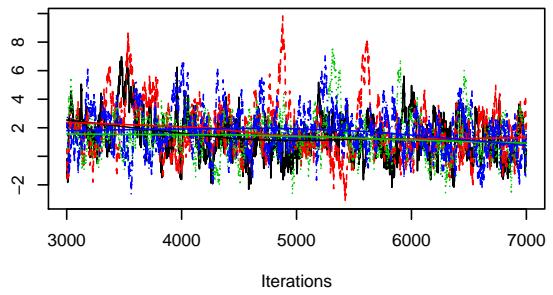
Trace of beta[38,2]



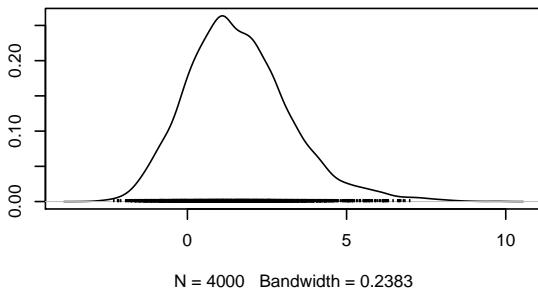
Density of beta[38,2]



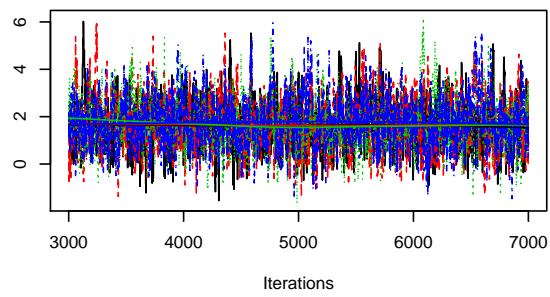
Trace of beta[39,2]



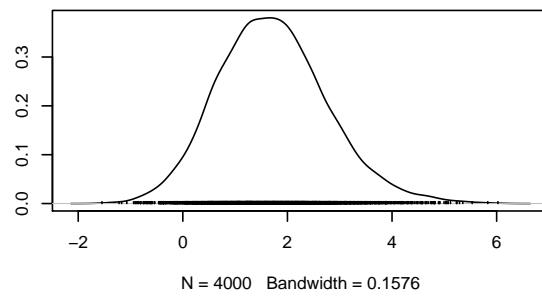
Density of beta[39,2]



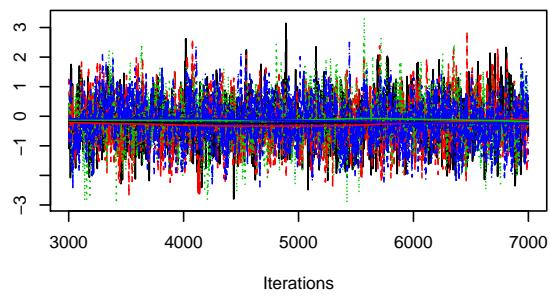
Trace of beta[40,2]



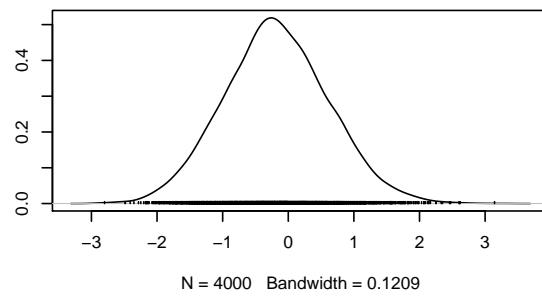
Density of beta[40,2]



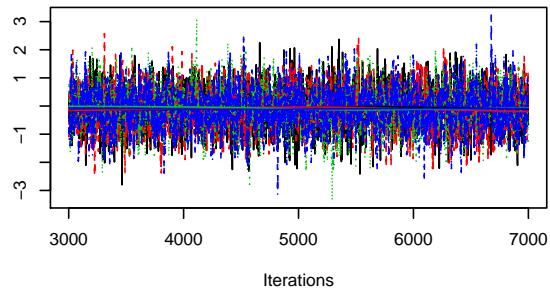
Trace of beta[41,2]



