Beta_p estimations vs rq() coefficients on mtcars

mtcars Dataset

The data was extracted from the 1974 Motor Trend US magazine, and comprises fuel consumption and 10 aspects of automobile design and performance for 32 automobiles (1973–74 models).

```
head(mtcars)
```

```
##                   mpg cyl disp  hp drat    wt  qsec vs am gear carb
## Mazda RX4         21.0   6  160 110 3.90 2.620 16.46  0  1    4    4
## Mazda RX4 Wag     21.0   6  160 110 3.90 2.875 17.02  0  1    4    4
## Datsun 710        22.8   4  108  93 3.85 2.320 18.61  1  1    4    1
## Hornet 4 Drive    21.4   6  258 110 3.08 3.215 19.44  1  0    3    1
## Hornet Sportabout 18.7   8  360 175 3.15 3.440 17.02  0  0    3    2
## Valiant           18.1   6  225 105 2.76 3.460 20.22  1  0    3    1
```

Model: mpg ~ cyl+drat+vs

Data types: mpg: Real data, Miles/(US) gallon
cyl: Integer/Count data, number of cylinders
drat: Real data, Rear axle ratio
vs: Binary data, Engine (0 = V-shaped, 1 = straight)

Quantreg

```
rqfit <- rq(mpg ~ cyl+drat+vs, data = mtcars, tau = quantiles)
summary(rqfit)
```

```
## Warning in rq.fit.br(x, y, tau = tau, ci = TRUE, ...): Solution may be nonunique
```

```
##
## Call: rq(formula = mpg ~ cyl + drat + vs, tau = quantiles, data = mtcars)
##
## tau: [1] 0.1
##
## Coefficients:
##             coefficients lower bd  upper bd
## (Intercept)  20.10375     13.58876  85.29796
## cyl          -2.54063     -4.71292  -1.36945
## drat          3.62500    -10.81283   4.40818
## vs           -1.85375     -3.00296   5.83125
```

```
##
## Call: rq(formula = mpg ~ cyl + drat + vs, tau = quantiles, data = mtcars)
##
## tau: [1] 0.5
##
## Coefficients:
##             coefficients lower bd upper bd
## (Intercept) 34.74953      9.74342 42.26316
## cyl         -2.66449     -3.01620 -1.14358
## drat         0.56075     -0.67615  4.67960
## vs          -1.76075     -3.03684  2.16945
##
## Call: rq(formula = mpg ~ cyl + drat + vs, tau = quantiles, data = mtcars)
##
## tau: [1] 0.9
##
## Coefficients:
##             coefficients lower bd  upper bd
## (Intercept)  -3.53871    -51.55192  89.33789
## cyl           0.23952     -7.75896   2.11267
## drat          6.45161     -2.65866  16.07341
## vs            8.65806    -13.09164   9.45551
```

