MCAR simulation-Method 2

7/20/2017

```
##run n_iter=10000 iterations
time
```

```
##      user   system  elapsed
## 1520.336  142.727 1667.540
```

```
burnin=5000
(posterior.mean.eta=apply(eta_keep[-(1:burnin),],2, mean))
```

```
## [1]  0.000000  1.673283  1.351208 -0.500491
```

```
(posterior.mean.M=apply(M_keep[-(1:burnin),],2, mean))
```

```
## [1]  0.0000000  0.5050907  1.0585758 -0.5590055
```

```
(posterior.mean.v=apply(v_keep[-(1:burnin),],2, mean))
```
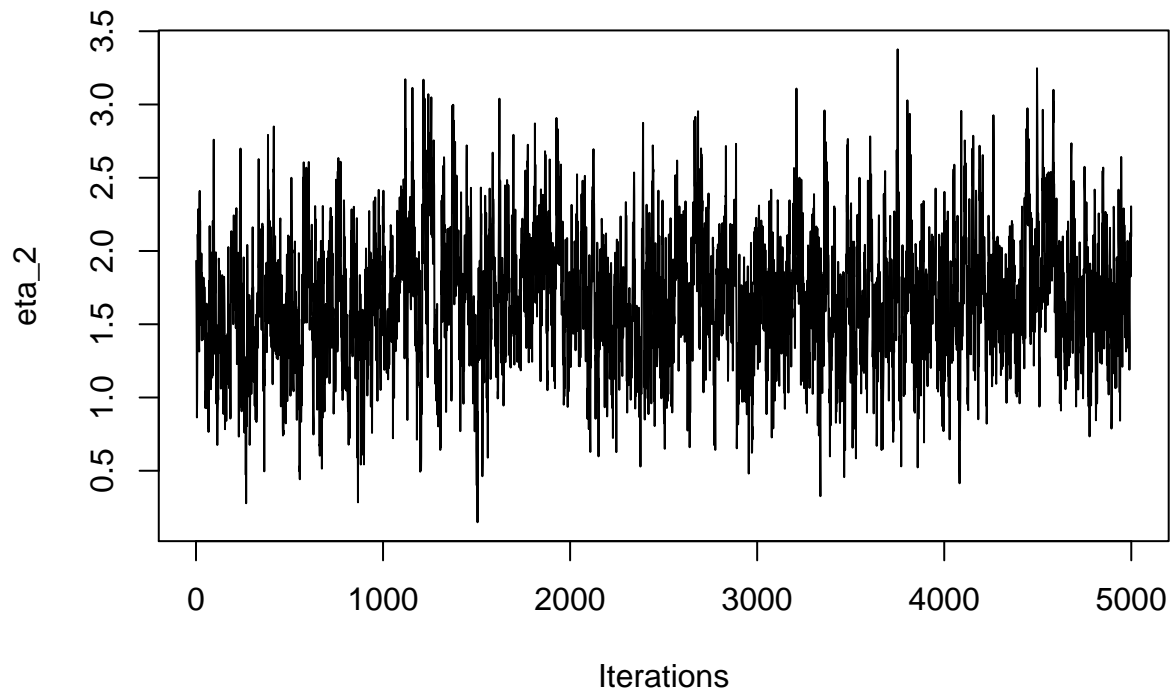
```
## [1]  0.4843459 -0.3045835
```

```
(posterior.mean.beta=apply(beta_keep[-(1:burnin),],2, mean))
```

```
## [1] -0.1619083  0.7372656
```

```
(posterior.mean.sgmr2=mean(sgmr2_keep[-(1:burnin)]))
```
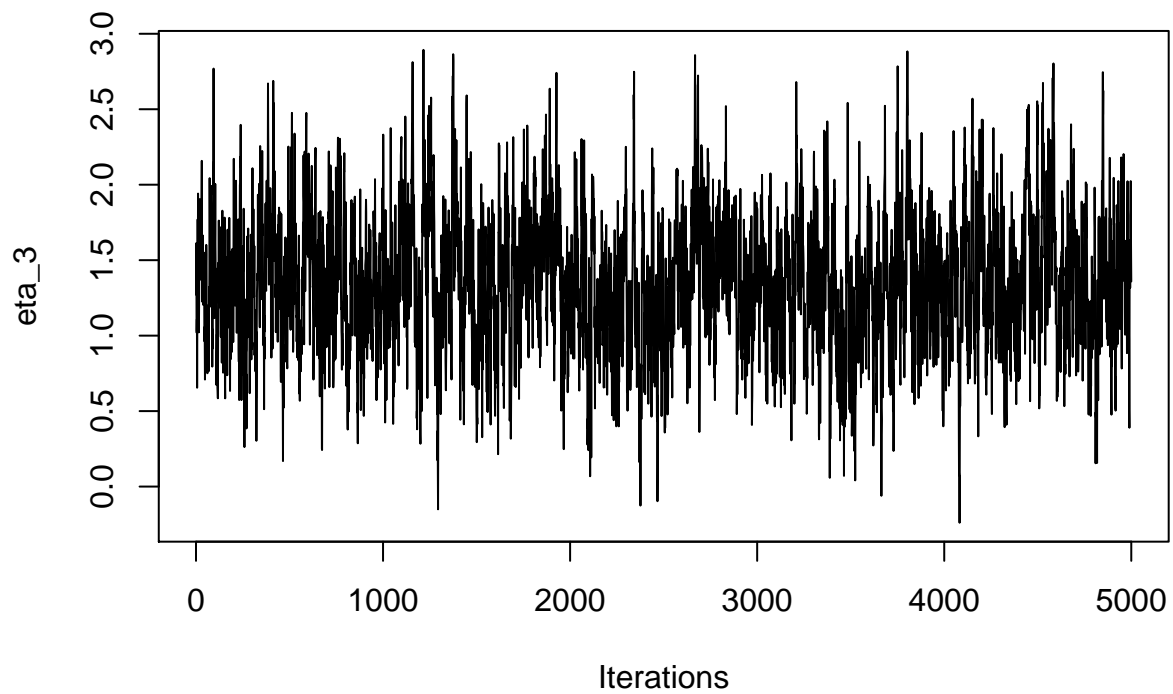
```
## [1] 12.81691
```

```
(posterior.mean.sgm2=mean(sgm2_keep[-(1:burnin)]))
```

```
## [1] 5.285127
```

```
(posterior.mean.E=mean(E_keep[-(1:burnin)]))
```
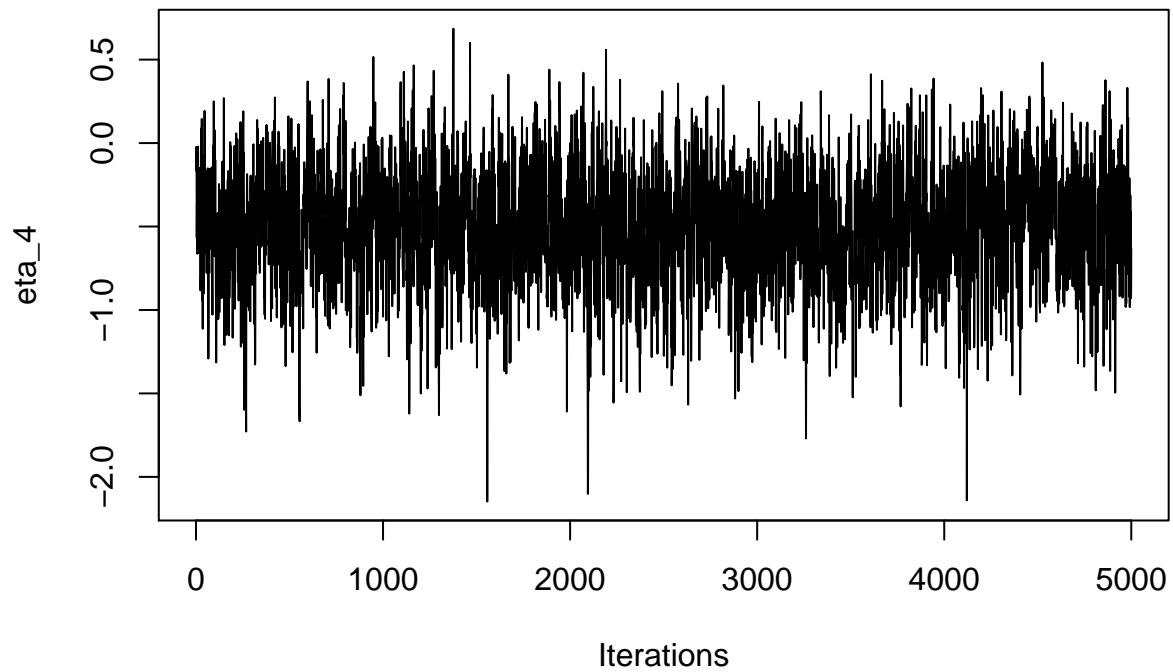
```
## [1] 1.68942
```

```
##traceplots after burn-in
##ture value of eta2 is 0.5
traceplot(x=as.mcmc(eta_keep[-(1:burnin),2]), ylab="eta_2")
```
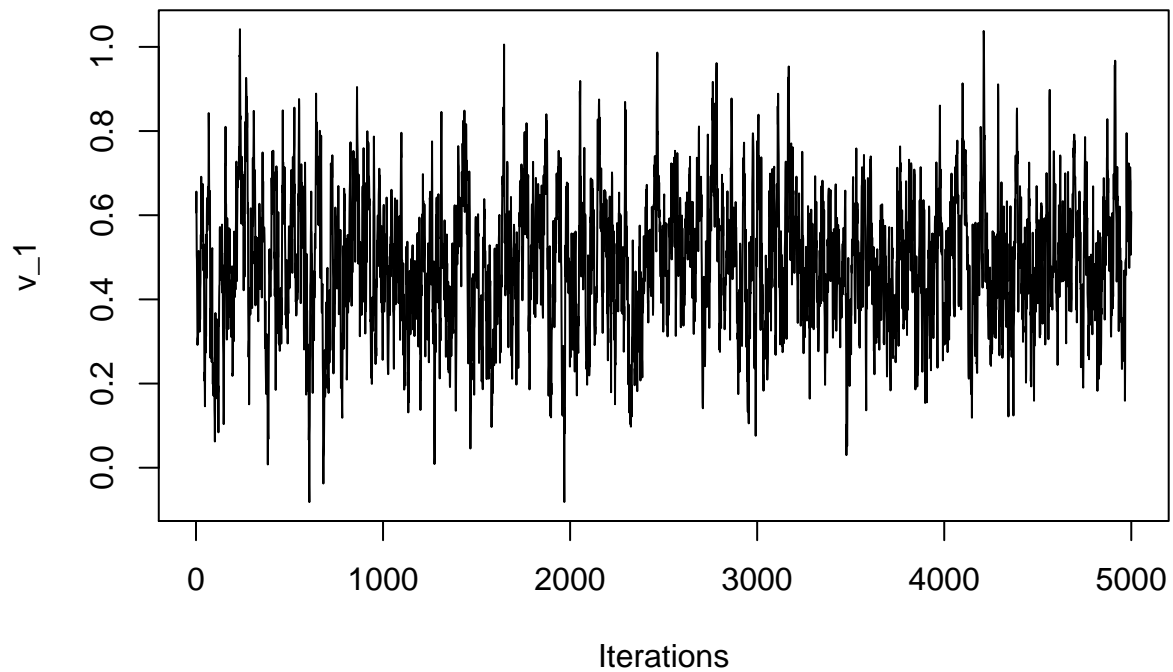
```
##true value of eta3 is 1.5
traceplot(x=as.mcmc(eta_keep[-(1:burnin),3]), ylab="eta_3")
```



```
##true value of eta4 is 1
traceplot(x=as.mcmc(eta_keep[-(1:burnin),4]), ylab="eta_4")
```

```
##true value of v1 is 0.5
traceplot(x=as.mcmc(v_keep[-(1:burnin),1]), ylab="v_1")
```



```
##true value of v2 is -0.3
traceplot(x=as.mcmc(v_keep[-(1:burnin),2]), ylab="v_2")
```

```
##true value of beta1 is -0.4
traceplot(x=as.mcmc(beta_keep[-(1:burnin),1]), ylab="beta_1")
```



```
##true value of beta2 is 0.5
traceplot(x=as.mcmc(beta_keep[-(1:burnin),2]), ylab="beta_2")
```

```
##true value of M2 is -0.6
traceplot(x=as.mcmc(M_keep[-(1:burnin),2]), ylab="M_2")
```
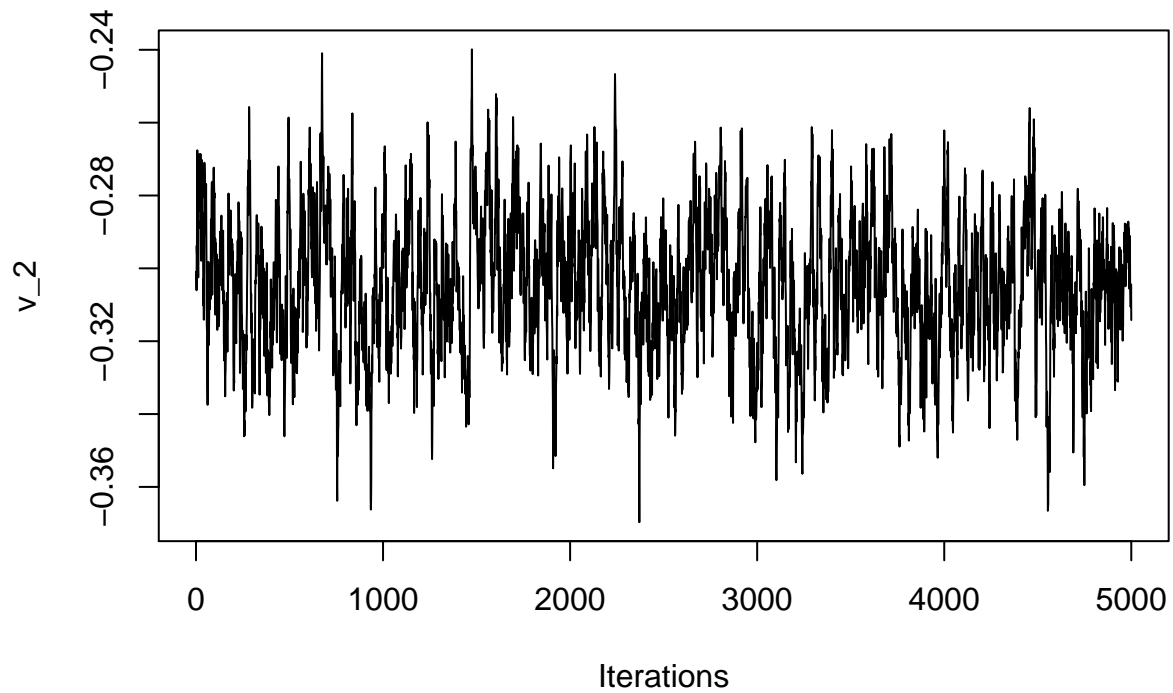


```
##true value of M3 is 0.6
traceplot(x=as.mcmc(M_keep[-(1:burnin),3]), ylab="M_3")
```
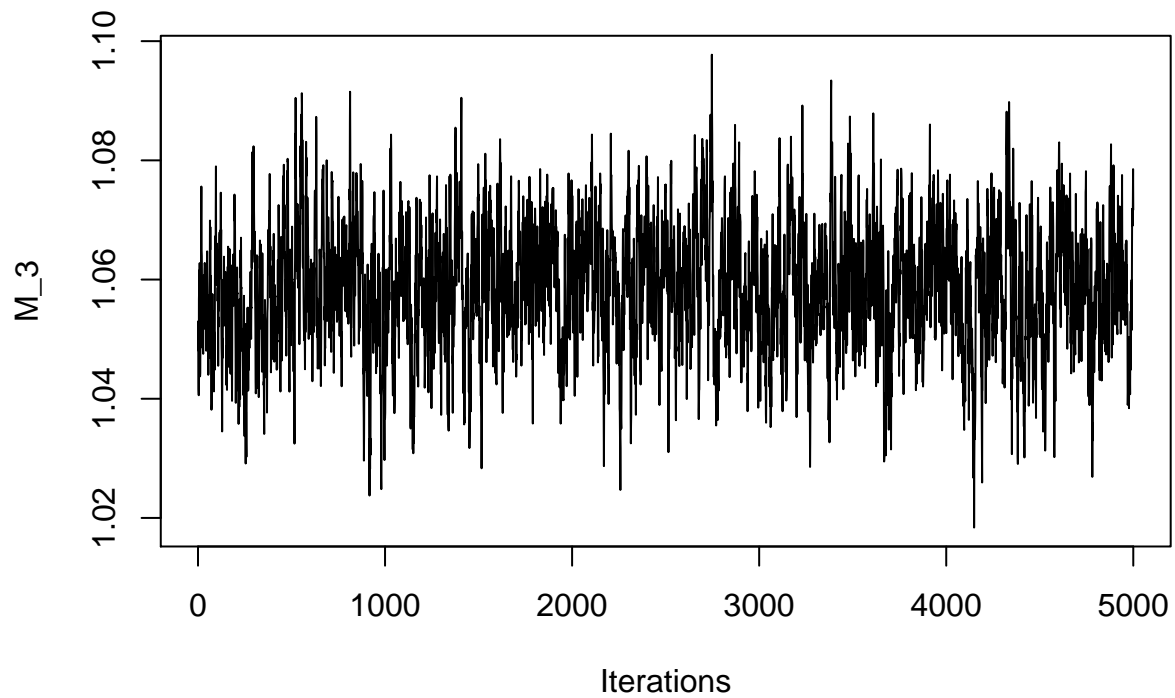
```
##true value of M4 is 1.2
traceplot(x=as.mcmc(M_keep[-(1:burnin),4]), ylab="M_4")
```
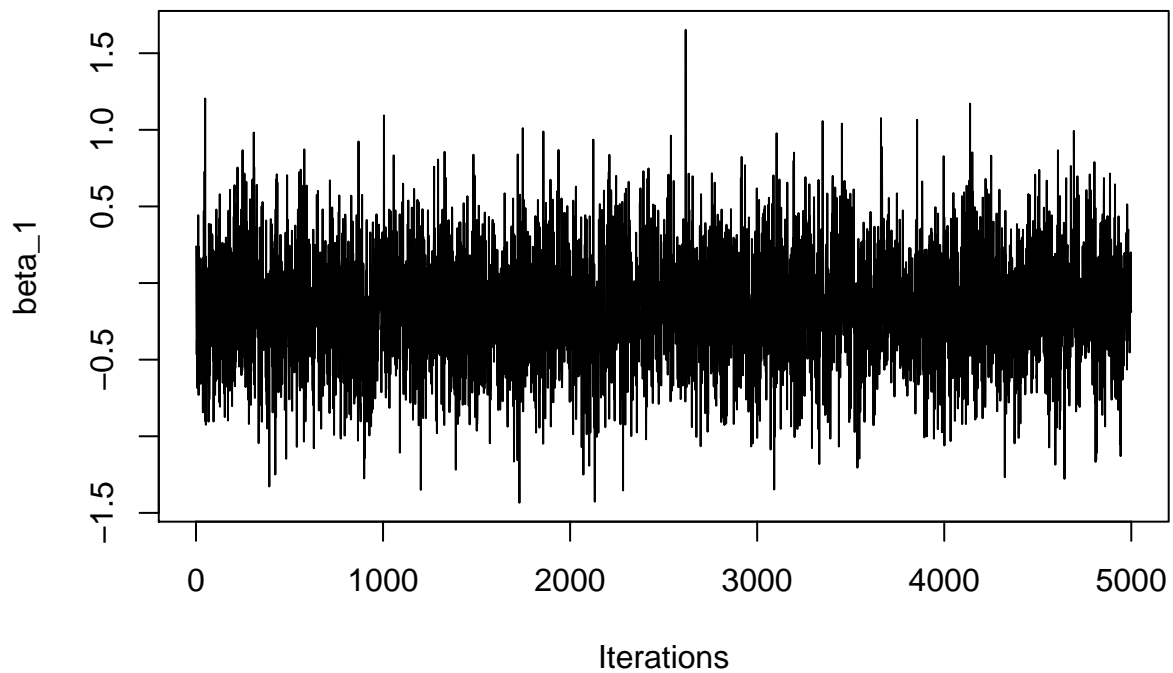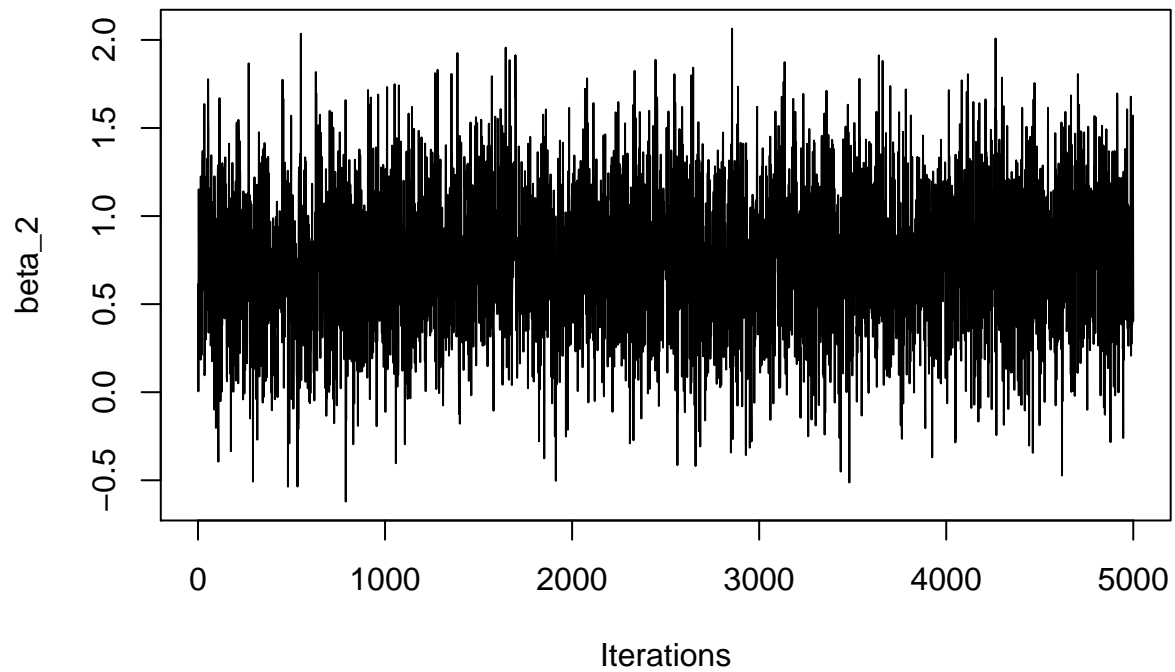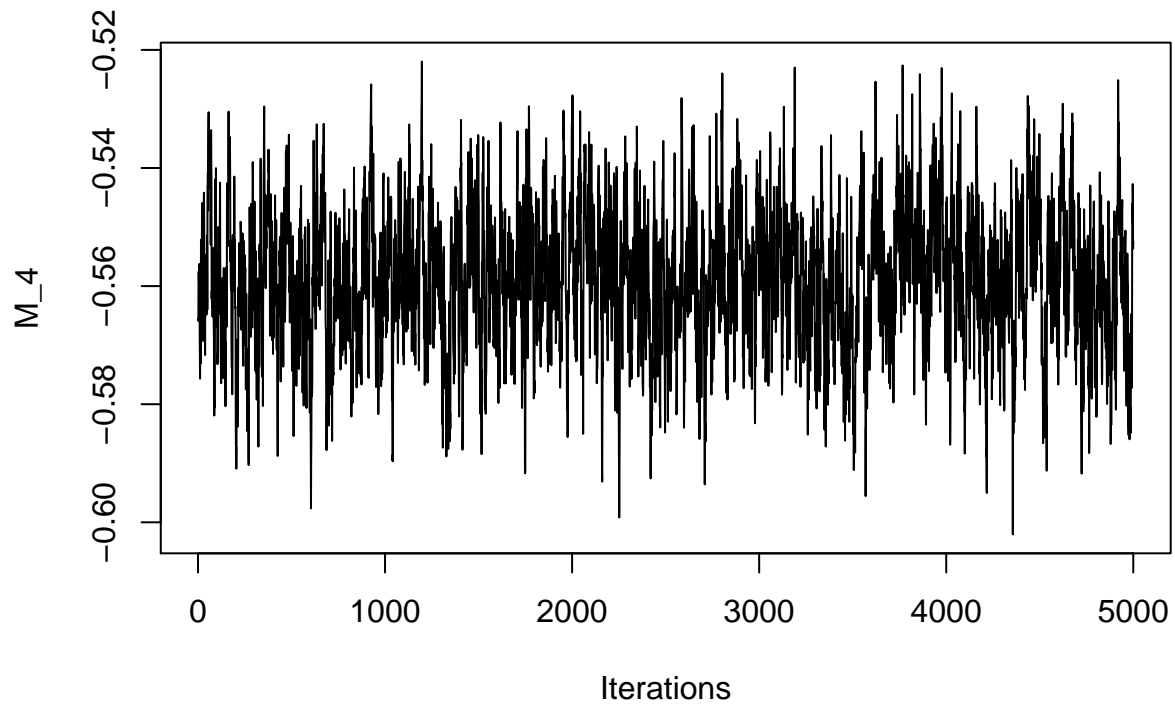