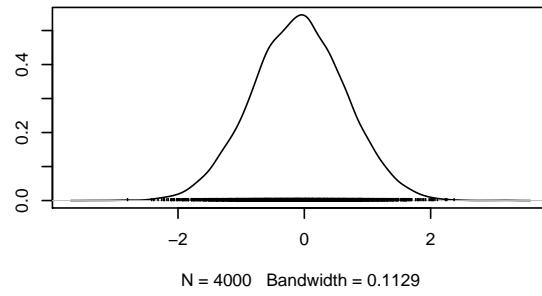
Density of beta[41,2]



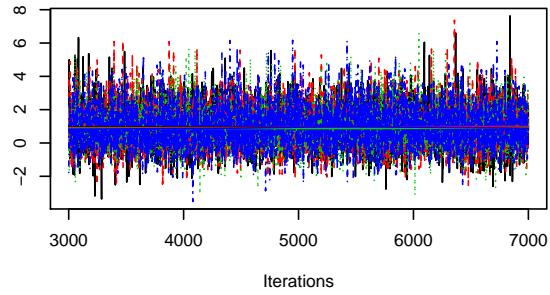
Trace of beta[42,2]



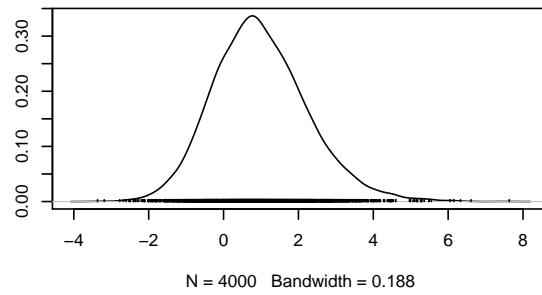
Density of beta[42,2]



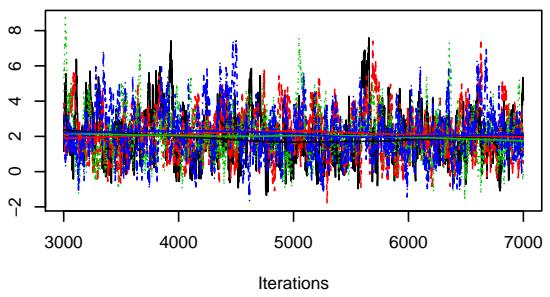
Trace of beta[43,2]



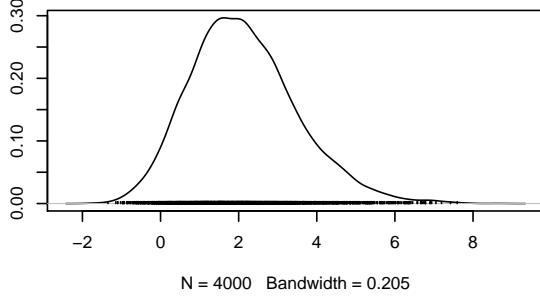
Density of beta[43,2]



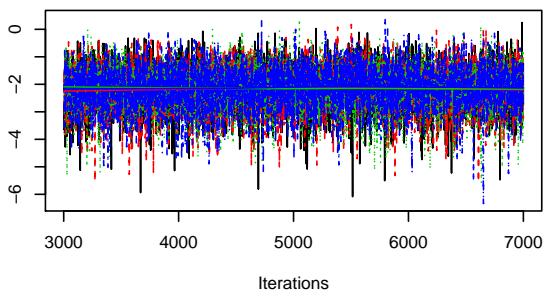
Trace of beta[44,2]



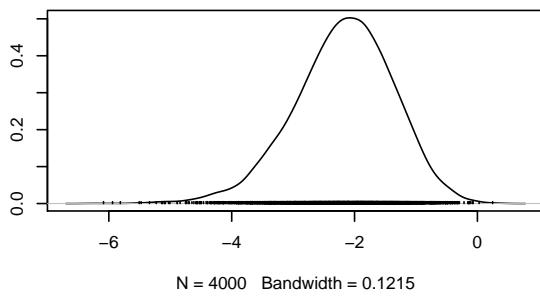
Density of beta[44,2]



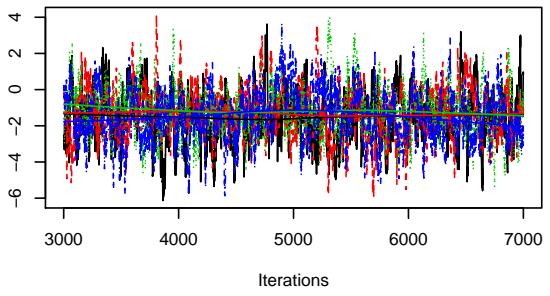
Trace of beta[45,2]



