require(jagsUI)

require(loo)

setwd("C:/R files BHMRA")

attach("DS\_9\_13.Rdata")

**cat("**model { for (t in 1:T) {D[t] <- exp(h[1,t]+h[2,t])\*(1-rho.e\*rho.e)

y.Prec[t,1,1] <- exp(h[2,t])/D[t]

y.Prec[t,2,2] <- exp(h[1,t])/D[t];

y.Prec[t,1,2] <- -rho.e\*exp(0.5\*h[1,t]+0.5\*h[2,t])/D[t];

y.Prec[t,2,1] <- y.Prec[t,1,2];

# multivariate normal log-likelihood

LL[t] <- -P\*log(2\*pi)/2 +

logdet(y.Prec[t,1:2,1:2])/2 - t(y[t,] - y.mu[]) %\*% y.Prec[t,,] %\*% (y[t,] - y.mu[])/2

y[t,1:2] ~ dmnorm(y.mu[],y.Prec[t,,])

y.rep[t,1:2] ~ dmnorm(y.mu[],y.Prec[t,,])

# predictive fit measure

for (k in 1:P) {g[t,k] <- pow(y[t,k]-y.rep[t,k],2)}}

G <- sum(g[,])

for (p in 1:P) { h.star[1,p] ~ dnorm(mu[p],1)

for (t in 2:T) { h.star[t,p] ~ dnorm(h.mu[t,p],1)

h.mu[t,p] <- mu[p] + phi[p]\*(h.star[t-1,p]-mu[p]) }}

# log volatilities h[p,t]

for (t in 1:T) {h[1,t] <- sig.u[1]\*h.star[t,1];

h[2,t] <- sig.u[2]\*rho.u\*h.star[t,1]+

sig.u[2]\*sqrt(1-rho.u\*rho.u)\*h.star[t,2] }

# priors

for (p in 1:P) {inv.sig2.u[p] ~ dexp(1);

sig.u[p] <- 1/sqrt(inv.sig2.u[p])

phi.star[p] ~ dbeta(19,1)

phi[p] <- 2\*phi.star[p] -1

mu[p] ~ dnorm(0,1)}

rho.e ~ dunif(-1,1)

rho.u ~ dunif(0,1)}

", file="model1.jag")

**# Initial Values and Estimation**

init1 <- list(phi.star=c(0.99,0.99),mu=c(0,0),inv.sig2.u=c(100,100),rho.e=0.7,rho.u=0.7)

init2 <- list(inv.sig2.u = c(3.5,3.8),mu = c(-1.1,-1.9),phi.star = c(0.91,0.98),rho.e = 0.52,rho.u = 0.99)

inits=list(init1,init2)

pars=c("h","phi","rho.e","rho.u","LL")

R = autojags(DS\_9\_13, inits, pars,model.file="model1.jag",2,iter.increment=2500, n.burnin=500, Rhat.limit=1.1, max.iter=10000, seed=1234)

R$summary

**# Fit measures**

LOO=loo(R$sims.list$LL)

**# ranked pointwise LOO-IC**

time=rep(1:252)

loopw=as.vector(LOO$pointwise[,3])

list <- data.frame(loopw,time)

head(list[order(-list$loopw),],10)

**# Plot of log volatilities**

h.samps= R$sims.list$h

means=apply(h.samps[1:5000,,],c(2,3),mean)

plot(time,means[2,],xlab="Days",ylab="Log volatility",type="l",main="Figure 9.10 Log Volatility Plot")

lines(time,means[1,], col = "grey20",lty=2)

legend(200, -1.3, legend=c(expression(paste(h[1])), expression(paste(h[2]))),col=c("black","grey20"), lty=1:2, cex=1.2)