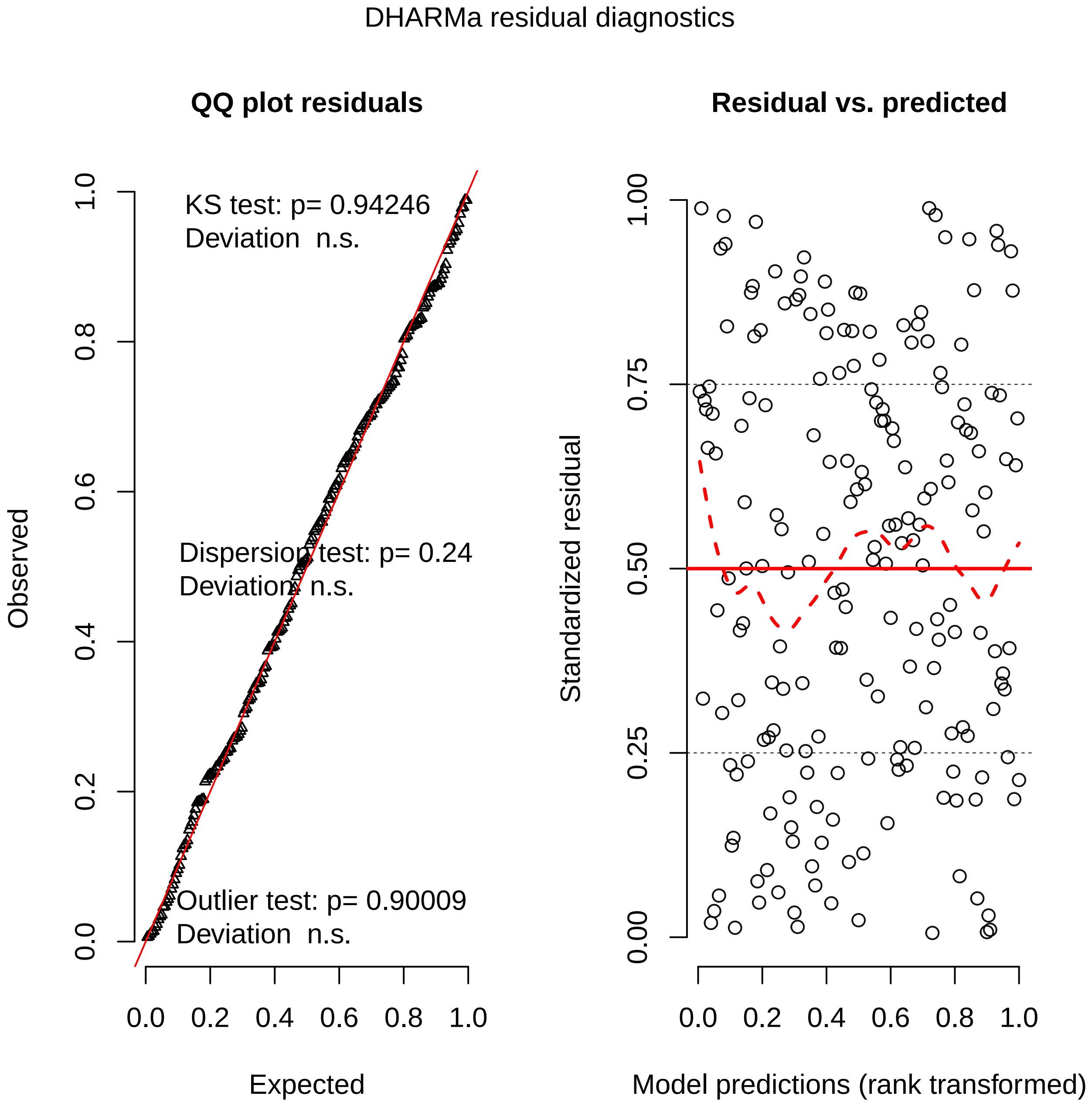
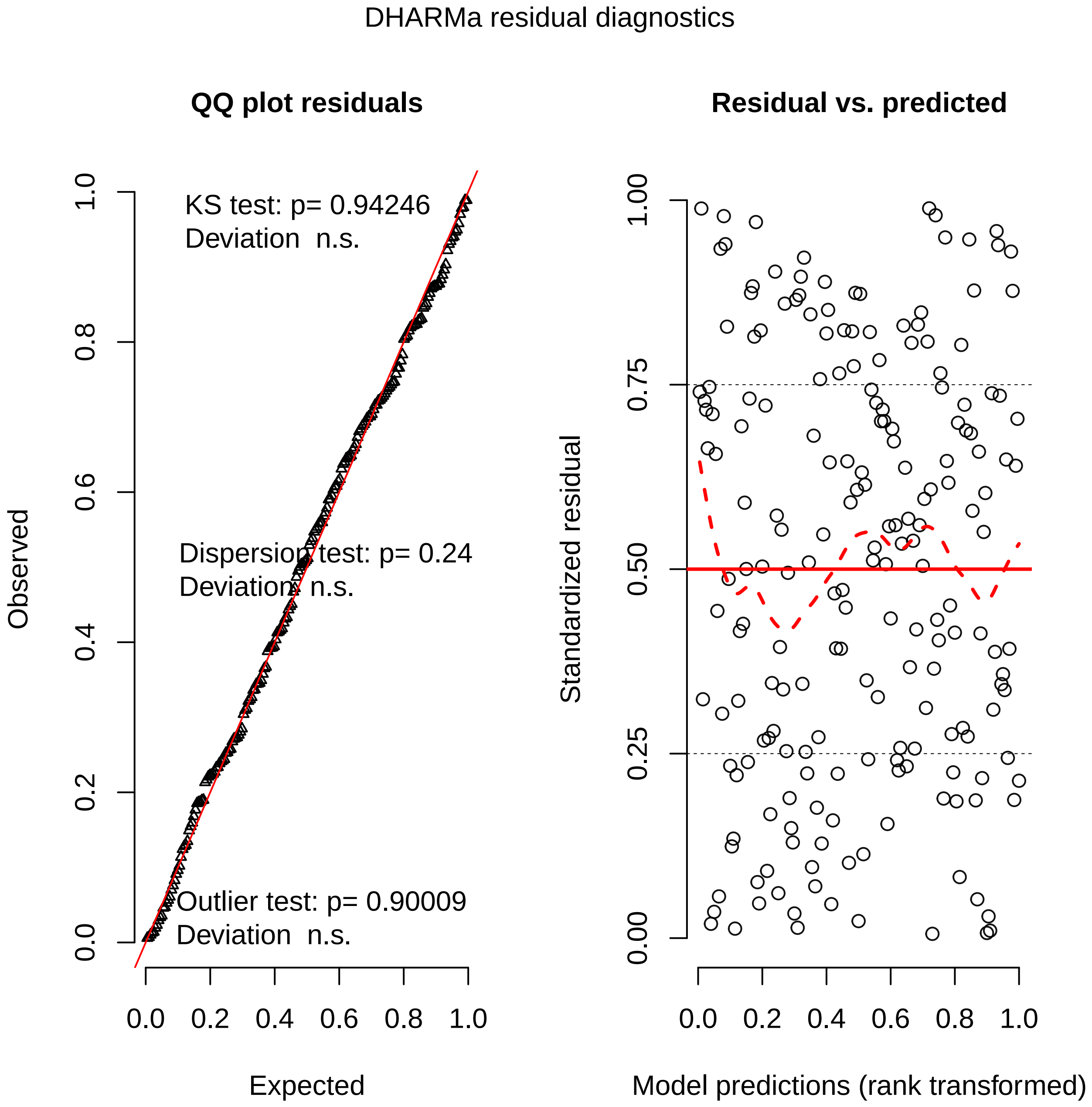
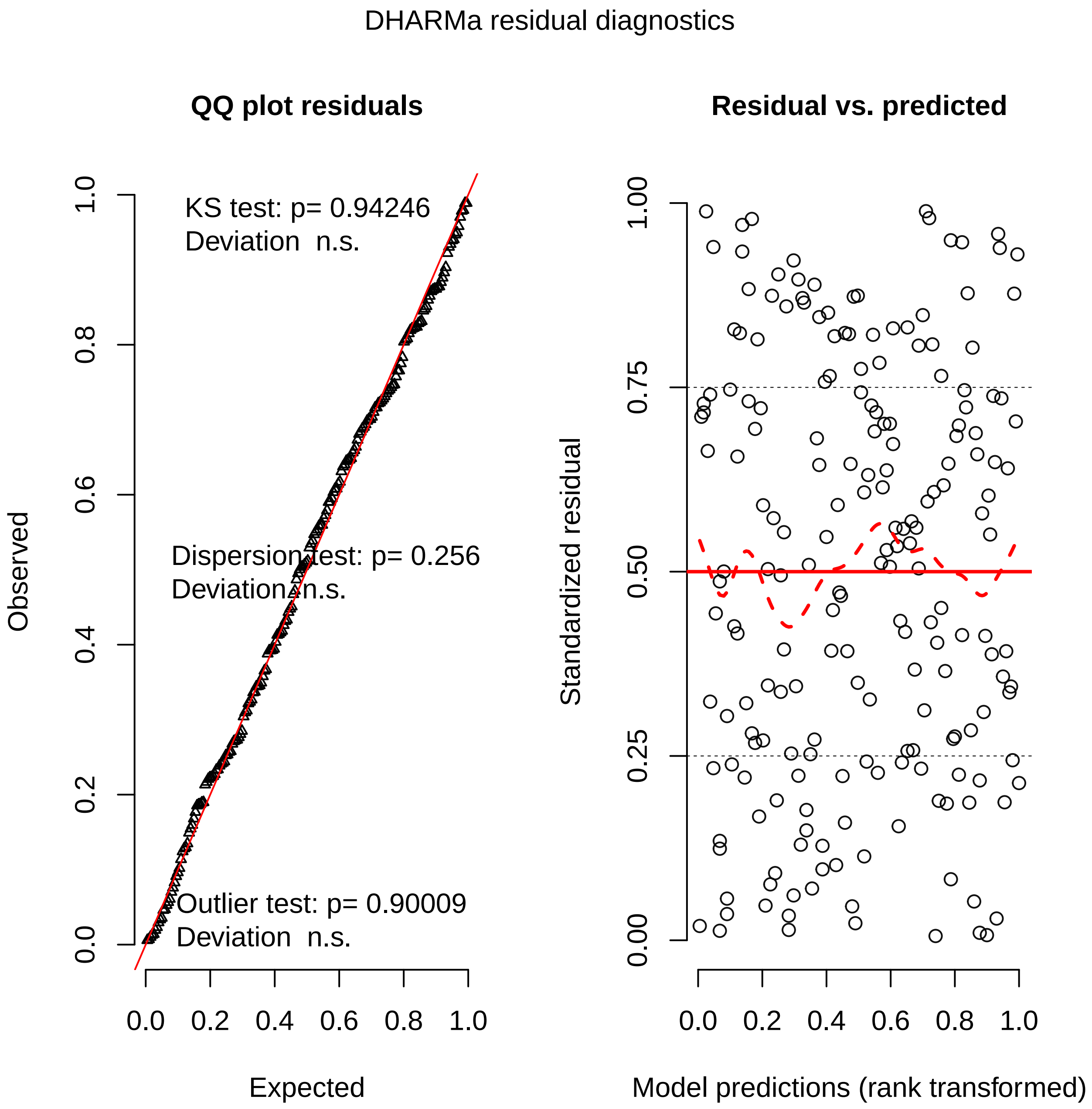