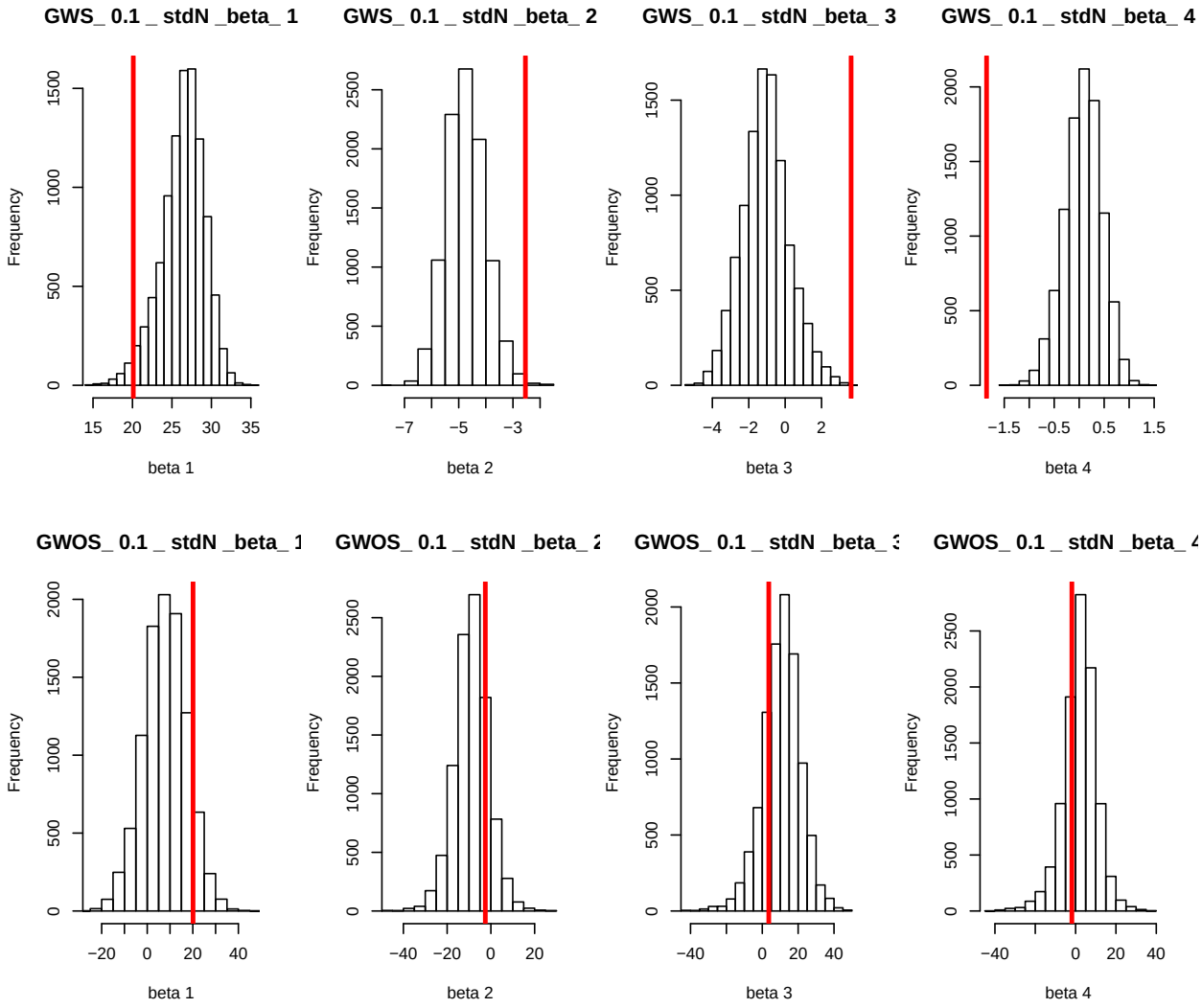
Beta_p estimations vs rq() coefficients

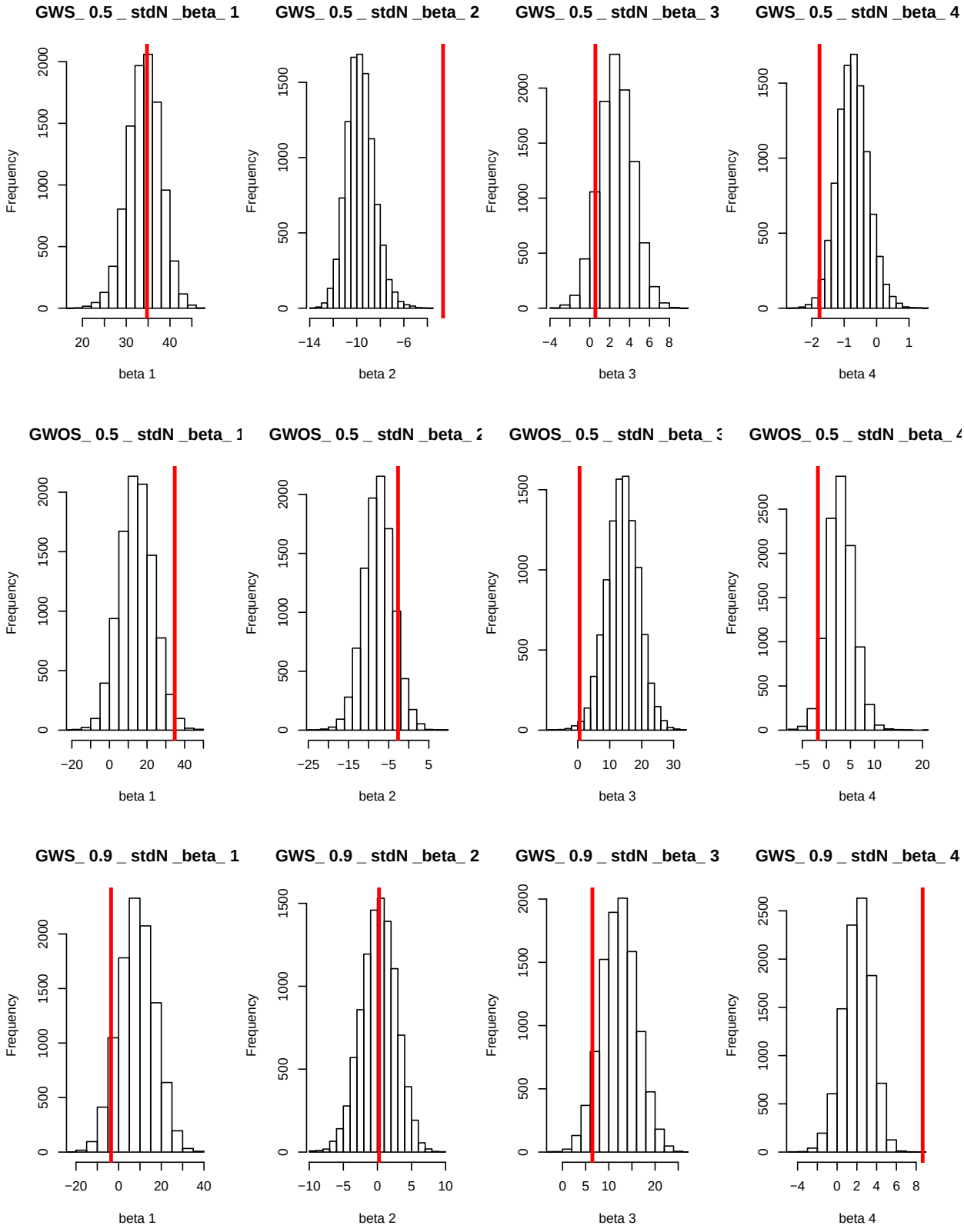
The plot titles are formatted as (sampling method)*(quantile)*(error distribution)_(beta_p). The histograms are the beta_p estimations