```
##true value of sgmr2 is 1
traceplot(x=as.mcmc(sgmr2_keep[-(1:burnin)]), ylab="sgmr2")
```
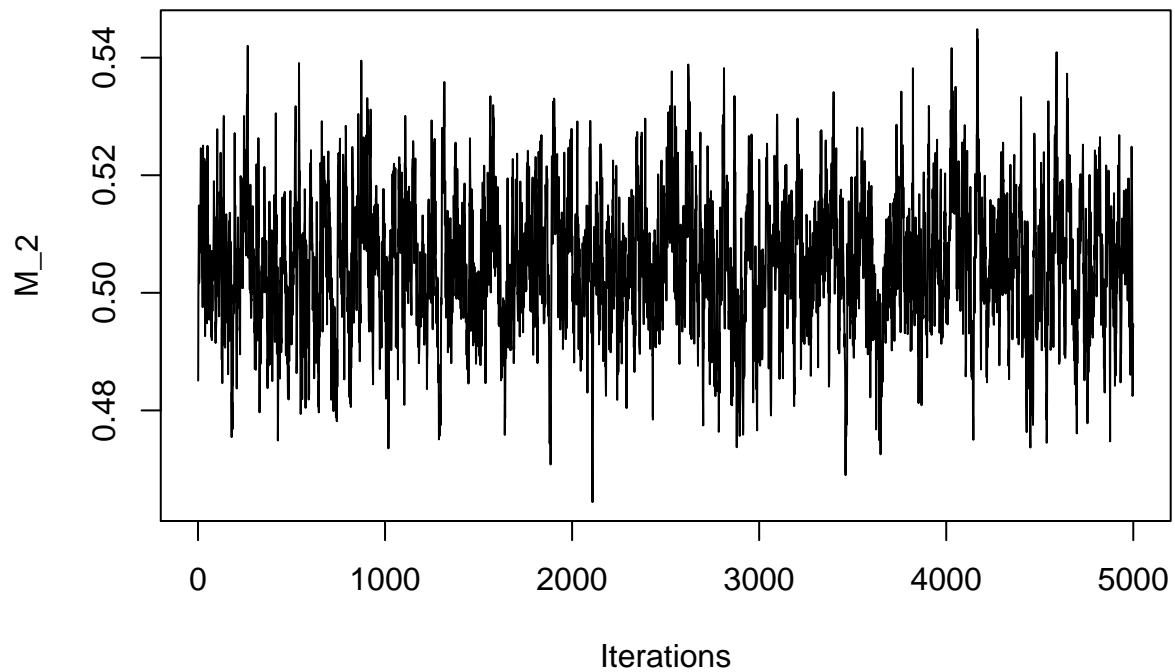
6

sgmr2

Iterations
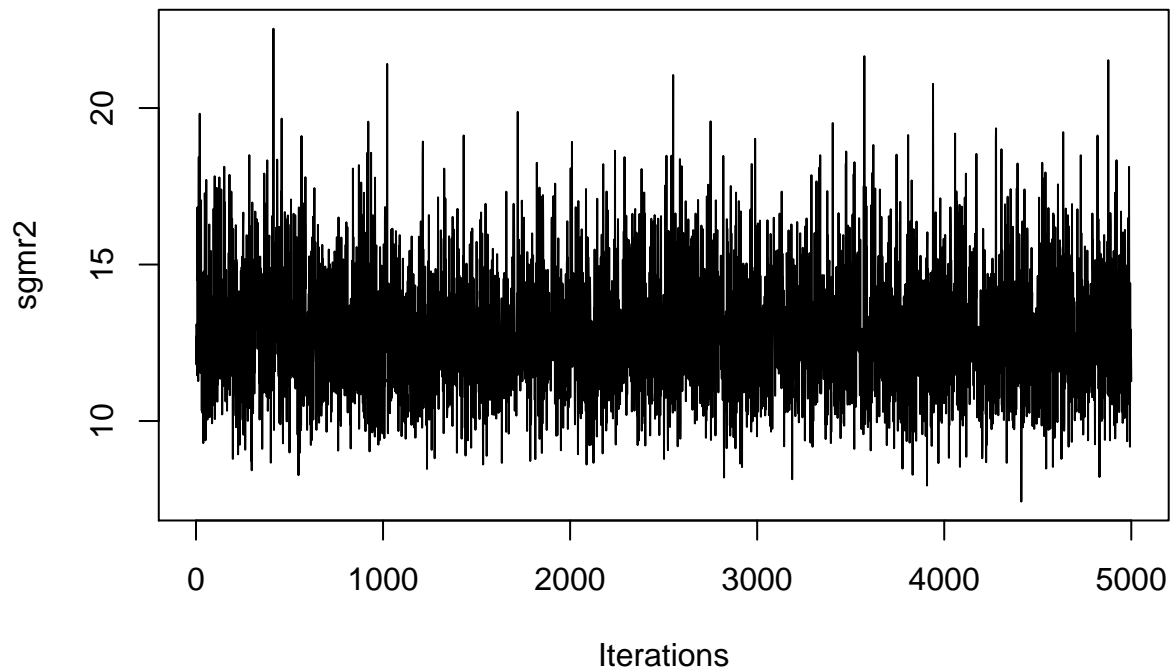
```
##true value of sgm2 is 1
traceplot(x=as.mcmc(sgm2_keep[-(1:burnin)]), ylab="sgm2")
```

sgm2

Iterations
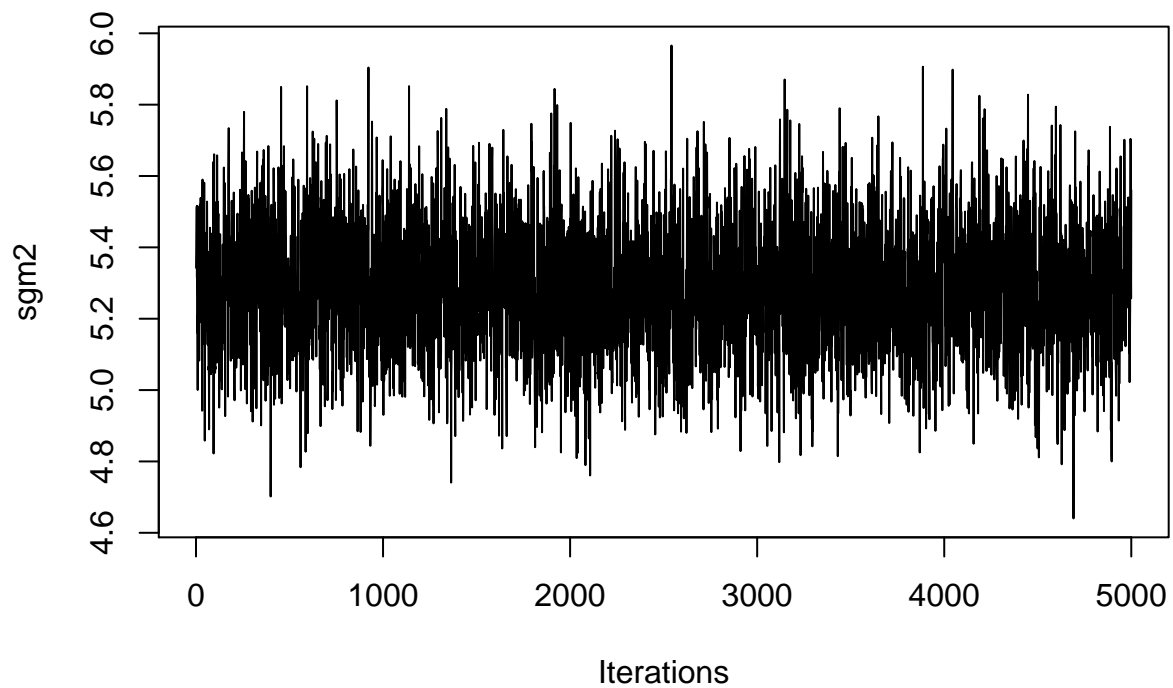
```
##mean of imputed X
(MI.mean.X=apply(X_keep[-(1:burnin),], 2, mean))
```

```
##    [1]    1.68350749    5.34470082   18.37401607   -5.56579353   -8.39888197
##    [6]  -11.74348628  -12.79756530  -15.54029705  -17.28572748    5.91001051
##   [11]   10.13133006   11.08900467   16.49122048   17.52830526   21.75022362
##   [16]   22.77016553   31.26573881   38.63247365   40.83752342    3.75239253
##   [21]    6.75007425    2.39248564    7.44919929    9.98418441   11.53291945
```

```
## [26]   12.07097580  13.45890234  14.52719484   3.76854325   4.89301057
## [31]    7.98057172   9.15757857  14.39494987  21.81272390  29.21530329
## [36]   33.49849242  40.90174468   6.10941550   3.25834760   0.52153368
## [41]   -2.28277377  -4.51329938   5.51675946  10.85470887  11.83374840
## [46]   16.11765872  17.21107725  25.67053035  31.98582018   5.30933815
## [51]   13.76632678  15.89482918  28.59621191  39.23883311  -9.49352478
## [56]   -7.91690313  -5.90785459   2.14303265   4.15555029   4.62430748
## [61]    2.39166745  22.52294876   2.17302925   4.68167506   9.76201082
## [66]   11.23203410  14.24750182  15.29038329  17.30551080   3.22236592
## [71]    3.86357680   7.54546526   8.12749189  -4.87687353  -8.21779431
## [76]  -12.14186333 -12.69155610 -15.51928525 -16.59271202 -17.79226906
## [81]    0.25016701   0.27884325   9.39619776  18.45307563  20.42475718
## [86]    6.82059967  -6.17079492   1.99945772   2.95599659  -1.01856590
## [91]   -2.65266587  -4.31782489  -6.04472926  -8.28500764  -4.01787772
## [96]   -4.61395766  -6.90866856 -11.89230918 -14.10186998 -15.28208665
## [101]   9.12330604  11.26672368   4.81069245   8.84770934  11.89457213
## [106]  12.90301555  13.88381269  14.89913990  16.41812204  17.41910748
## [111]  19.46485324  19.99044289  20.42357987  -6.73506264  -9.06154874