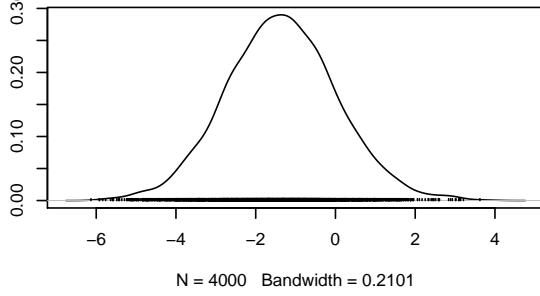
Density of beta[45,2]



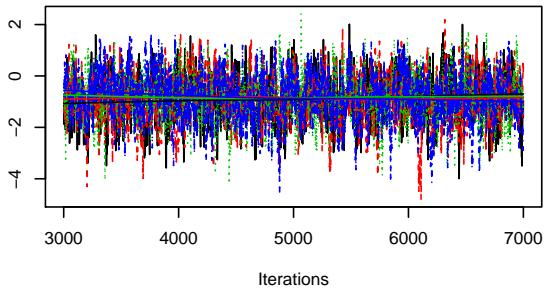
Trace of beta[46,2]



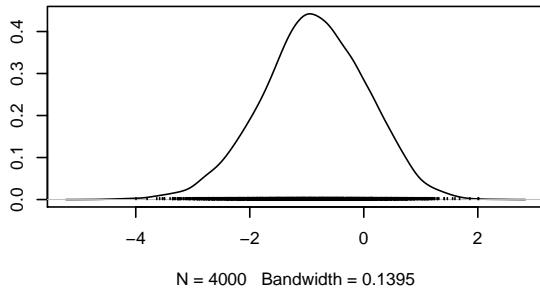
Density of beta[46,2]



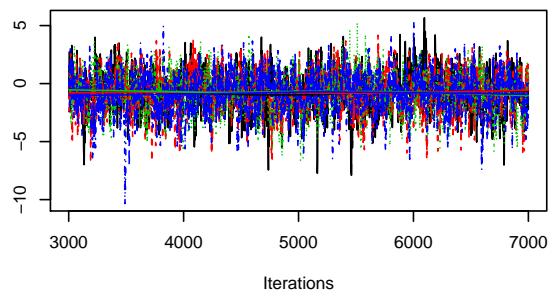
Trace of beta[47,2]



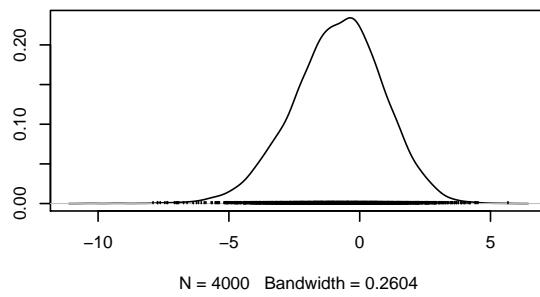
Density of beta[47,2]



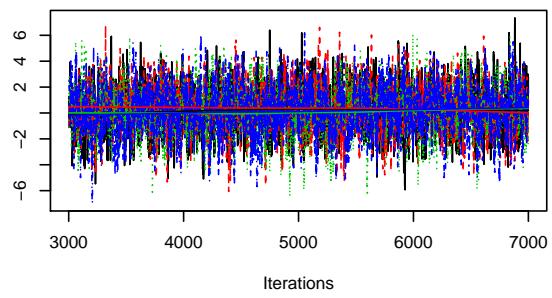
Trace of beta[48,2]



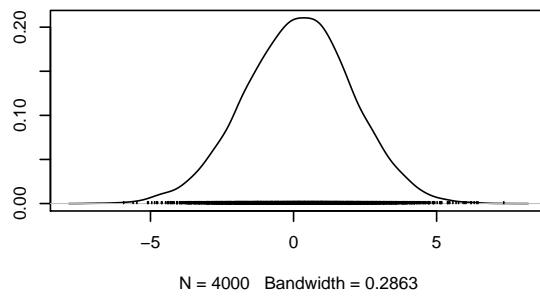
Density of beta[48,2]