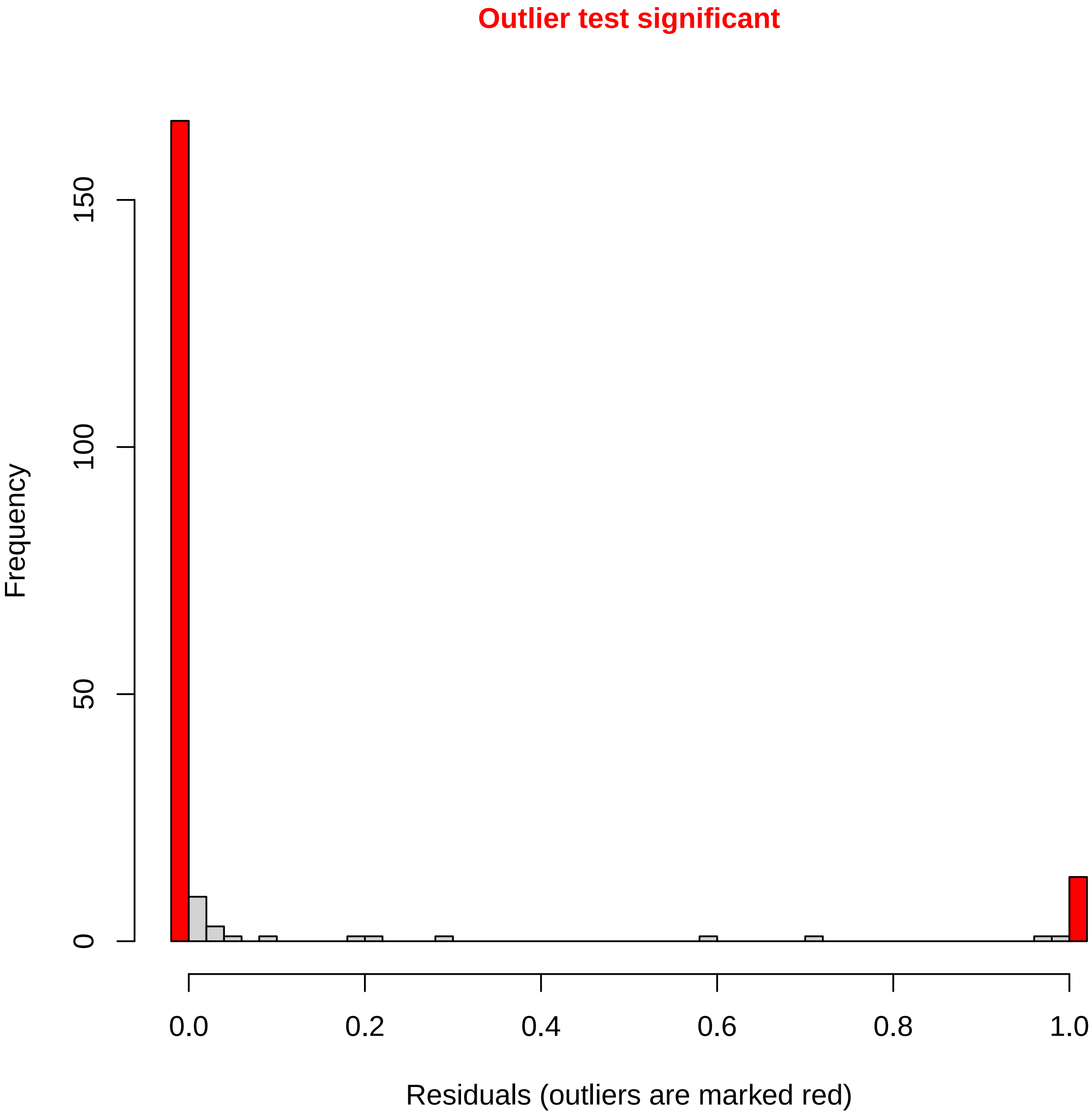
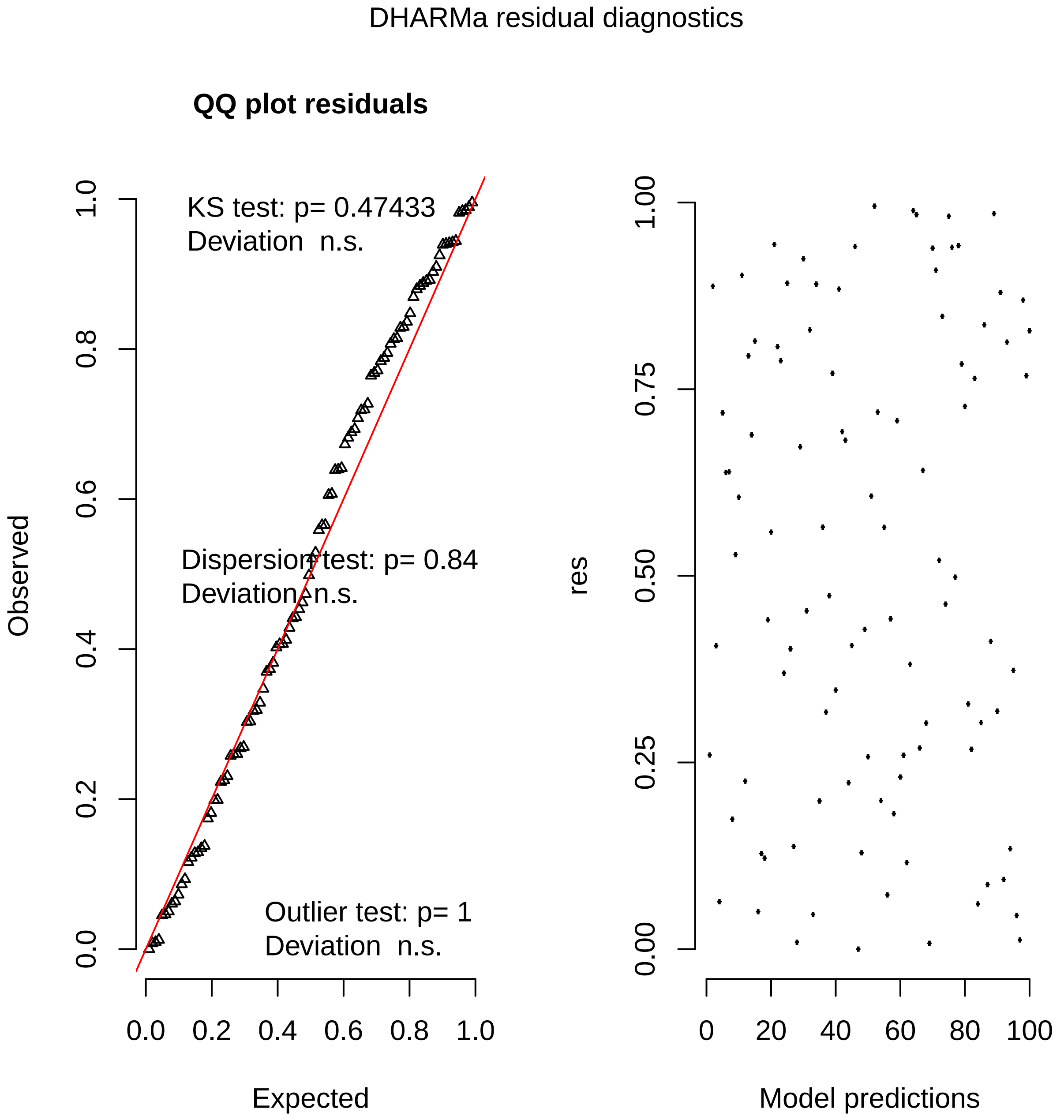
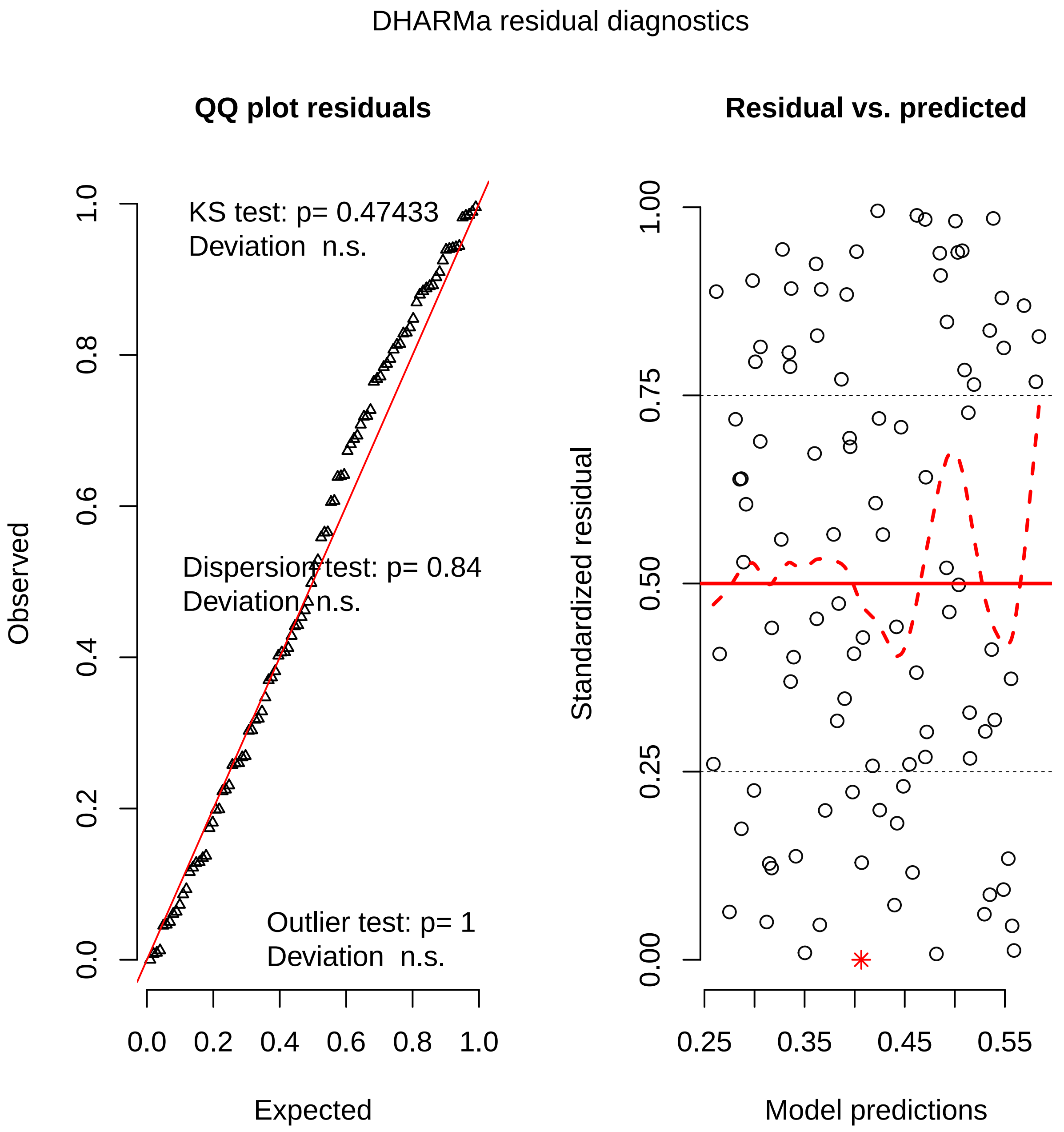