## [116] -15.76367357 -16.23613325   1.10373014   1.12649683   1.10776201
## [121]   1.11019723   1.13742493   1.10768303   1.09518725   1.08079891
## [126]   5.03084751  -0.09006894  -0.12939410  -6.35474045  -2.08375680
## [131]   2.15155614   4.26522070   8.50084874  14.87027073  20.11764361
## [136]  26.41019638   7.58148970  19.21767648  20.33754645  22.41236016
## [141]  24.52554183  30.88444748  33.03365411  34.07992477   0.11176679
## [146]   0.22603404   0.21811248   0.15120890   0.22041069   0.20474028
## [151]   0.15279383   0.11449604   0.16373924   3.76436287   8.03426435
## [156]  20.74271609  26.07365214  27.09527186  29.17347403  34.50388657
## [161]   6.99084089   9.05748915  11.19263204  13.24491584  16.49950495
## [166]   6.76464577   7.25049098   9.74935892  10.25750488  16.29840169
## [171]   0.69299696   2.89681993   9.19113373  10.25084824  11.28695279
## [176]  18.73752884  21.92390192  22.98544721  27.25177979  29.39081661
## [181]   0.49919508   1.44349520   3.40701709   4.51176262  13.96703081
## [186]   4.71448490   7.88378497   9.99065417  12.16922531  14.28609980
## [191]   2.23458891   3.99974870  -7.13318863  -9.95872614  -0.09113325
## [196]  -0.04826394  12.74209554  18.05730788  19.15065910  22.27176343
## [201]  -2.08509608  -5.47225424  -8.81421917   5.86325578   5.26577720
## [206]   3.56500822   0.74813457  -6.52950732   6.11130127   7.14917127
## [211]  20.91201067  21.91219954  37.88495887   0.19553810   0.21174398
## [216]   0.28549604   0.17614328  -4.45649569  -5.07683993  -5.71203513
## [221]  -6.68226258  -6.68334953  -6.67900596  -6.69744027  -3.45834231
## [226]  -4.05462731  -7.93773790  -9.60346348 -11.28255288 -12.92360098
## [231] -14.09701723 -20.27744305   2.00555482   3.07378529   5.11793001
## [236]  19.99818493  31.60740772   6.79328055  14.27769917  -2.46876543
## [241]  -3.01395279 -10.87291942 -11.93372411 -15.33418265   2.08371737
## [246]   2.12718769   2.06408667   2.07533984   2.06366685  -1.76326833
## [251]  -3.38194770  -4.49358606  -5.11151560  -7.32198974  -7.92810890
## [256] -16.27008888  13.19018098  13.24791394  13.17727062  13.21124704
## [261]  13.20939947  13.18940970  13.23975729  