yielded by the paper's model. The red horizontal line reflects rq() beta coefficients. The absence of red lines in some plots reflects big difference in our beta_p estimations and the rq() results.

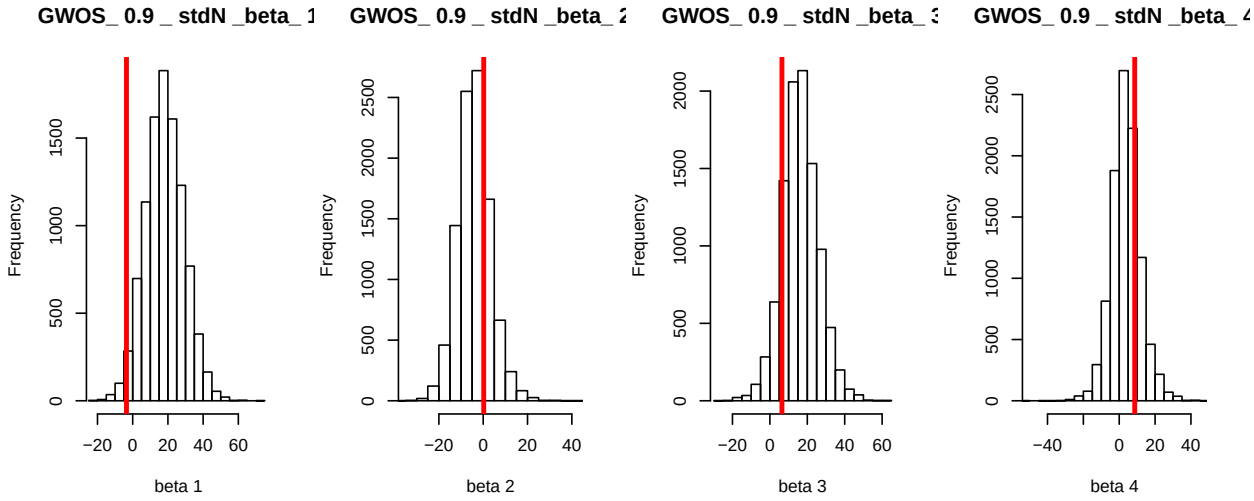
Notations:

GWS: Gibbs sampler of the asymmetric Laplace distribution (ALD) with Scale parameter
GWOS: Gibbs sampler of the asymmetric Laplace distribution (ALD) without Scale parameter
stdN: Standard Normal Prior
beta_1: Intercept
beta_2: Regression coefficient associated with cyl
beta_3: Regression coefficient associated with drat
beta_4: Regression coefficient associated with vs

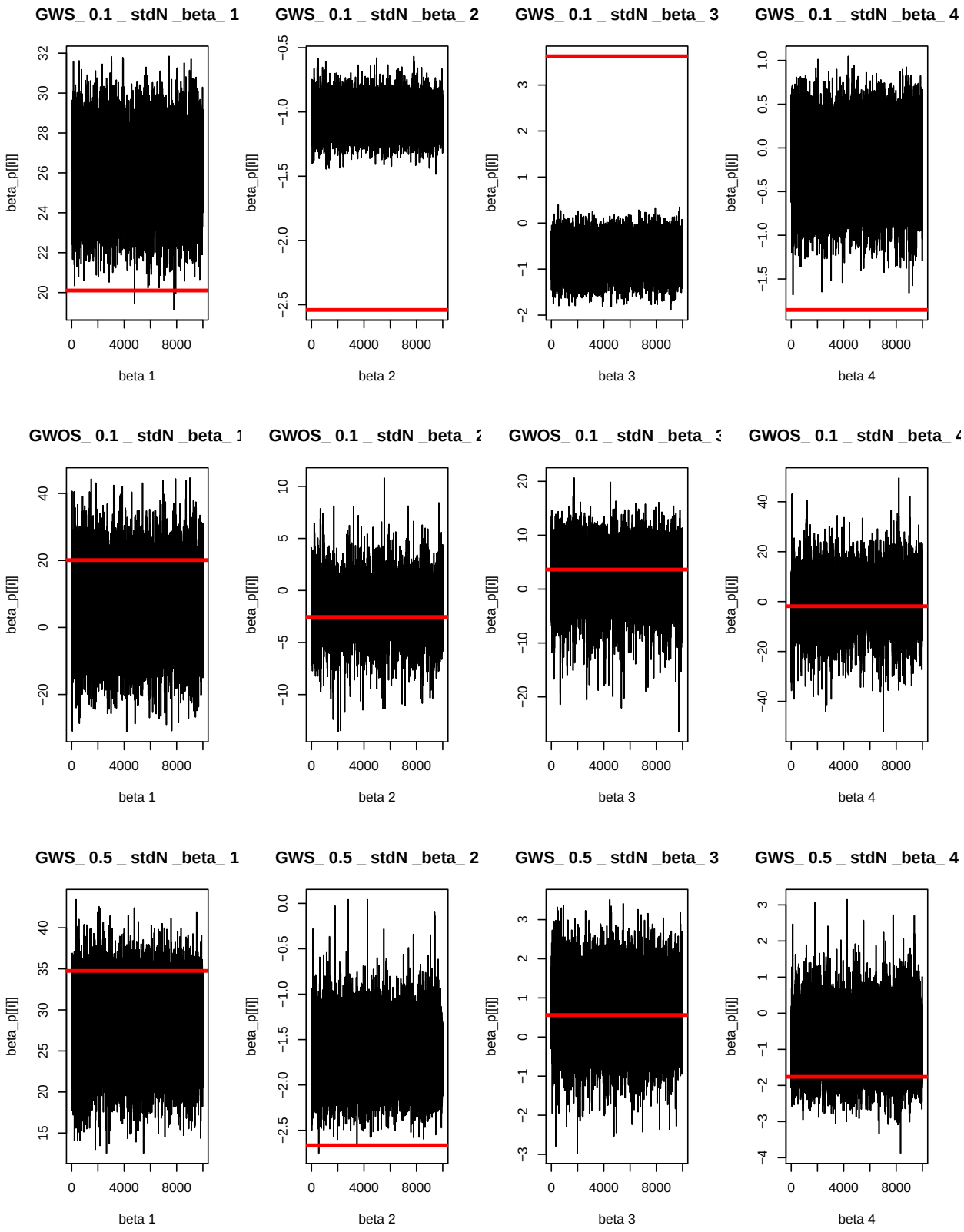
Histograms

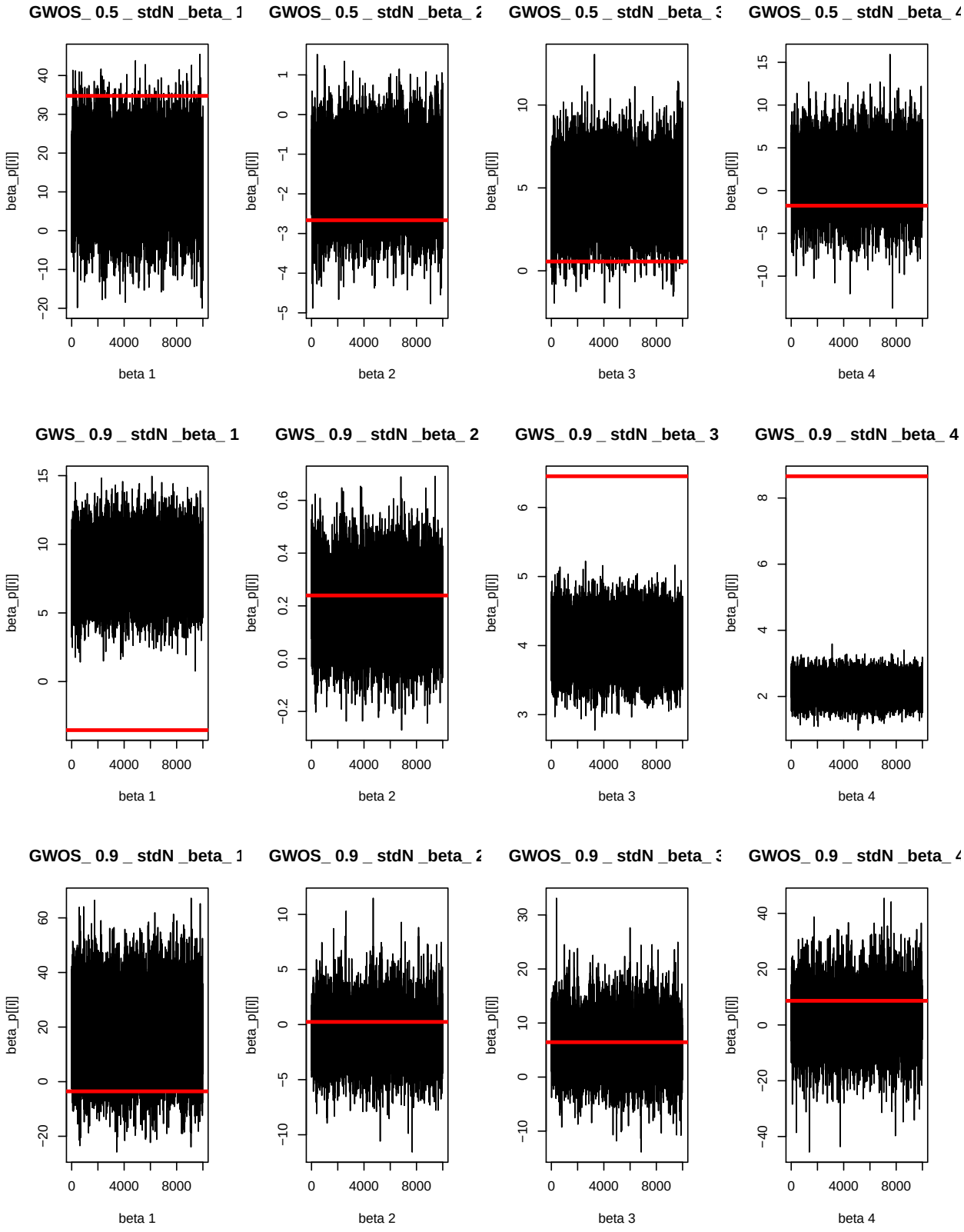



GWS_ 0.5 _ stdN _beta_ 1
GWS_ 0.5 _ stdN _beta_ 2
GWS_ 0.5 _ stdN _beta_ 3
GWS_ 0.5 _ stdN _beta_ 4
GWOS_ 0.5 _ stdN _beta_ 1
GWOS_ 0.5 _ stdN _beta_ 2