DHARMa residual diagnostics
QQ plot residuals
KS test: p= 0.94246
Deviation n.s.
Dispersion test: p= 0.24
Deviation n.s.
Outlier test: p= 0.90009
Deviation n.s.
Observed
Expected
0.0
0.2
0.4
0.6
0.8
1.0
Residual vs. predicted
Standardized residual
Model predictions (rank transformed)
0.00
0.25
0.50
0.75
1.00
0.0
0.2
0.4
0.6
0.8
1.0

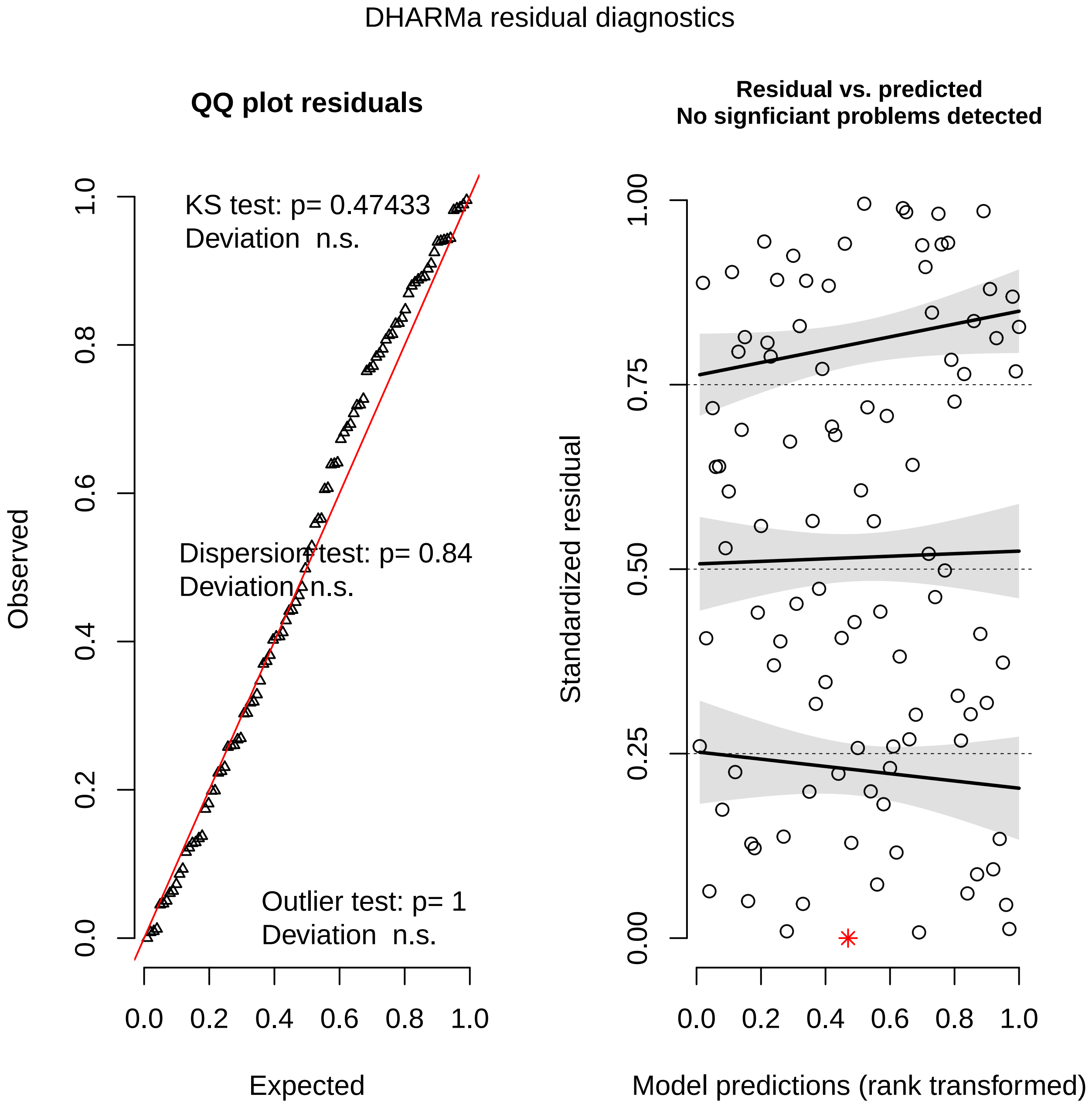

DHARMa residual diagnostics
QQ plot residuals
KS test: p= 0.94246
Deviation n.s.
Dispersion test: p= 0.24
Deviation n.s.
Outlier test: p= 0.90009
Deviation n.s.
Observed
Expected
0.0
0.2
0.4
0.6
0.8
1.0
Residual vs. predicted
Standardized residual
Model predictions (rank transformed)
0.00
0.25
0.50
0.75
1.00


DHARMa residual diagnostics
QQ plot residuals
KS test: p= 0.94246
Deviation n.s.
Dispersion test: p= 0.256
Deviation n.s.
Outlier test: p= 0.90009
Deviation n.s.
Observed
0.0
0.2
0.4
0.6
0.8
1.0
Expected
0.0
0.2
0.4
0.6
0.8
1.0
Residual vs. predicted
Standardized residual
0.00
0.25
0.50
0.75
1.00
Model predictions (rank transformed)
0.0
0.2
0.4
0.6
0.8
1.0