13.25815786  13.26228949
## [266]  13.21556748  13.19219750  13.22317909  -2.77332109  -1.64425719
## [271]   9.94182673  22.65594481  25.87761240   0.47607891   0.40599481
## [276]   0.37739077   0.46466200   0.45647392  -4.52991680  -5.56891656
## [281]   1.81801916   7.10771099   8.29297807  12.49031825   4.06021768
## [286]   3.45004410   2.90047729   1.78105043  -2.61452767  11.86428975
## [291]  17.18388862  27.75424925  28.86721764  32.02732700   0.11359016
```

```
## [296]    0.75787585  -0.64726016  -0.61930760  -2.31308891  -3.46182820
## [301]   -4.62063610  -5.11860148  -6.23196768 -12.42014637 -17.41314355
## [306]    1.49156320   4.60587431   7.60125479   8.11521630   8.58459654
## [311]   10.71239609  -7.56669925  -8.64948182  -9.21600409 -13.11970014
## [316]  -14.82539026   2.97895305   3.52192610   6.48139105   9.04333415
## [321]   14.09274411  15.08791256  15.63883174  11.35108784  11.39004510
## [326]   11.39162816  11.32572039  11.29911501  11.39407636  11.34238335
## [331]   11.36085540  11.34987557  11.28687763  -2.75826391  -3.29428126
## [336]   -6.73119175 -10.60459247 -11.11291556 -11.68380487 -14.50368205
## [341]  -18.38766551 -18.94791101 -21.23020896  -3.17165544  -4.26897039
## [346]   -8.76353101 -10.40864955 -12.65212491  -0.57080384  -0.55913543
## [351]    1.60945347   2.04888578   6.64901443  10.64041586  12.25218344
## [356]   15.17501563  16.70224840  -2.99620447  -7.49052805 -10.13214167
## [361]  -15.28446510  -3.99514759  -8.47038472  -9.57303576 -10.10364301
## [366]  -10.65866322 -14.06558921   5.83509805   7.87023278   9.36702762
## [371]   13.94266948  18.45879726   8.62103605  10.66897600  12.86911586
## [376]   13.86824465  15.95089090  30.81123756  32.89548086  34.06184646
## [381]   44.55937741   3.60492782   8.73839047   9.73095817   3.25897533
## [386]    4.30054445   4.81925010   5.26076289   6.29709703   9.85698400
## [391]   12.85047434  13.88296049  -3.83871404  -5.55328368  -8.24862070
## [396]   -2.18415206  -2.22311493   4.03614274   4.54695450   7.01896383
## [401]    0.60481986   0.64280454   0.56282936   0.56700446   2.96057271
## [406]    8.52261454  11.07036423  11.55772357  12.13067062  12.55553027