GWOS_ 0.5 _ stdN _beta_ 3
GWOS_ 0.5 _ stdN _beta_ 4
GWS_ 0.9 _ stdN _beta_ 1
GWS_ 0.9 _ stdN _beta_ 2
GWS_ 0.9 _ stdN _beta_ 3
GWS_ 0.9 _ stdN _beta_ 4
Frequency
beta 1
beta 2
beta 3
beta 4


GWOS_ 0.9 _ stdN _beta_ 1
Frequency
0
500
1000
1500
−20
0
20
40
60
beta 1
GWOS_ 0.9 _ stdN _beta_ 2
Frequency
0
500
1000
1500
2000
2500
−20
0
20
40
beta 2
GWOS_ 0.9 _ stdN _beta_ 3
Frequency
0
500
1000
1500
2000
−20
0
20
40
60
beta 3
GWOS_ 0.9 _ stdN _beta_ 4
Frequency
0
500
1000
1500
2000
2500
−40
0
20
40
beta 4

Traceplots


GWS_ 0.1 _ stdN _beta_ 1
GWS_ 0.1 _ stdN _beta_ 2
GWS_ 0.1 _ stdN _beta_ 3
GWS_ 0.1 _ stdN _beta_ 4
GWOS_ 0.1 _ stdN _beta_ 1
GWOS_ 0.1 _ stdN _beta_ 2
GWOS_ 0.1 _ stdN _beta_ 3
GWOS_ 0.1 _ stdN _beta_ 4
GWS_ 0.5 _ stdN _beta_ 1
GWS_ 0.5 _ stdN _beta_ 2
GWS_ 0.5 _ stdN _beta_ 3
GWS_ 0.5 _ stdN _beta_ 4
beta_p[[i]]
beta 1
beta 2
beta 3
beta 4
0
4000
8000


GWOS_ 0.5 _ stdN _beta_ 1
GWOS_ 0.5 _ stdN _beta_ 2
GWOS_ 0.5 _ stdN _beta_ 3
GWOS_ 0.5 _ stdN _beta_ 4
GWS_ 0.9 _ stdN _beta_ 1
GWS_ 0.9 _ stdN _beta_ 2
GWS_ 0.9 _ stdN _beta_ 3
GWS_ 0.9 _ stdN _beta_ 4
GWOS_ 0.9 _ stdN _beta_ 1
GWOS_ 0.9 _ stdN _beta_ 2
GWOS_ 0.9 _ stdN _beta_ 3
GWOS_ 0.9 _ stdN _beta_ 4
beta_p[[i]]
beta 1
beta 2
beta 3
beta 4
0
4000
8000