Chapter 11.6 Inference through MCMC

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Chapter 11 Simple Linear Regression

Overview

- As before, we will use JAGS to draw MCMC samples (Chapter 9 and Chapter 10)
- Straightforward to transpose the statement of the Bayesian model (sampling density and prior) directly to the JAGS model script

```
PriceAreaData <- read_csv("house_prices.csv")
PriceAreaData$newsize <- PriceAreaData$size / 1000
```

JAGS step 1: describe the model by a script

```
modelString <-"
model {
## sampling
for (i in 1:N){
   y[i] ~ dnorm(beta0 + beta1*x[i], invsigma2)
}
## priors
beta0 ~ dnorm(mu0, g0)
beta1 ~ dnorm(mu1, g1)
invsigma2 ~ dgamma(a, b)
sigma <- sqrt(pow(invsigma2, -1))
}"
```

JAGS step 2: define the data and prior parameters

```
y <- PriceAreaData$price
x <- PriceAreaData$newsize
N <- length(y)
the_data <- list("y" = y, "x" = x, "N" = N,
                 "mu0" = 0, "g0" = 0.0001,
                 "mu1" = 0, "g1" = 0.0001,
                 "a" = 1, "b" = 1)
```

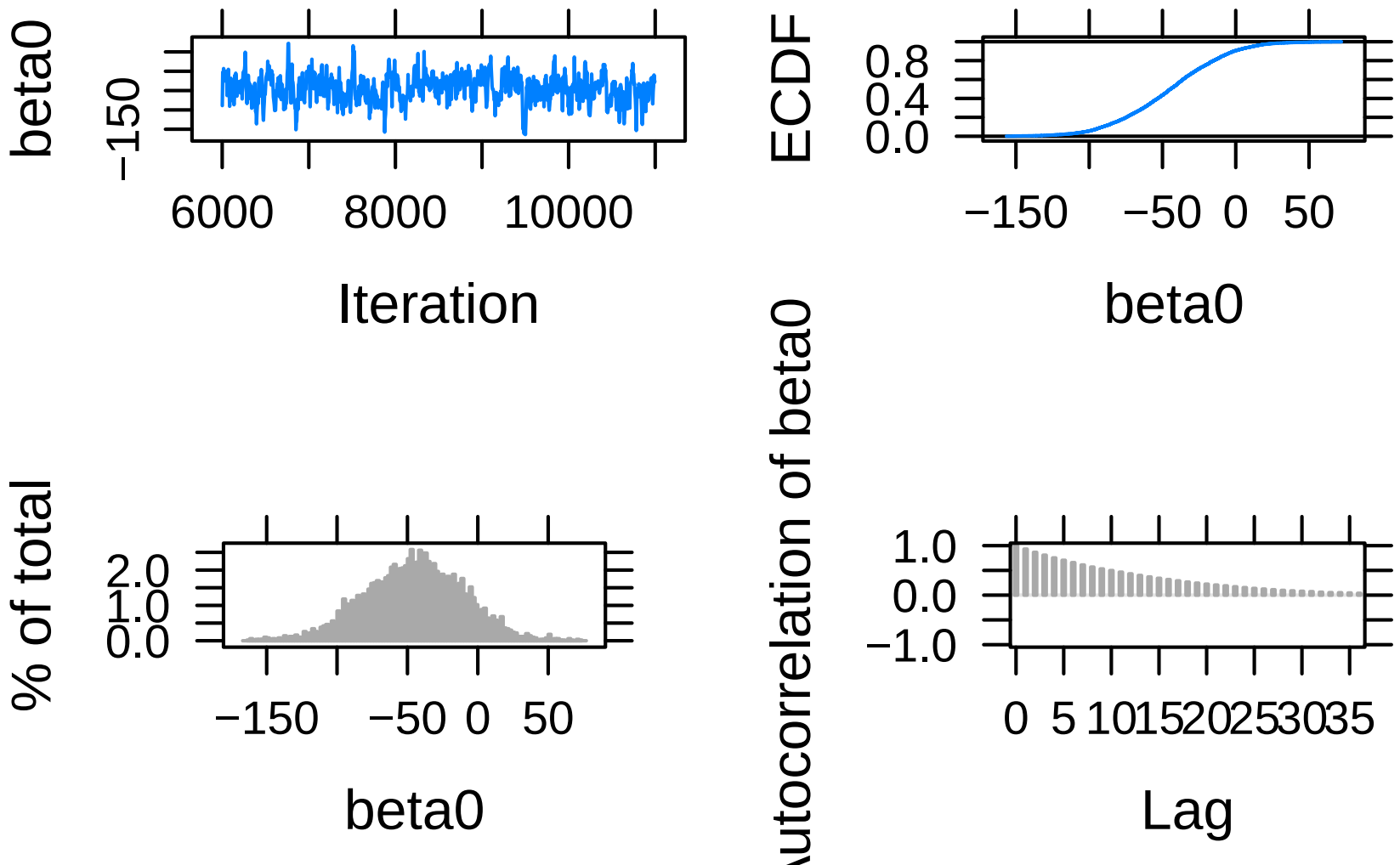
JAGS step 3: generate samples from the posterior distribution

```
posterior <- run.jags(modelString,
                      n.chains = 1,
                      data = the_data,
                      monitor = c("beta0",
                                  "beta1", "sigma"),
                      adapt = 1000,
                      burnin = 5000,
                      sample = 5000)
```