## [411]   13.57999683  17.14806021  -3.09102349  -3.65039250  -4.17088865
## [416]  -10.85381060 -15.34280437 -15.91768700 -18.21067091 -22.63839904
## [421]    6.82630080   7.92355294   8.54951690  -3.26722000  -5.48999136
## [426]   -6.01204184  -8.89247020 -10.51984878 -12.12553500 -12.76514672
## [431]   -2.71703227  -4.91650623  -7.11451230  -8.27111565  -9.40486039
## [436]   -9.95984843 -12.77829866 -15.00276775 -16.72458687   2.92257316
## [441]    8.97269731  10.53574044  -1.13219089  -1.10589908   0.80079201
## [446]    4.55990103  -3.85482864   6.73492186   7.78695962  10.96481693
## [451]   -1.50555951  -6.53241515  -9.36814659 -13.78992607   6.17274957
## [456]   12.25913073  14.77986612  -7.09251173  -6.58052090  -6.03252226
## [461]   -3.62273450  -1.51703106   5.54439700   9.05410248
```

```r
##difference with the true X
(diff=MI.mean.X-(XR$X)[R_sim==0])
```

```
##    [1]    3.612387377  -0.945992578  -1.635045112   0.068410230  -0.620904041
##    [6]    0.457131298   0.538134138   1.972646691  -0.996656802   3.702213276
##   [11]    3.763716443   3.000688033   0.705311929  -0.243204477   1.595081823
##   [16]   -1.344416339  -0.733755954  -0.752392289  -3.108775141   0.674067763
##   [21]   -0.880349176   0.757926671  -0.325753818  -1.566977415   0.922255721
##   [26]    0.036813861  -1.269225048  -0.946723428  -2.174476995   0.469264945
##   [31]    4.192564478   0.538435774   2.674555315   0.800739760   0.620823017
##   [36]   -1.877188968  -1.604530020   3.816642179   3.134851650   1.368218172
##   [41]   -2.605421914  -6.091165212  -0.797089340   1.659923823   0.739373333
##   [46]   -1.626890039  -0.177887210  -0.843087084  -3.668301374   2.215870516
##   [51]    0.160051095   1.405077518  -2.671645978  -3.182222763  -6.801374398
##   [56]   -7.001973860  -3.538781263   3.746816153   7.989804029   6.122668514
##   [61]   -2.016846419  -1.317736501   1.851980487   0.691274417  -0.698542099
##   [66]    0.308158645  -2.263191934  -1.730589054  -1.738782484   0.693819478
##   [71]    0.712144870   0.841281503   0.538760048  -0.294530312   0.102296134
##   [76]    1.483304548  -0.627087590   0.259053811   0.319740755   1.355136233
##   [81]    0.896991898  -0.734570132   1.122664612   1.184721976  -2.977313023
```

