

Website1 xxx: Winbugs Code Program

Winbugs Code Program for the small areas estimation proportion using the logistic random plus spatial intercept model

INITIAL VALUES FOR THE FOUR CHAINS

[illegible]

MODEL SPECIFICATION

```

model {
  delta ~ dflat()
  beta1 ~ dflat()
  beta2 ~ dflat()
  beta3 ~ dflat()
  tau-phi ~ dgamma(rstar, dstar)
  tau-delta ~ dgamma(rstar, dstar)
  # rstar and dstar are specified in data file as rstar=0.5 and dstar=0.0005
  phi[1:34]~ car.normal(adj[], weights[], num[], tau-phi)
  for(i in 1:34){
    delta[i] ~ dnorm(delta0, tau-delta)
  }
  for(i in 1:34){
    for (j in n[i]+1:n[i+1]) {
      logit(pi[j])<- delta[i] + phi[i] + beta1*x1[j] + beta2*x2[j] + beta3*x3[j]

```

```

y[j] ~ dbin(pi[j],1);
    }
}

# n[i + 1] - n[i] = ni -

# SMALL AREA ESTIMATION PROCEDURE
for(i in 1:34){
  for(j in nf[i]+1:nf[i+1]) {
    pif[j] <- - (exp(delta[i] + phi[i] + beta1*xf1[j] + beta2*xf2[j]
+ beta3*xf3[j] ))/ (1+exp(delta[i] + phi[i]+ beta1*xf1[j] +
beta2*xf2[j] + beta3*xf3[j] ));
    yf[j] ~ dbin(pif[j],1);
  }
}

# pif, yf are, respectively, the predicted values of  $\pi_{ij}$ ,  $y_{ij}$ ,  $\forall(ij) \notin \mathbf{s}$ ,
 $xfk[j] = x_{ij} \forall(ij) \notin \mathbf{s}, k = 1, 2, 3$ , and  $nf[i + 1] - nf[i] = N_i - n_i$ 

for(i in 1:34){
  theta[i] <- - (sya[i] + sum(yf[nf[i]+1:nf[i+1]]))/N[i];
}

# sya[i] =  $\sum_{j \in s_i} y_{ij}$ 

# MODEL CHOICE MEASUREMENT:G(l)
for(i in 1:34){
  diff[i] <- - theta[i]- sya[i]/(n[i+1]-n[i])
  G[I] <- - inprod(diff[], diff[])
  Gl <- - sum(G[])
}

# The penalty for model complexity P(l) is calculated outside the Win-
bugs program using the posterior variances output

