

SCRIPT MOD6S3C: CONVERGENCE PLOTS

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COMPARE GS PERFORMANCE UNDER DIFFERENT STARTING VALUES

Data generation.

```
R> n<-10000 #sample size
R> x1<-rep(1,n)
R> x2<-rnorm(n,-1.4,1)
R> x3<-rnorm(n,3,2)
R> btrue<-c(1.2,0.4,0.8)
R> X<-cbind(x1,x2,x3)
R> k<-ncol(X)
R> sig2true<-1.44
R> eps<-rnorm(n,0,sqrt(sig2true))
R> y<-X %*% btrue + eps
```

OLS starting values.

```
R> #TUNERS
R> #####
R> r1<-0 #burn-ins; here: keep all for diagnostics
R> r2<-5000 #keepers
R> R<-r1+r2
R> # of Gibbs Sampler
R> #
R> #PRIORS:
R> #####
R> #for beta:
R> mu0<-rep(0,k)
R> V0<-100*diag(k)
R> #for sig2:
R> v0<-0.5
R> tau0<-0.5
R> #
R> # STARTING VALUES
R> #####
R> bols<-solve(t(X) %*% X) %*% (t(X) %*% y)
R> e<-y-X%*%bols
R> s2<-(t(e)%*%e)/(n-k)
R> betastart1<-bols
R> sig2start1<-as.vector(s2)
R> #
R> #GIBBS SAMPLER
R> #####
R> betamat<-matrix(0,k,r2) #will collect draws of beta
```

```

R> sig2mat<-matrix(0,1,r2) #will collect draws of sig2
R> #
R> # Call for a progress bar to monitor progress of Gibbs Sampler
R> pb<-winProgressBar(title="progress bar", min=0,max=R,width= 300)
R> #
R> for (i in 1:R) {
  setWinProgressBar(pb,i,title=paste(round((i/R)*100,0),"% done"))
  #
  sig2draw<-sig2start1
  # draw betas
  #####
  V1<-solve(solve(V0)+(1/sig2draw)*t(X)%*%X)
  mu1<-V1 %*% (solve(V0) %*% mu0 + (1/sig2draw)* t(X) %*% y)
  betadraw<-mvrnorm(n=1,mu1,V1)
  if (i>r1) {
    betamat[, (i-r1)]<-betadraw
  }
  # draw sig2
  #####
  v1<-(n+2*v0)/2
  tau1<-(1/2)*(t(y-X %*% betadraw) %*% (y-X %*% betadraw)+2*tau0)
  sig2draw<-rinvgamma(1,v1,scale=tau1)
  if (i>r1) {
    sig2mat[i-r1]<-sig2draw
  }
}
R> close (pb) #close progress bar
R> #
R> # add starting draw to GS chain. Let's focus on beta3
R> b3chain1<-c(betastart1[3],betamat[3,])
R> sig2chain1<-c(sig2start1,sig2mat)

```

Arbitrary starting values.

```

R> #TUNERS
R> #####
R> r1<-0 #burn-ins; here: keep all for diagnostics
R> r2<-5000 #keepers
R> R<-r1+r2
R> # of Gibbs Sampler
R> #
R> #PRIORS:
R> #####
R> #for beta:
R> mu0<-rep(0,k)
R> V0<-100*diag(k)
R> #for sig2:
R> v0<-0.5
R> tau0<-0.5
R> #
R> # STARTING VALUES
R> #####

```

```

R> betastart2<-c(-1,-1,-1)
R> sig2start2<-2
R> #
R> #GIBBS SAMPLER
R> #####
R> betamat<-matrix(0,k,r2) #will collect draws of beta
R> sig2mat<-matrix(0,1,r2) #will collect draws of sig2
R> #
R> # Call for a progress bar to monitor progress of Gibbs Sampler
R> pb<-winProgressBar(title="progress bar", min=0,max=R,width= 300)
R> #
R> for (i in 1:R) {
  setWinProgressBar(pb,i,title=paste(round((i/R)*100,0),"% done"))
  #
  sig2draw<-sig2start2
  # draw betas
  #####
  V1<-solve(solve(V0)+(1/sig2draw)*t(X)%*%X)
  mu1<-V1 %*% (solve(V0) %*% mu0 + (1/sig2draw)* t(X) %*% y)
  betadraw<-mvrnorm(n=1,mu1,V1)
  if (i>r1) {
    betamat[, (i-r1)]<-betadraw
  }
  # draw sig2
  #####
  v1<-(n+2*v0)/2
  tau1<-(1/2)*(t(y-X %*% betadraw) %*% (y-X %*% betadraw)+2*tau0)
  sig2draw<-rinvgamma(1,v1,scale=tau1)
  if (i>r1) {
    sig2mat[i-r1]<-sig2draw
  }
}
R> close (pb) #close progress bar
R> #
R> # add starting draw to GS chain. Let's focus on beta3
R> b3chain2<-c(betastart2[3],betamat[3,])
R> sig2chain2<-c(sig2start2,sig2mat)