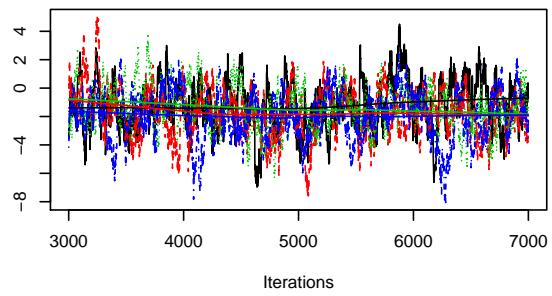
Trace of beta[49,2]



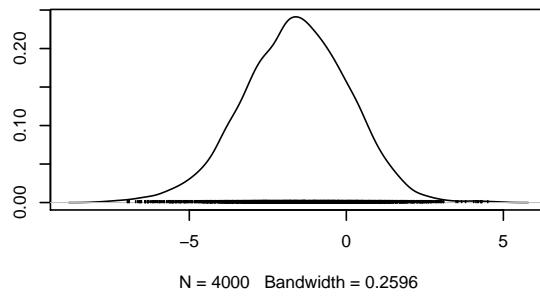
Density of beta[49,2]



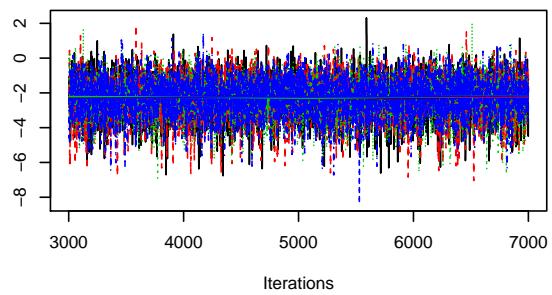
Trace of beta[50,2]



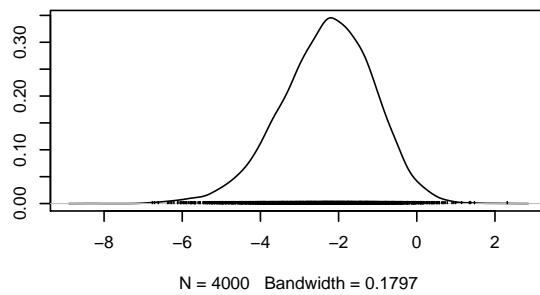
Density of beta[50,2]



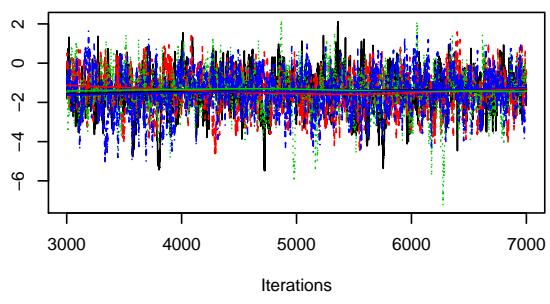
Trace of beta[51,2]



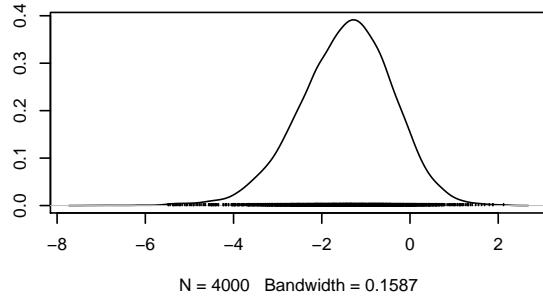
Density of beta[51,2]



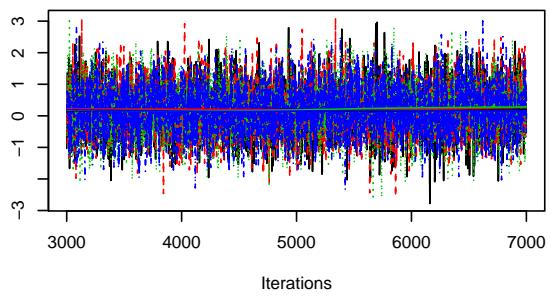
Trace of beta[52,2]



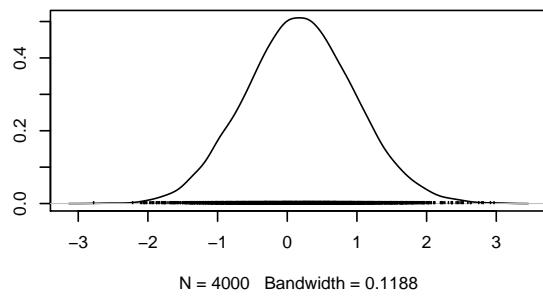
Density of beta[52,2]