```

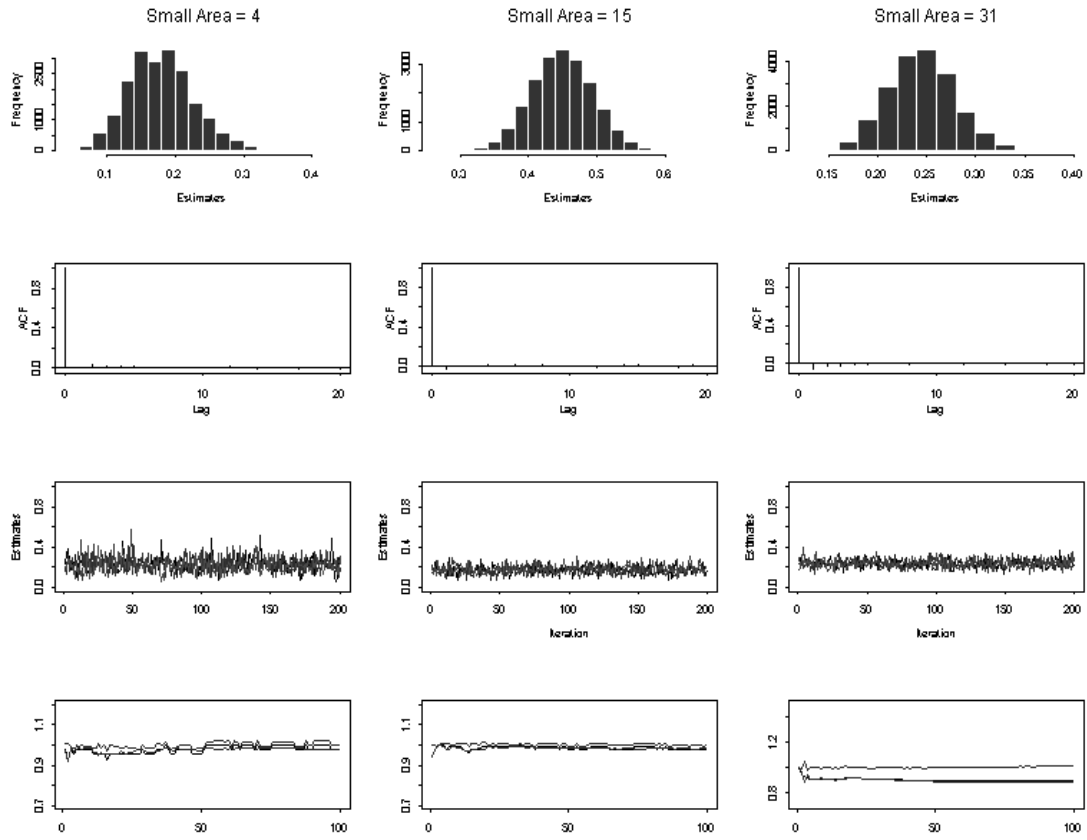


Figure 1: *Posterior distribution of the small area proportion (θ_i), the autocorrelation function, the trace of the MCMC chains, Gelman and Brooks(1998) convergence plot for three selected small areas, obtained by the random plus spatial intercept model.*