```

COMPARE GS PERFORMANCE UNDER DIFFERENT SAMPLE SIZES

n=100.

```

R> # Modify data
R> #####
R> y<-y[1:100]
R> n<-length(y)
R> X<-X[1:100,]
R> #
R> #TUNERS
R> #####
R> r1<-0 #burn-ins; here: keep all for diagnostics
R> r2<-5000 #keepers

```

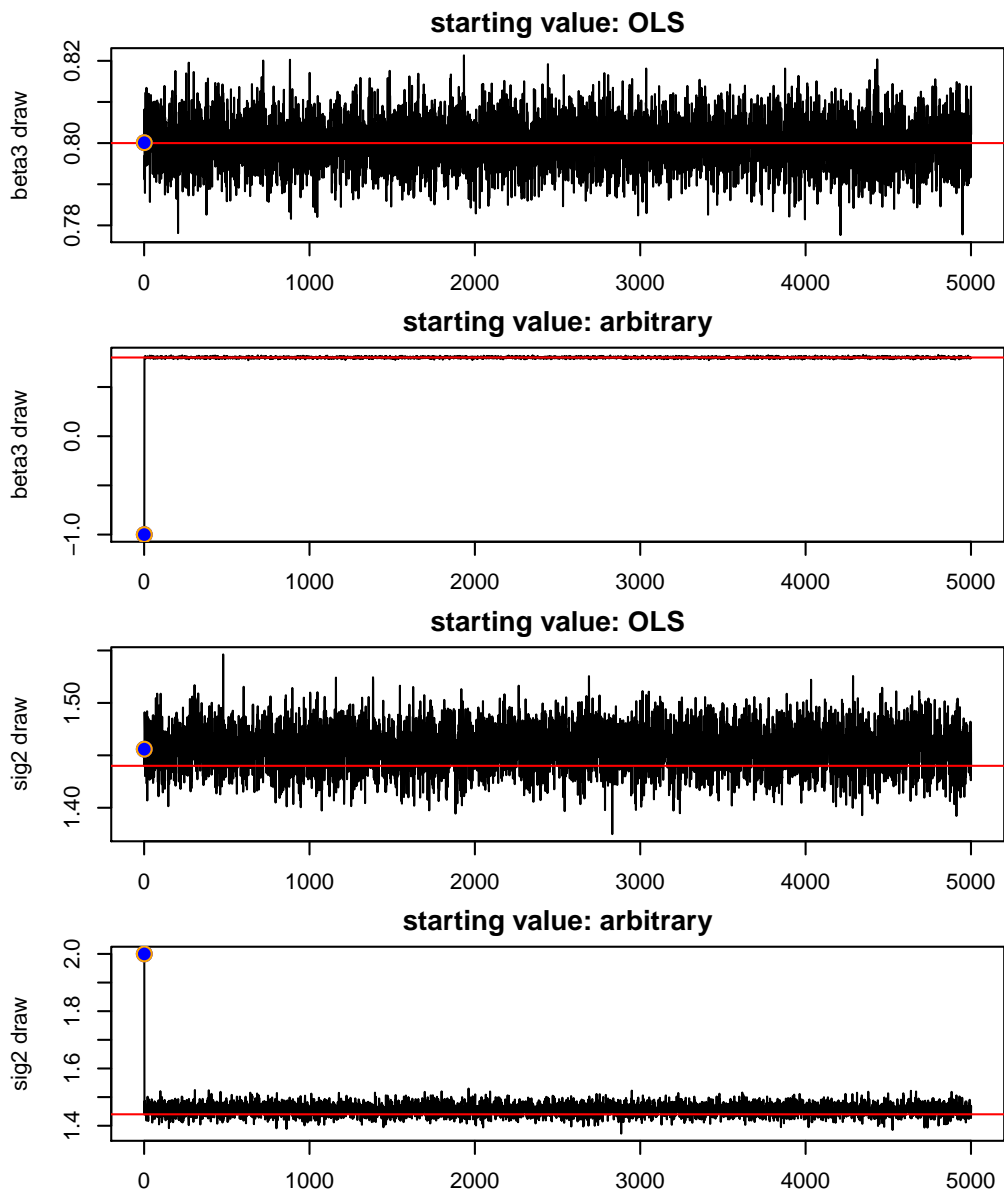


FIGURE 1. Convergence of β_3 and σ^2 for different starting draws

```

R> R<-r1+r2
R> # of Gibbs Sampler
R> #
R> #PRIORS:
R> #####
R> #for beta:
R> mu0<-rep(0,k)
R> V0<-100*diag(k)
R> #for sig2:
R> v0<-0.5

```

```

R> tau0<-0.5
R> #
R> # STARTING VALUES
R> #####
R> betastart<-c(-1,-1,-1)
R> sig2start<-2
R> #
R> #GIBBS SAMPLER
R> #####
R> betamat<-matrix(0,k,r2) #will collect draws of beta
R> sig2mat<-matrix(0,1,r2) #will collect draws of sig2
R> #
R> # Call for a progress bar to monitor progress of Gibbs Sampler
R> pb<-winProgressBar(title="progress bar", min=0,max=R,width= 300)
R> #
R> for (i in 1:R) {
  setWinProgressBar(pb,i,title=paste(round((i/R)*100,0),"% done"))
  #
  sig2draw<-sig2start
  # draw betas
  #####
  V1<-solve(solve(V0)+(1/sig2draw)*t(X)%*%X)
  mu1<-V1 %*% (solve(V0) %*% mu0 + (1/sig2draw)* t(X) %*% y)
  betadraw<-mvrnorm(n=1,mu1,V1)
  if (i>r1) {
    betamat[, (i-r1)]<-betadraw
  }
  # draw sig2
  #####
  v1<-(n+2*v0)/2
  tau1<-(1/2)*(t(y-X %*% betadraw) %*% (y-X %*% betadraw)+2*tau0)
  sig2draw<-rinvgamma(1,v1,scale=tau1)
  if (i>r1) {
    sig2mat[i-r1]<-sig2draw
  }
}
R> close (pb) #close progress bar
R> #