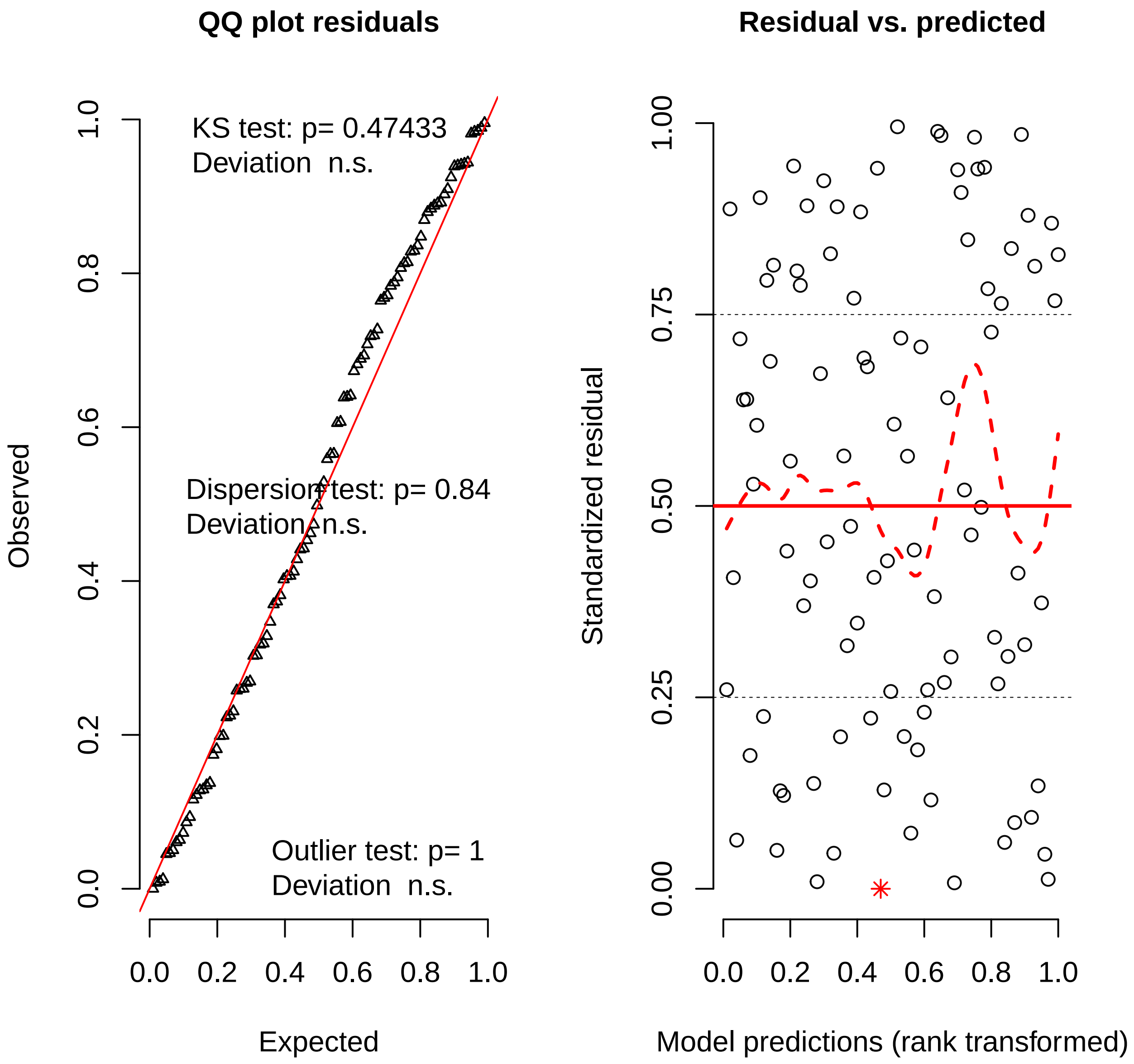

Outlier test significant
Frequency
0
50
100
150
0.0
0.2
0.4
0.6
0.8
1.0
Residuals (outliers are marked red)

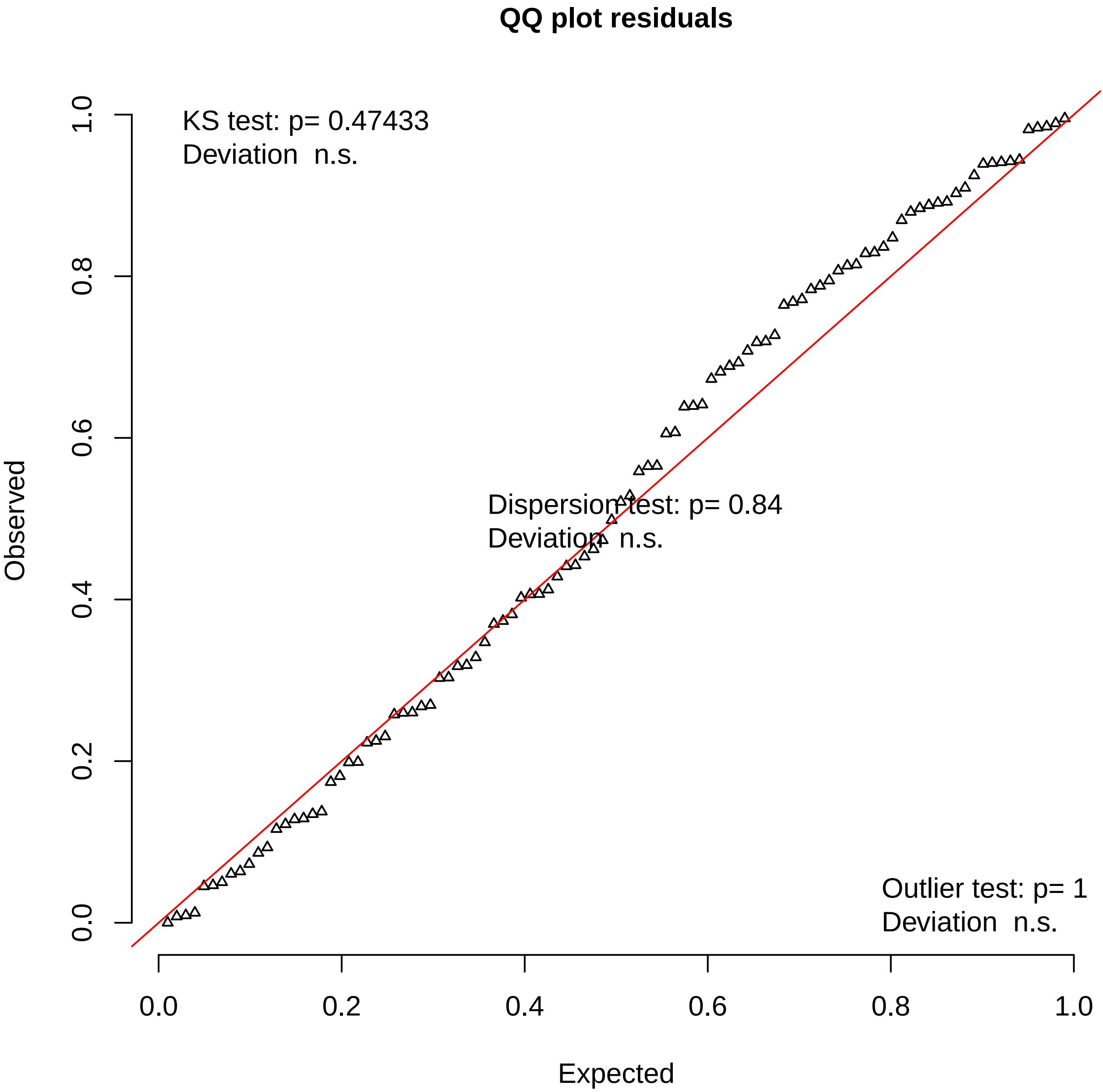

DHARMa residual diagnostics
QQ plot residuals
KS test: p= 0.47433
Deviation n.s.
Dispersion test: p= 0.84
Deviation n.s.
Outlier test: p= 1
Deviation n.s.
Observed
0.0
0.2
0.4
0.6
0.8
1.0
Expected
0.0
0.2
0.4
0.6
0.8
1.0
res
0.00
0.25
0.50
0.75
1.00
Model predictions
0
20
40
60
80
100