Website2 xxx: Diagnostic graphics

Figure 2: Posterior distributions of the small area proportion

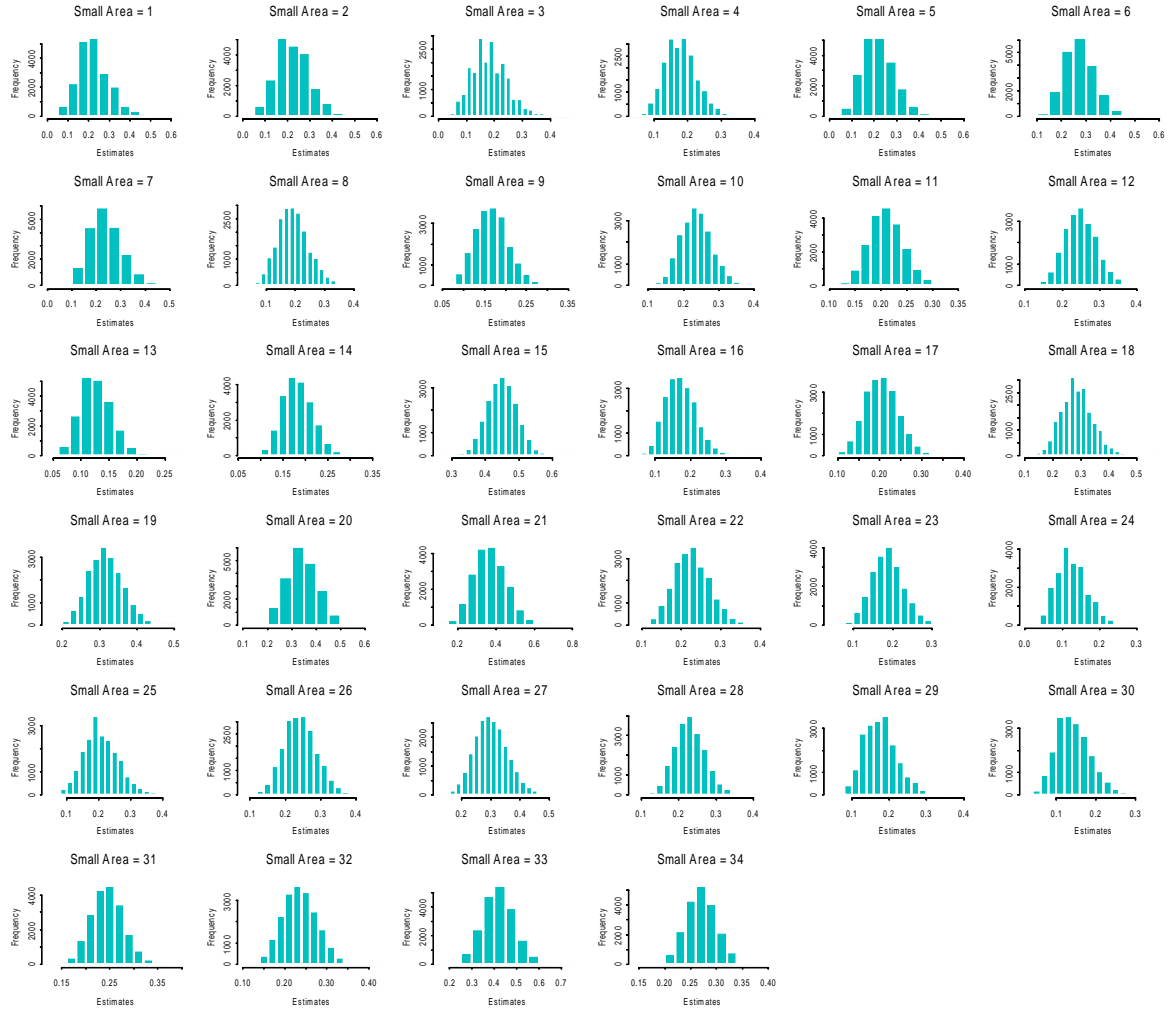


Figure 3: The autocorrelation function of the small area proportion