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```
##  [86]    0.327062117   -1.611257480    0.004514778    0.611059211   -0.182602639
##  [91]   -1.505839746    0.664595027    1.366739386    0.181759584   -1.198037556
##  [96]   -1.042057765   -1.353422854    1.212997288   -1.180037010    0.228037377
## [101]    0.479059748   -0.733403647   -0.462320683    1.666551772   -0.291334035
## [106]    0.085588133   -0.509490233   -2.262144858   -1.536722564   -1.127985082
## [111]   -1.458489167   -1.921100145   -1.722604342   -0.473431097   -0.153654955
## [116]    0.010393208   -0.265313644   -0.167370631    0.938537593   -0.832381379
## [121]   -0.023229136    0.025997113   -0.621867739    1.425679827   -0.484490155
## [126]   -0.667620580    0.339617699   -1.044900250   -7.654105364   -4.344239213
## [131]   -4.211777185   -2.567187905   -1.488731638    2.146791744    2.659604172
## [136]    4.641308603    2.029233134    0.050516146   -0.476836417   -0.542613365
## [141]   -2.400569914   -2.213994366   -2.201421602   -0.216812794   -0.161113071
## [146]    0.358172009   -0.320252319   -1.809030597   -0.199244931   -1.264913951
## [151]   -1.034539488   -0.115980364    0.336290383    3.077326342    1.530588360
## [156]   -0.893014297    1.362252043    0.075370423   -1.355678458   -0.907517305
## [161]    0.168197548    1.113499618    2.575129209    2.095707092    4.402838255
## [166]    1.267825915    0.979382921    0.864440227    0.311457881   -0.726022010
## [171]    0.985275168    0.482414645   -0.605322872   -0.530343335   -0.196086469
## [176]   -1.438594474   -2.841266532   -0.201651064   -0.878364136   -3.654268980
## [181]    2.090904513    1.337924283    1.279199290    1.191648899    1.031511414
## [186]   -0.255439537   -0.265459919    0.593485123    2.210263732    3.141674781
## [191]   -0.595953373   -0.691387212    0.668761688    1.192528275    1.089190492
## [196]    1.901958138    1.135987575   -0.297936610   -1.893705616    0.928953754
## [201]    0.457138893    1.261508996   -0.735913811    5.211071016    6.194273933
## [206]    3.409695044    2.926923971   -4.519697709    1.146276773    1.350204557
## [211]   -0.778915277    0.666131583   -1.761344484    0.494227205   -0.270673216
## [216]    0.326004643   -1.749861060    0.964610066   -0.859954393   -0.406109146
## [221]   -4.009485592   -3.478685852   -0.519053429    3.197533241   -0.625600830
## [226]   -1.088453267   -0.607239595   -0.751950655    1.159511970    0.783004352
## [231]    1.402881831    1.105892290    1.373610916    4.694122221    2.202330778
## [236]   -2.422276255   -1.371382167    0.510162730    0.455386746    1.187166464
## [241]   -0.923317101    0.917087546    1.014291771    1.914832303    1.041356029
## [246]   -0.377581718   -0.419231683    0.002212820    0.637981847   -0.044278528
## [251]    0.597890533    1.135485254    0.473924958    0.220445123    0.438159903
## [256]    0.067062254   11.711618989   10.730881976    8.526737665    7.334232565
## [261]    4.917110733    5.810171784   -0.065926148   -2.652078323   -3.824360275
## [266]   -6.822718623   -5.920695727   -7.041374102   -4.664156633   -3.472172848
## [271]   -1.304978332    6.215197769    7.340506147    0.549954652    0.890570463
## [276]   -1.097378244    0.210047616    0.860266588   -0.232232834   -7.813883247
## [281]   -2.769449562   -3.473985620   -0.865736503    0.077780341    4.041527745
## [286]    2.596760977    3.773980002    3.097352655   -3.614258298    0.170299812
## [291]    1.355530717   -1.418994222   -2.910835794   -1.844326284    0.396576853
## [296]   -0.563226309   -0.172510489   -0.292160907   -1.059572478   -0.521382040
## [301]   -0.579118840   -0.239679100   -0.044394408    0.654076259    1.249927609
## [306]   -0.921165130    0.461721555    0.164342744   -1.255756031   -0.960328600
## [311]   -0.302369820   -0.473751882   -0.920037516   -1.376947520    1.938055551
## [316]   -0.678083855    0.914282972    1.774739969    0.403475511   -1.103215022
## [321]   -1.490667268   -0.776425950   -2.199752311   10.619908228   11.893521614
## [326]    7.511849706    4.538050141    5.022518771   -0.266383676   -2.887240684
## [331]   -7.454943479   -8.590851473  -10.779031638   -1.754186001   -0.680575956
## [336]   -0.023912233    1.787086142    1.057231193    0.581615225    1.288582849
## [341]    1.882200475    0.711592066   -0.329210033   -0.117529280   -1.975162743
## [346]    0.457164761    1.071441355   -0.972120829   -1.402157821    1.138359595
## [351]    1.638840893   -0.389361526    1.147011830    1.179500526   -1.954216794
```