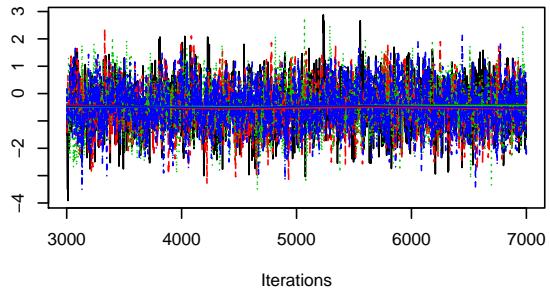
Trace of beta[53,2]



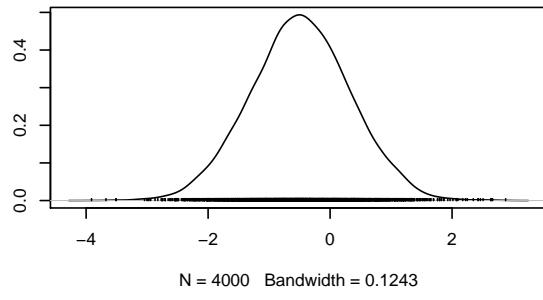
Density of beta[53,2]



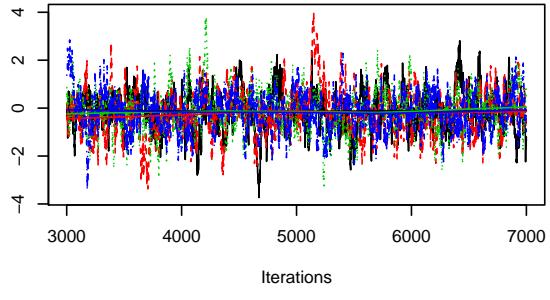
Trace of beta[54,2]



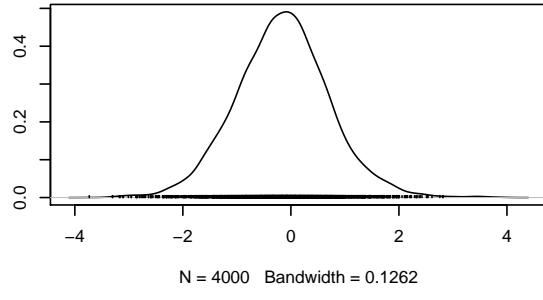
Density of beta[54,2]



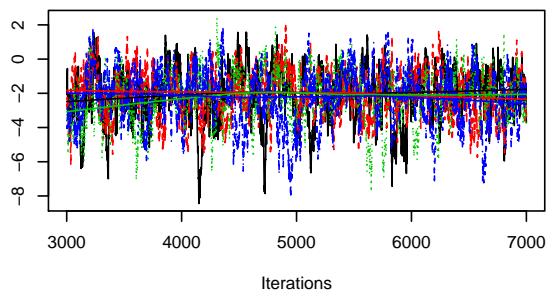
Trace of beta[55,2]



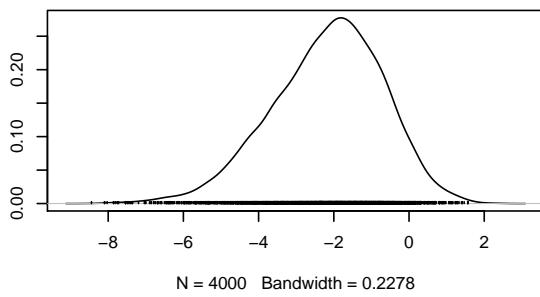
Density of beta[55,2]



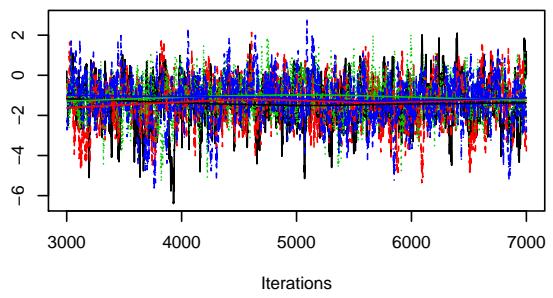
Trace of beta[56,2]