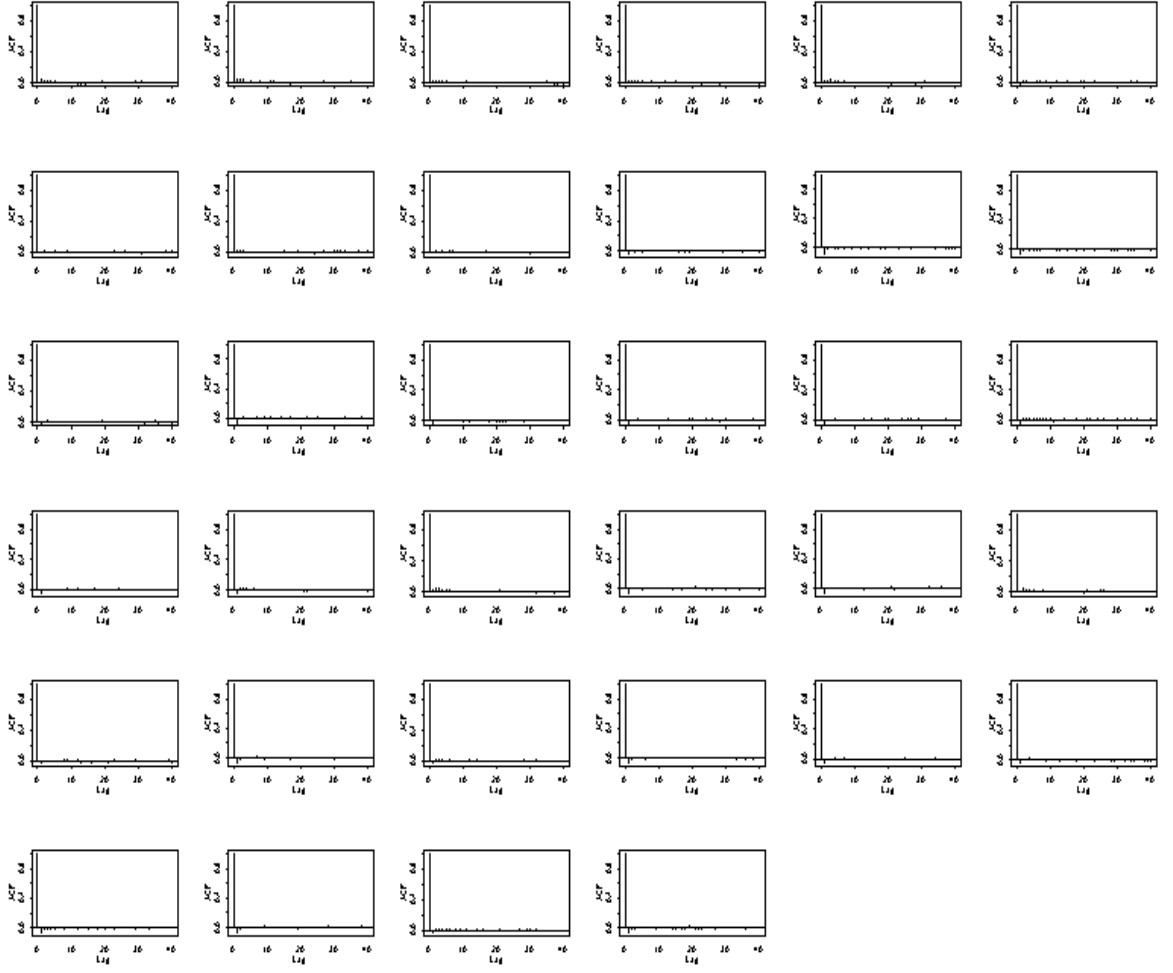


Figure 4: Trace of the small area proportions for four chains

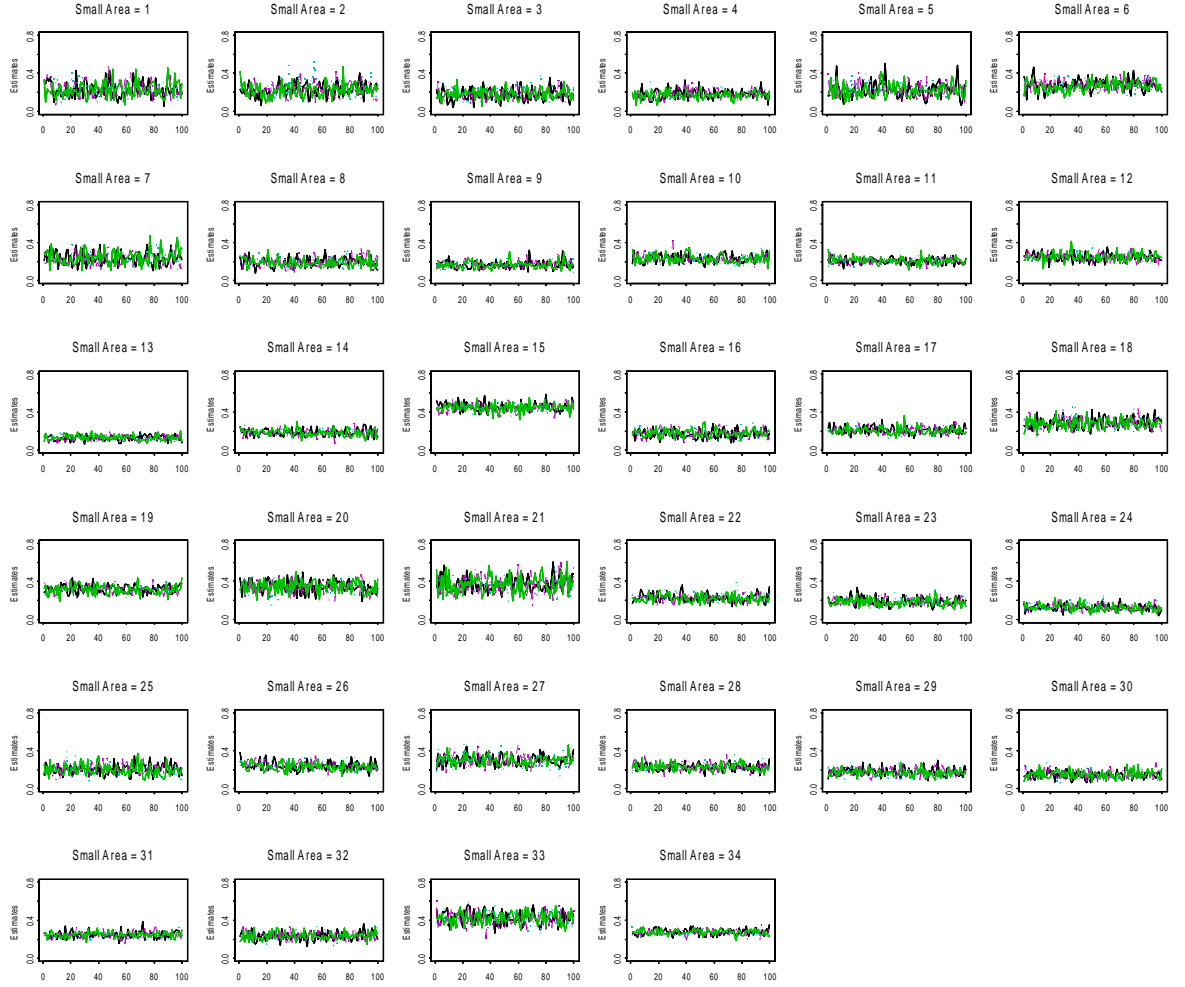


Figure 5: Gelman and Brooks diagnostics for the small area proportion based on four chains