```
## [356]  -2.221485904  -1.856152027   1.095321819  -0.176525180  -1.144583926
## [361]   0.604907334   1.162279725  -0.577277600  -0.201551519  -0.391746822
## [366]   0.752070797   1.010982937   0.756395474   2.783955588   0.428771330
## [371]  -1.133137302  -2.337726274   1.750419504   0.915666102   0.424154669
## [376]  -0.083359883   2.736434940  -2.669074143  -1.165587464   0.109488358
## [381]  -1.952212035   1.742209968   0.550584397   0.205658588  -0.542395318
## [386]   0.702605312  -0.039814397   1.270603684   0.673794647   0.881256690
## [391]   1.272268434  -1.541934062   0.390875257   0.234118172   0.837531799
## [396]   0.154294921   0.337050790   0.040667817   0.207289723   1.701784835
## [401]   0.797563908   1.115070296   0.766692447  -0.064216505   1.150687477
## [406]   2.354988032   0.485077447  -1.466602339  -0.627119560   0.536119779
## [411]  -0.923314103   0.439946032   0.242307138  -1.001273186  -0.866016201
## [416]   0.039522381   0.471620243  -0.932020075   1.251659497  -1.164809039
## [421]   0.504392305  -0.117766827   0.219429033  -0.399353898   0.053944052
## [426]   0.464611979  -0.775409363   0.495327832   1.132787931   2.077475195
## [431]  -3.056136663   0.591329653  -0.202467120  -1.635454306  -1.689052070
## [436]   0.438786201   1.557632354  -0.253784726   0.022534938   1.145603142
## [441]  -0.795369449   1.035323008  -0.001602128  -0.163275061   0.397096523
## [446]   0.737376799  -3.110522511   1.235374586  -0.097688101   3.994799888
## [451]  -2.336147419  -1.984749719   0.878035734   0.137034039   0.741699635
## [456]   0.051021454  -0.272839641  -6.090789281  -7.532774092  -5.803326849
## [461]  -4.451113170  -2.230812388   3.688185571   6.873150254
```

```r
min(diff)
```

```
## [1] -10.77903
```

```r
max(diff)
```

```
## [1] 11.89352
```

```r
##true value of E is 1
traceplot(x=as.mcmc(E_keep[-(1:burnin)]), ylab="E")
```