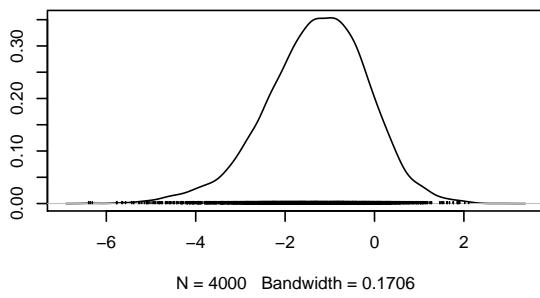
Density of beta[56,2]



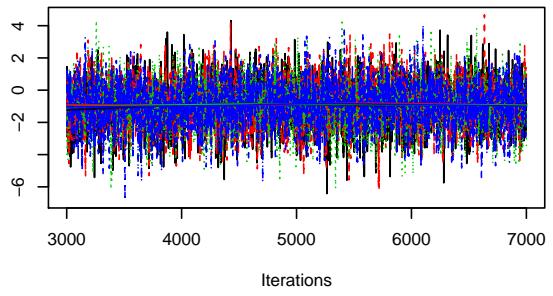
Trace of beta[57,2]



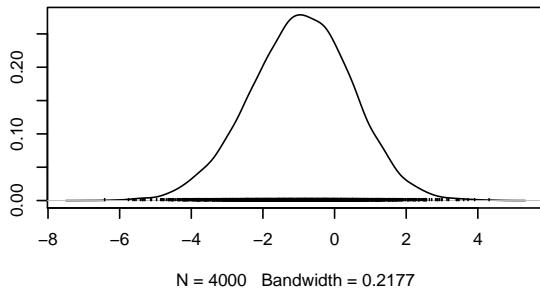
Density of beta[57,2]



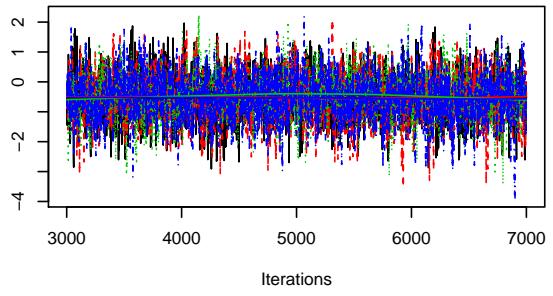
Trace of beta[58,2]



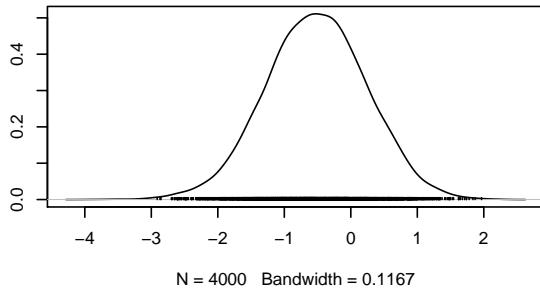
Density of beta[58,2]