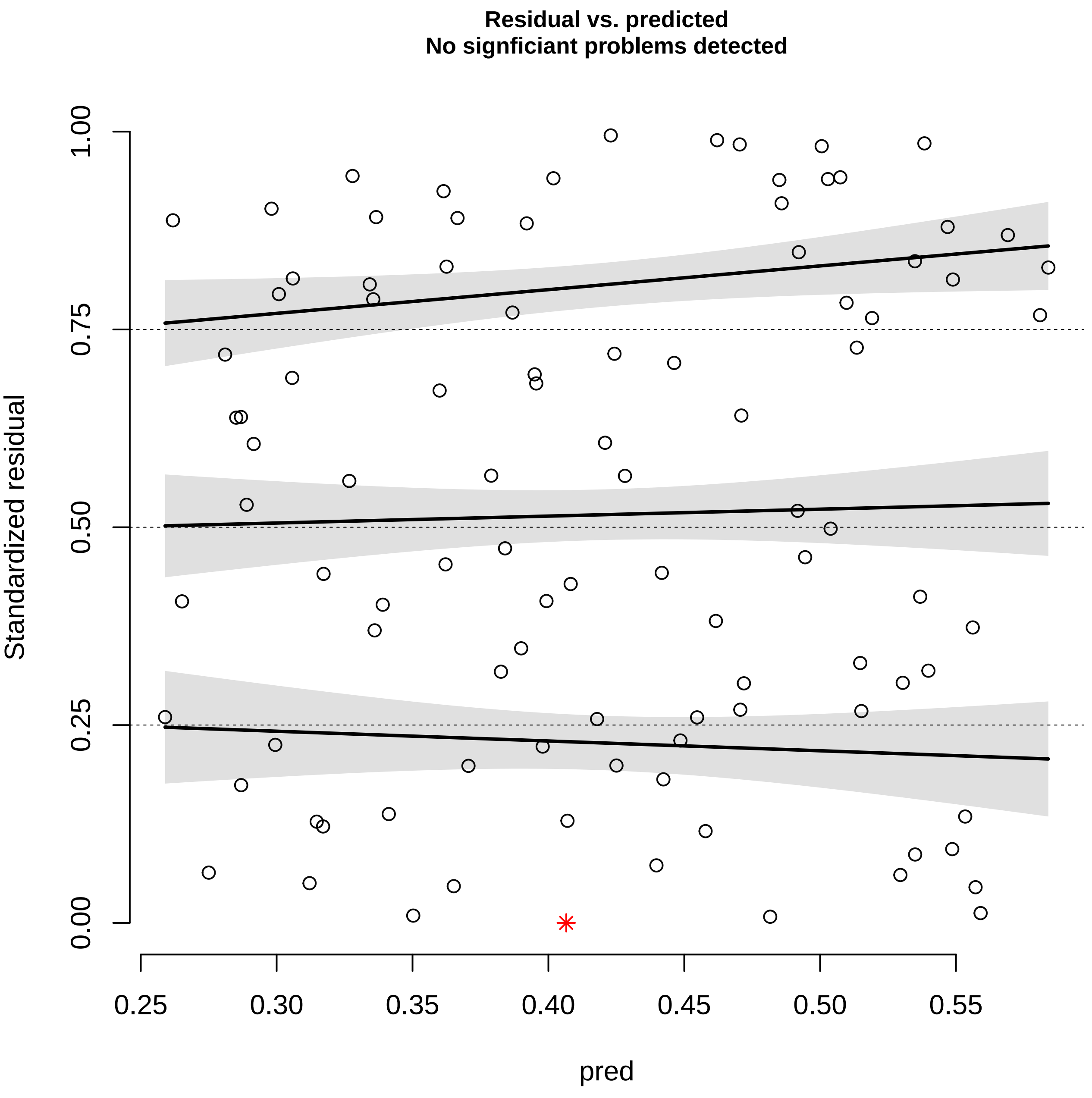

DHARMa residual diagnostics
QQ plot residuals
KS test: p= 0.47433
Deviation n.s.
Dispersion test: p= 0.84
Deviation n.s.
Outlier test: p= 1
Deviation n.s.
Observed
Expected
0.0
0.2
0.4
0.6
0.8
1.0
Residual vs. predicted
Standardized residual
Model predictions
0.00
0.25
0.50
0.75
1.00
0.25
0.35
0.45
0.55

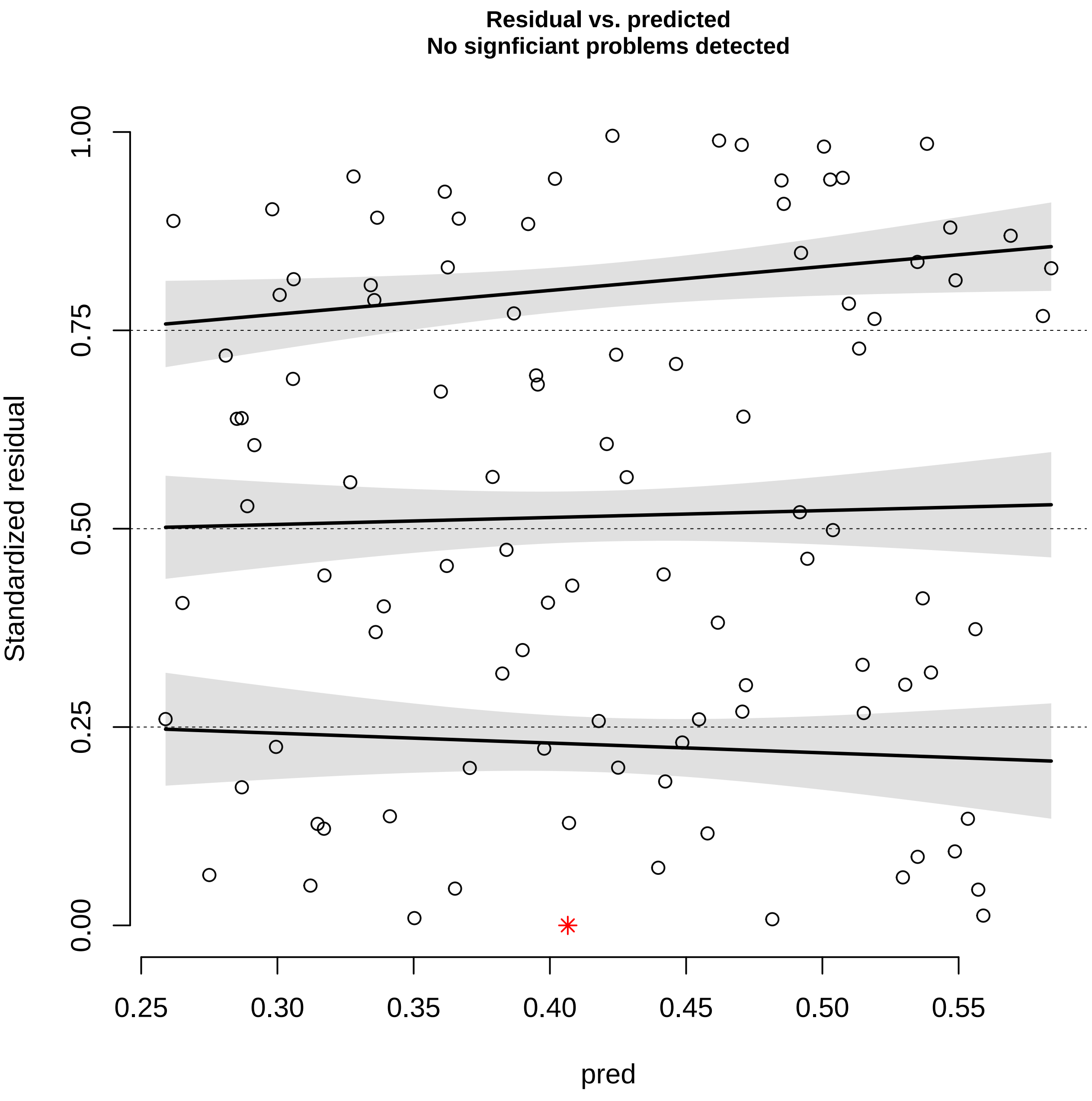

DHARMa residual diagnostics
QQ plot residuals
KS test: p= 0.47433
Deviation n.s.
Dispersion test: p= 0.84
Deviation n.s.
Outlier test: p= 1
Deviation n.s.
Observed
0.0
0.2
0.4
0.6
0.8
1.0
Expected
0.0
0.2
0.4
0.6
0.8
1.0
Residual vs. predicted
No signficiant problems detected
Standardized residual
0.00
0.25
0.50
0.75
1.00
Model predictions (rank transformed)
0.0
0.2
0.4
0.6
0.8
1.0