R> # add starting draw to GS chain. Let's focus on beta3
R> b3chainA<-c(betastart[3],betamat[3,])
R> sig2chainA<-c(sig2start,sig2mat)

```

n=10.

```

R> # Modify data
R> #####
R> y<-y[1:10]
R> n<-length(y)
R> X<-X[1:10,]
R> #
R> #TUNERS
R> #####

```

```

R> r1<-0 #burn-ins; here: keep all for diagnostics
R> r2<-5000 #keepers
R> R<-r1+r2
R> # of Gibbs Sampler
R> #
R> #PRIORS:
R> #####
R> #for beta:
R> mu0<-rep(0,k)
R> V0<-100*diag(k)
R> #for sig2:
R> v0<-0.5
R> tau0<-0.5
R> #
R> # STARTING VALUES
R> #####
R> betastart<-c(-1,-1,-1)
R> sig2start<-2
R> #
R> #GIBBS SAMPLER
R> #####
R> betamat<-matrix(0,k,r2) #will collect draws of beta
R> sig2mat<-matrix(0,1,r2) #will collect draws of sig2
R> #
R> # Call for a progress bar to monitor progress of Gibbs Sampler
R> pb<-winProgressBar(title="progress bar", min=0,max=R,width= 300)
R> #
R> for (i in 1:R) {
  setWinProgressBar(pb,i,title=paste(round((i/R)*100,0),"% done"))
  #
  sig2draw<-sig2start
  # draw betas
  #####
  V1<-solve(solve(V0)+(1/sig2draw)*t(X)%*%X)
  mu1<-V1 %*% (solve(V0) %*% mu0 + (1/sig2draw)* t(X) %*% y)
  betadraw<-mvrnorm(n=1,mu1,V1)
  if (i>r1) {
    betamat[, (i-r1)]<-betadraw
  }
  # draw sig2
  #####
  v1<-(n+2*v0)/2
  tau1<-(1/2)*(t(y-X %*% betadraw) %*% (y-X %*% betadraw)+2*tau0)
  sig2draw<-rinvgamma(1,v1,scale=tau1)
  if (i>r1) {
    sig2mat[i-r1]<-sig2draw
  }
}
R> close (pb) #close progress bar
R> #
R> # add starting draw to GS chain. Let's focus on beta3