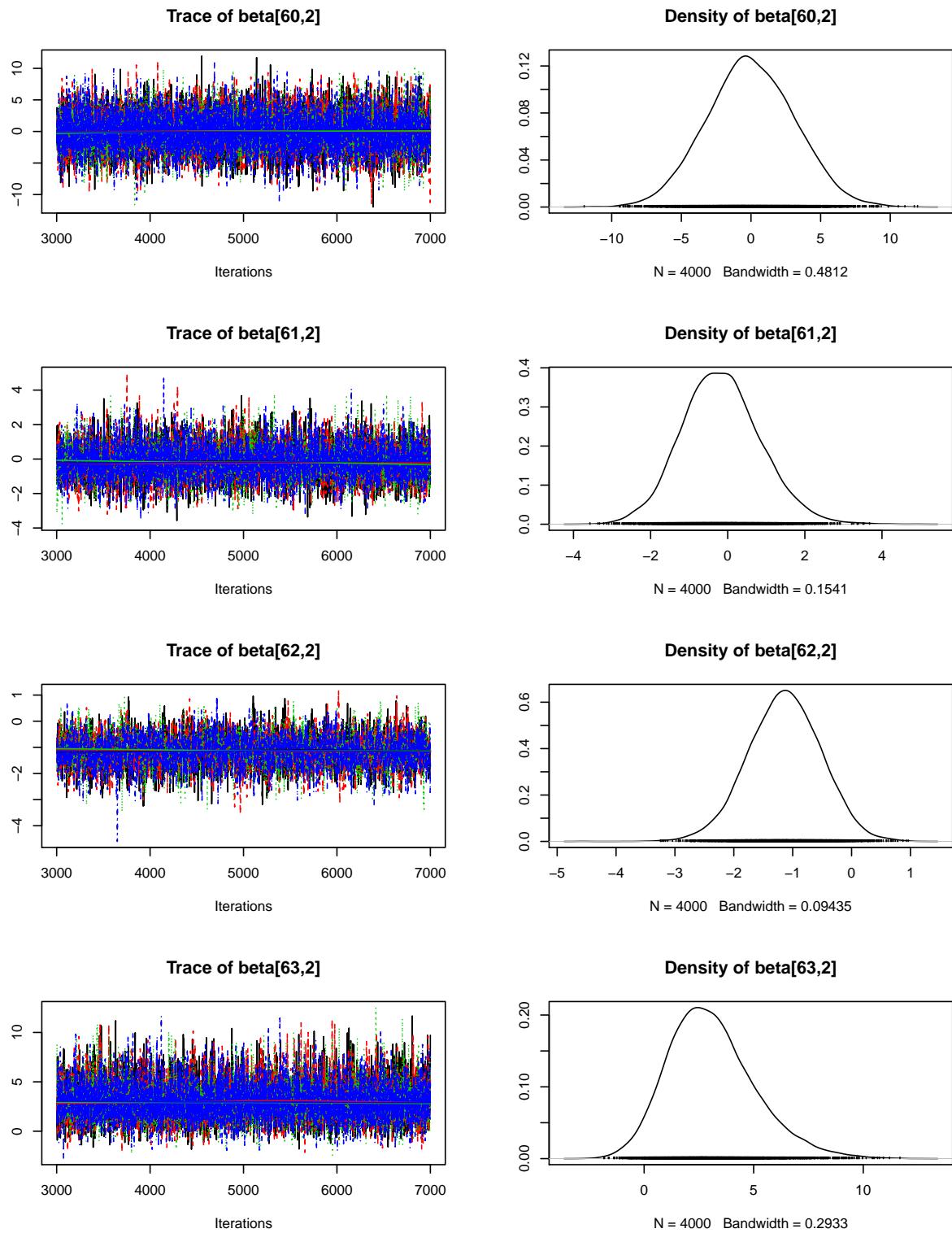


Trace of beta[59,2]

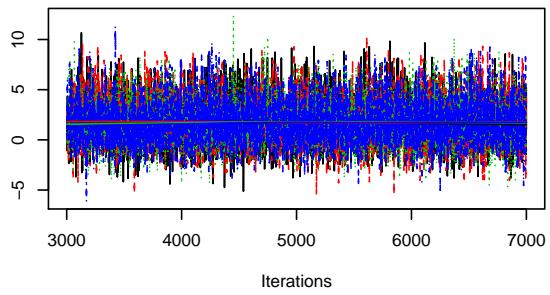


Density of beta[59,2]

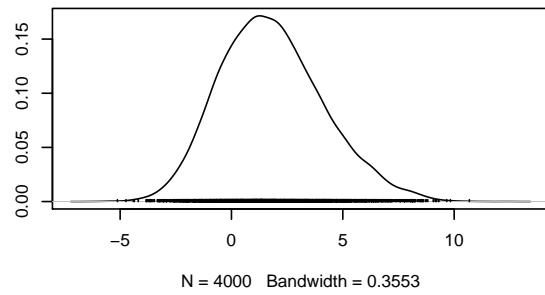




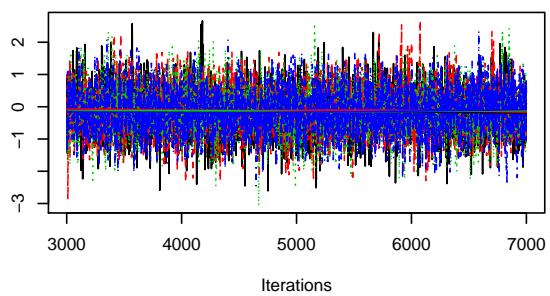
Trace of beta[64,2]



Density of beta[64,2]



Trace of beta[65,2]



Density of beta[65,2]