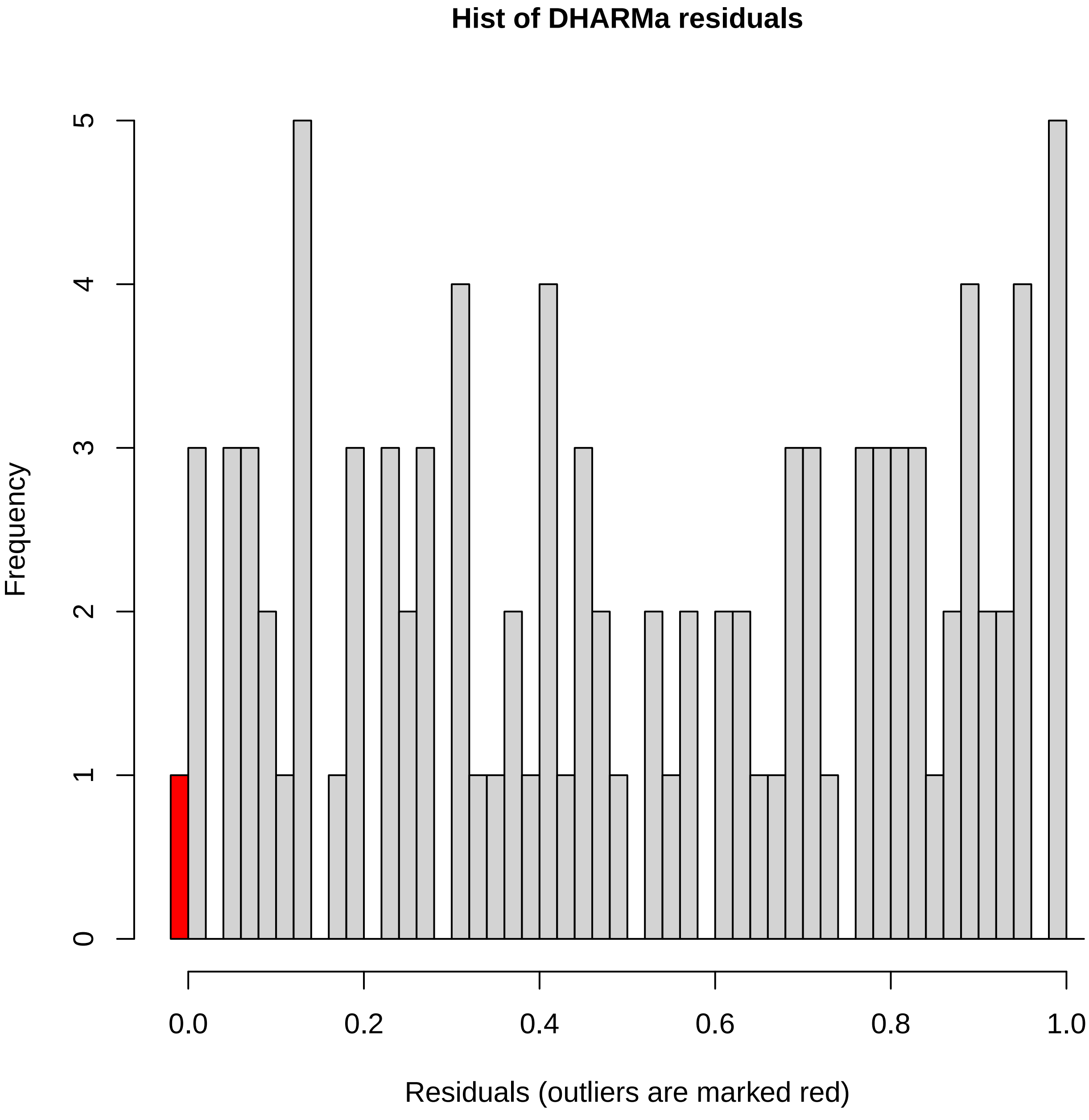
DHARMa residual diagnostics

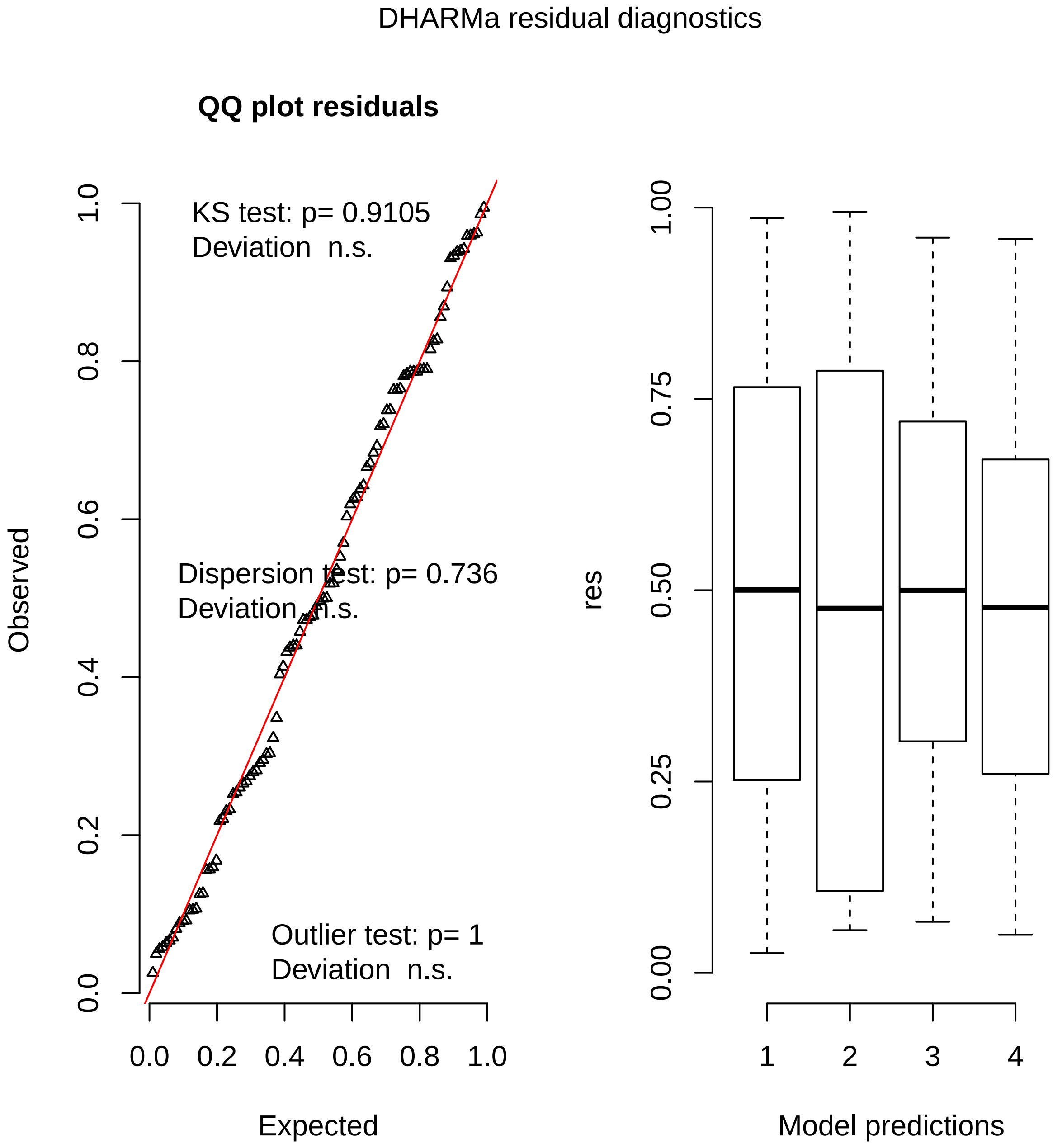


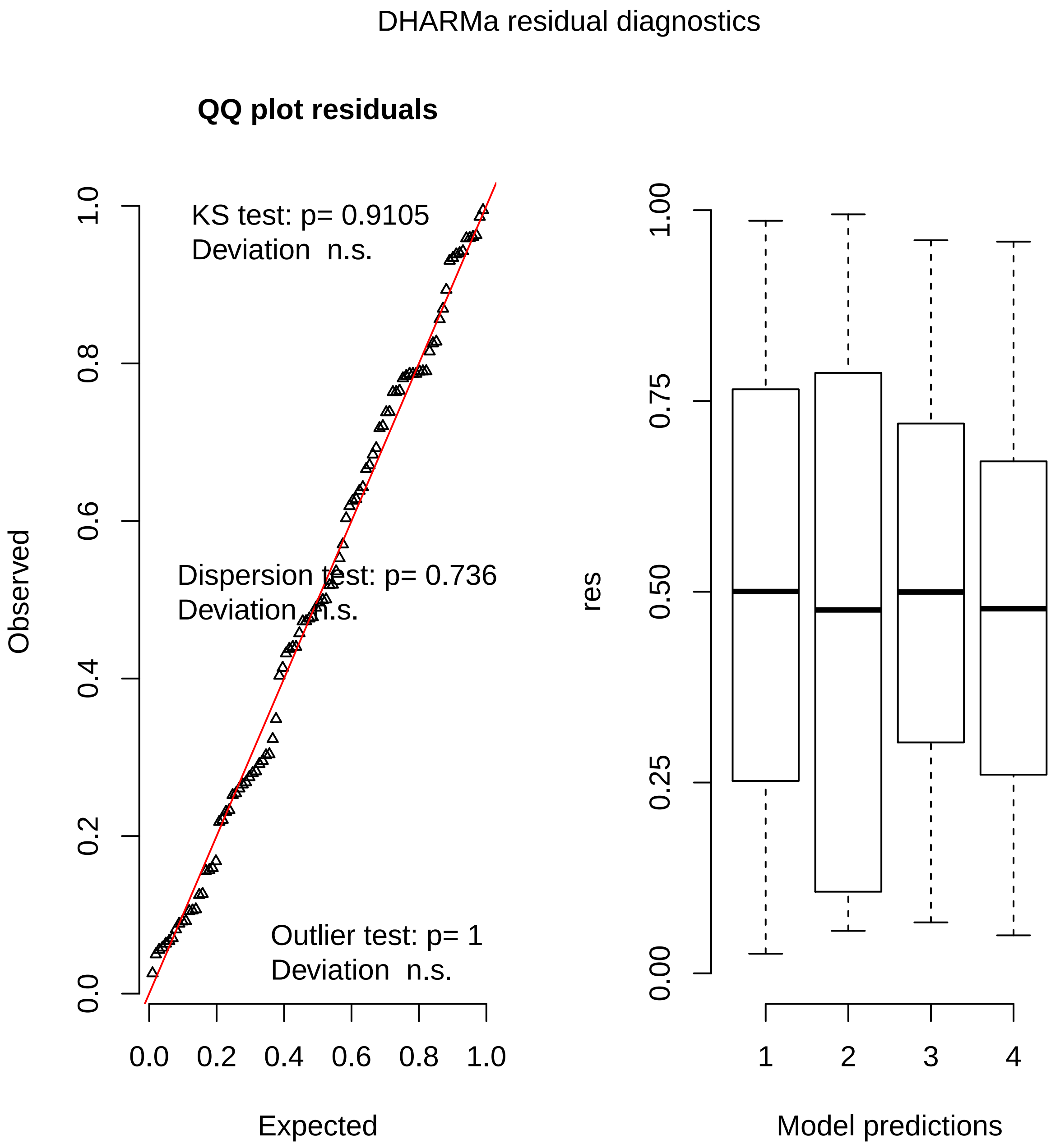

QQ plot residuals
KS test: p= 0.47433
Deviation n.s.
Dispersion test: p= 0.84
Deviation n.s.
Outlier test: p= 1
Deviation n.s.
Observed
Expected
0.0
0.2
0.4
0.6
0.8
1.0