```

```
R> b3chainB<-c(betastart[3],betamat[3,])
R> sig2chainB<-c(sig2start,sig2mat)
```

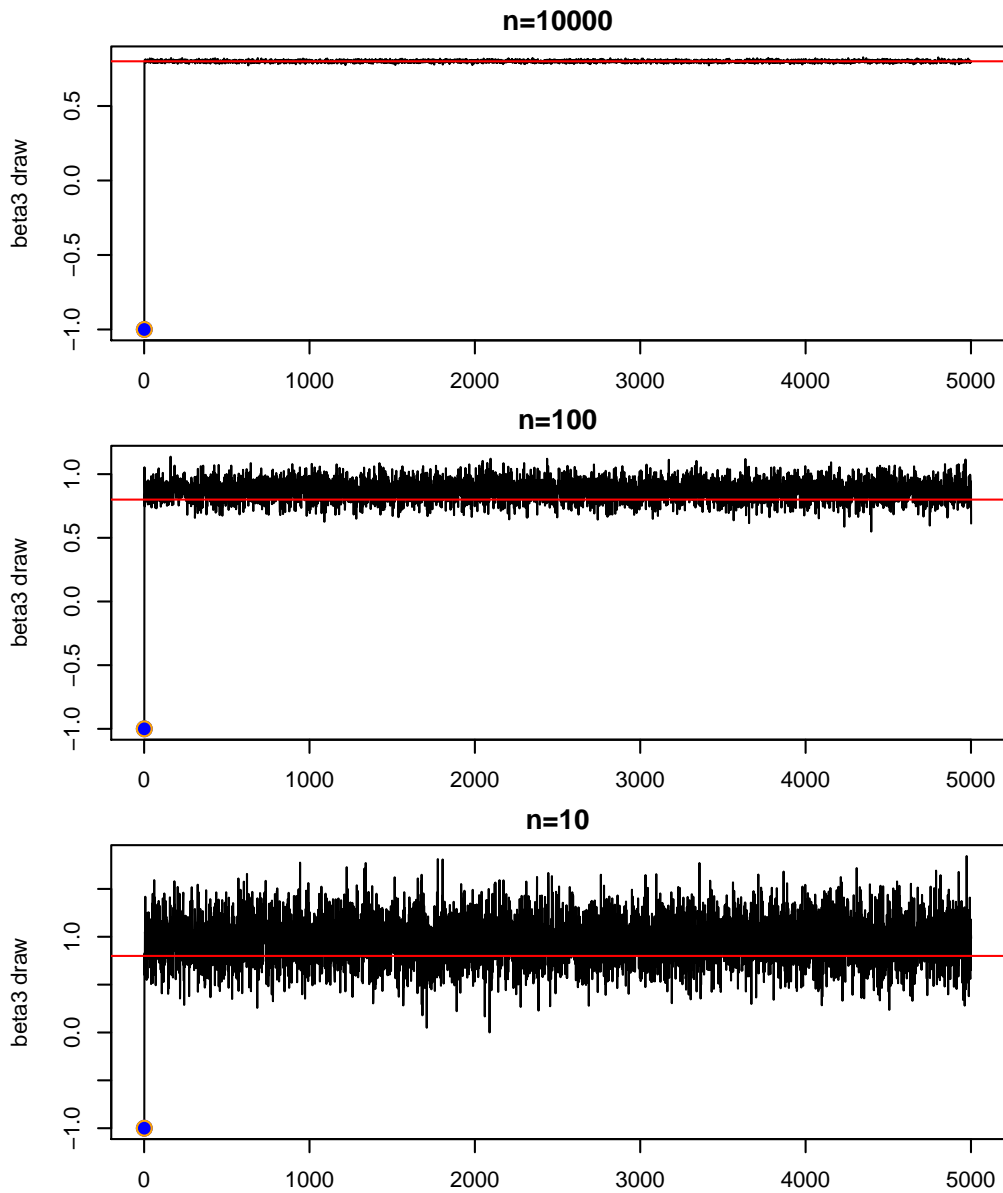


FIGURE 2. Convergence of β_3 under diminishing sample size

```
R> proc.time()-tic
  user  system elapsed
25.30   5.23   32.01
```