MCMC diagnostics and summarization

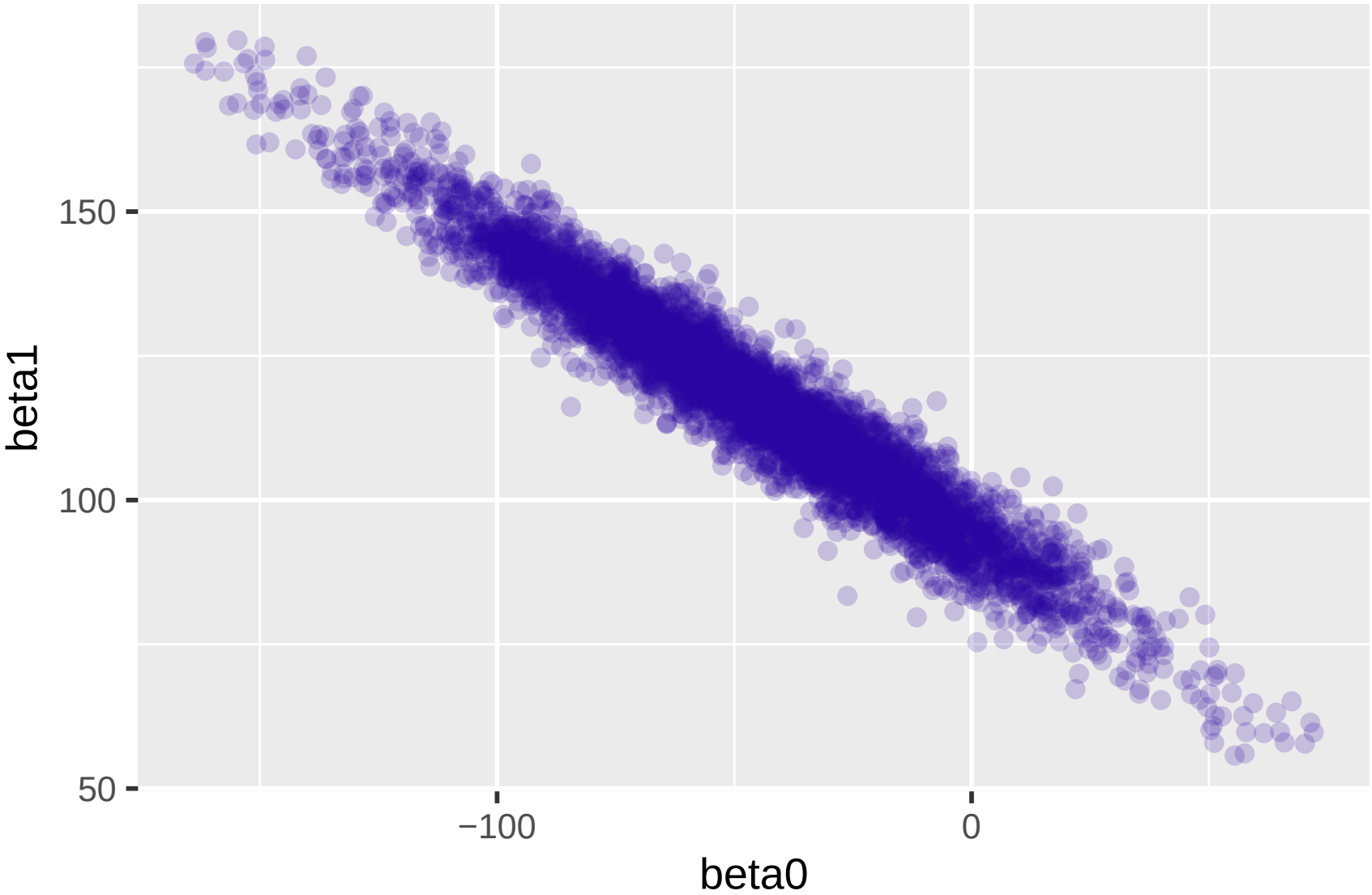
```
plot(posterior, vars = "beta0")
```

```
## Generating plots...
```



MCMC diagnostics and summarization cont'd

- A scatterplot of the simulated draws of the regression parameters β_0 and β_1 (a strong negative correlation)



MCMC diagnostics and summarization cont'd

```
print(posterior, digits = 3)
```

```
       Lower95 Median Upper95  Mean    SD Mode MCerr
beta0     -122  -46.2    31.4 -45.7 37.6   --  2.98
beta1     78.7    117     159   117   20   --  1.65
sigma     33.2     45    59.3  45.7 6.93   -- 0.157
```

MCMC diagnostics and summarization cont'd

```
print(posterior, digits = 3)
```

```
      Lower95 Median Upper95  Mean   SD Mode MCerr
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```

- Interpretations
  - Intercept β_0
  - Slope β_1
  - Standard deviation σ