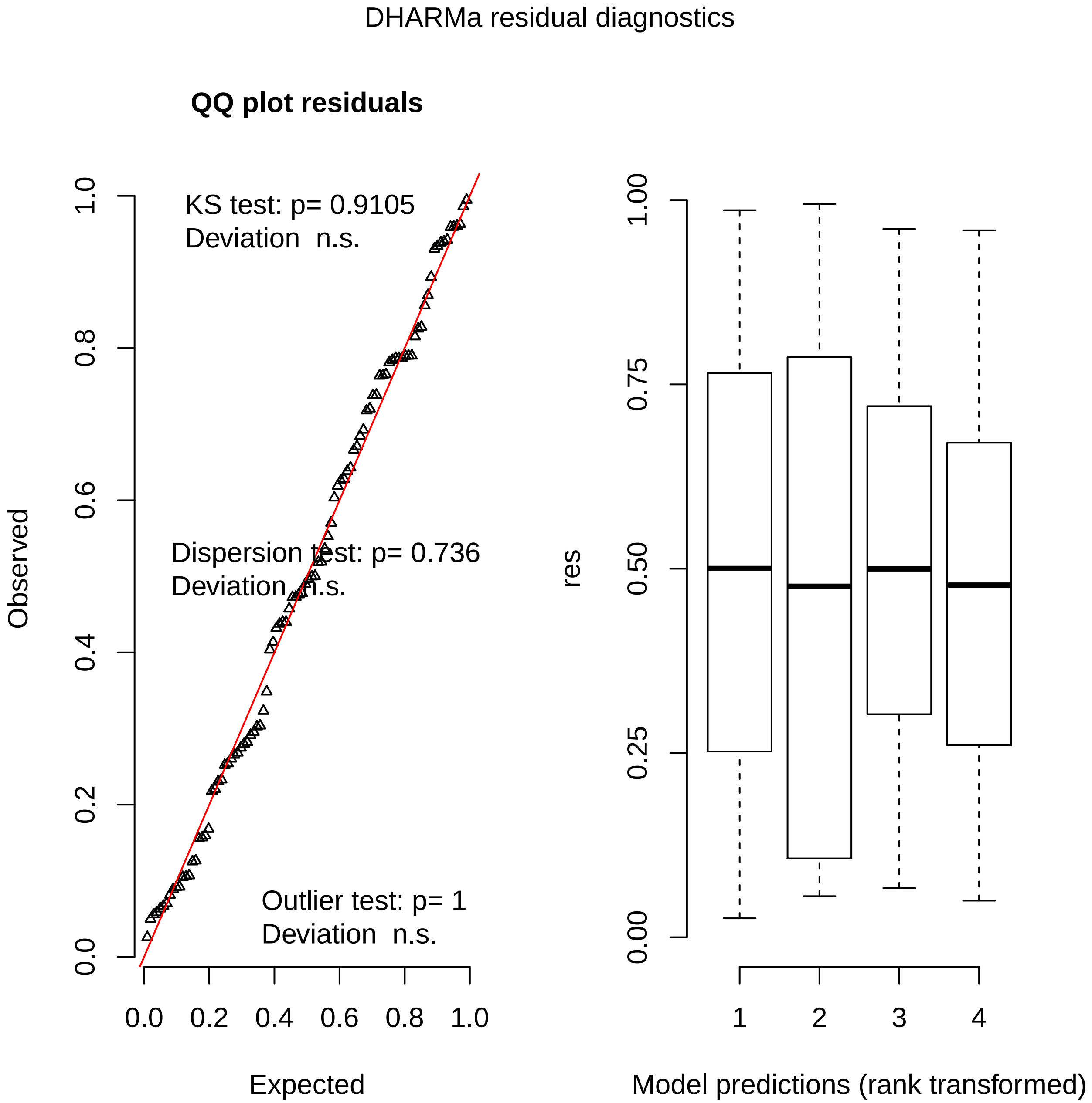

Residual vs. predicted
No signficiant problems detected
Standardized residual
0.00
0.25
0.50
0.75
1.00
0.25
0.30
0.35
0.40
0.45
0.50
0.55
pred

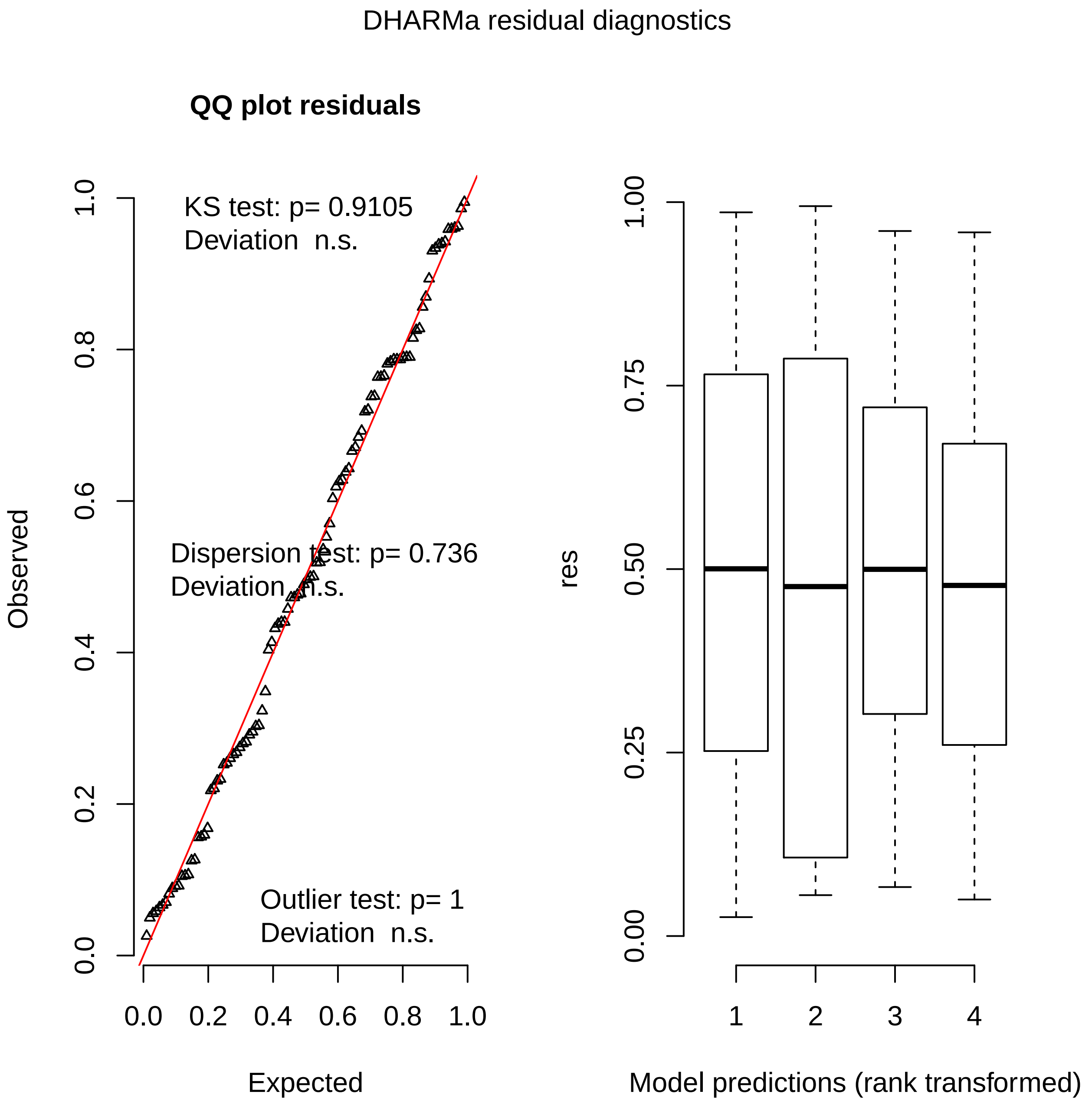

Residual vs. predicted
No signficiant problems detected
Standardized residual
0.00
0.25
0.50
0.75
1.00
pred
0.25
0.30
0.35
0.40
0.45
0.50
0.55

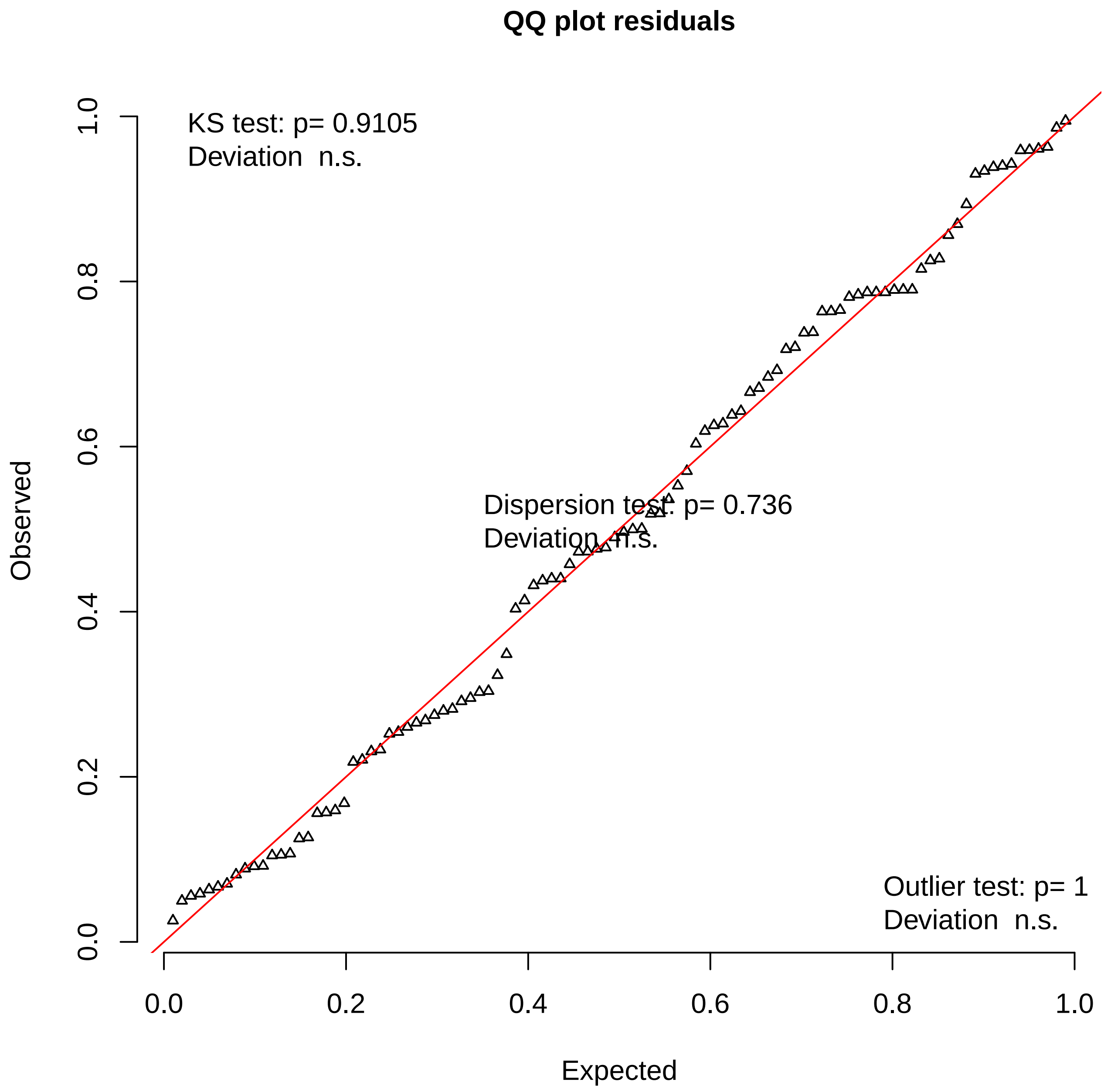

Hist of DHARMa residuals
Frequency
0
1
2
3
4
5
0.0
0.2
0.4
0.6
0.8
1.0
Residuals (outliers are marked red)