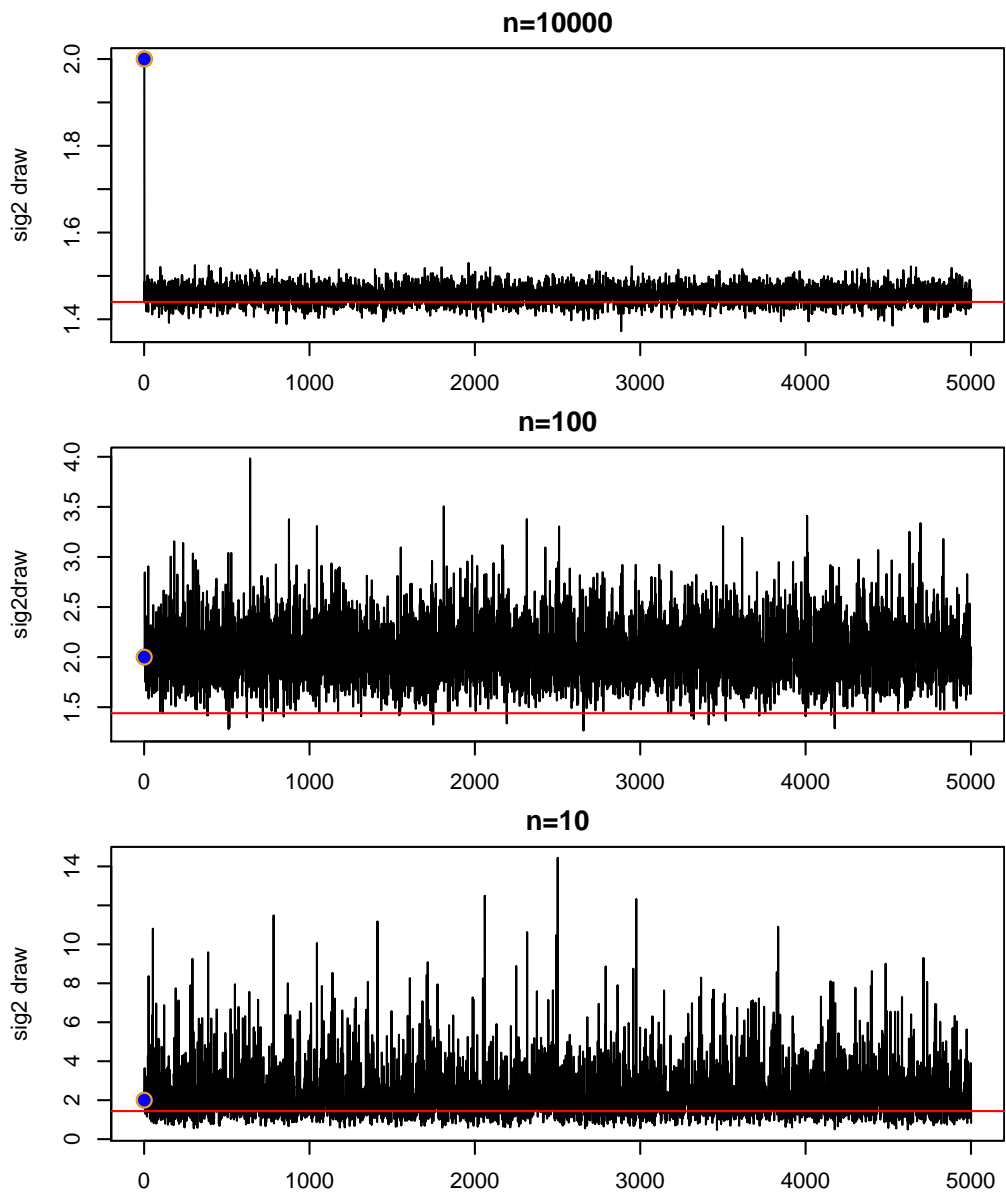


FIGURE 3. Convergence of σ^2 under diminishing sample size