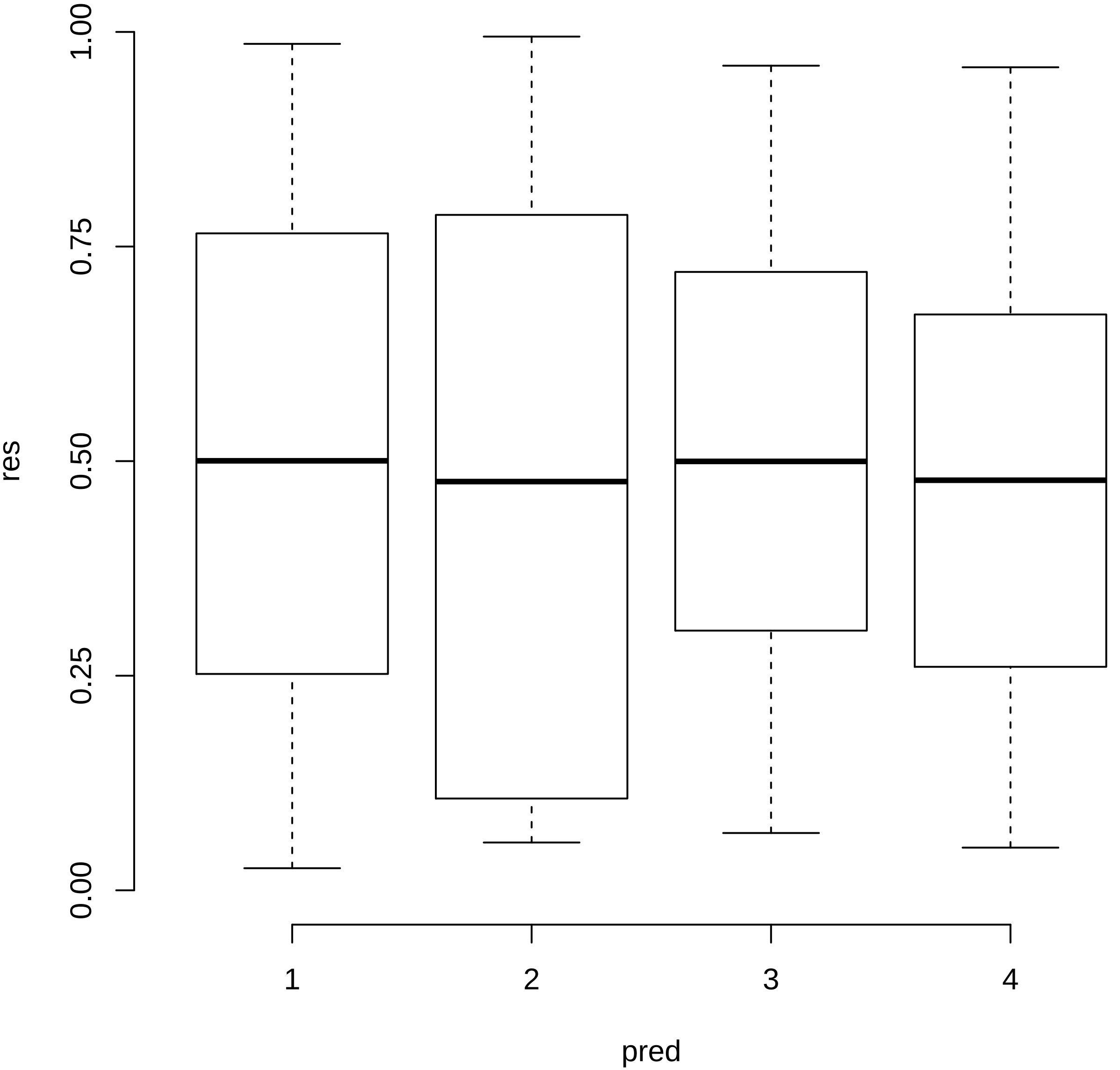

DHARMa residual diagnostics
QQ plot residuals
KS test: p= 0.9105
Deviation n.s.
Dispersion test: p= 0.736
Deviation n.s.
Outlier test: p= 1
Deviation n.s.
Observed
0.0
0.2
0.4
0.6
0.8
1.0
Expected
0.0
0.2
0.4
0.6
0.8
1.0
res
0.00
0.25
0.50
0.75
1.00
1
2
3
4
Model predictions

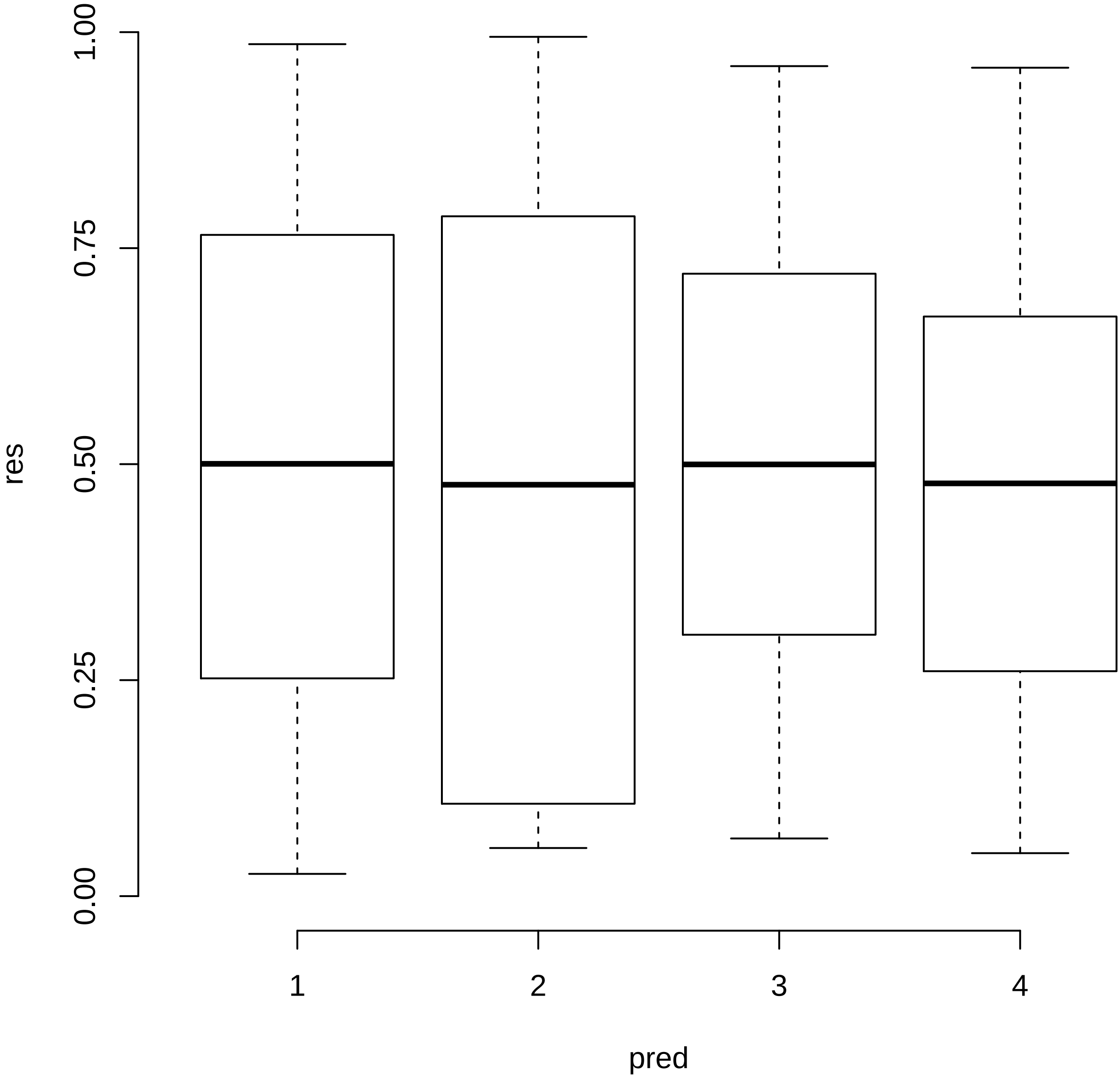

DHARMa residual diagnostics
QQ plot residuals
KS test: p= 0.9105
Deviation n.s.
Dispersion test: p= 0.736
Deviation n.s.
Outlier test: p= 1
Deviation n.s.
Observed
0.0
0.2
0.4
0.6
0.8
1.0
Expected
0.0
0.2
0.4
0.6
0.8
1.0
res
0.00
0.25
0.50
0.75
1.00
1
2
3
4
Model predictions

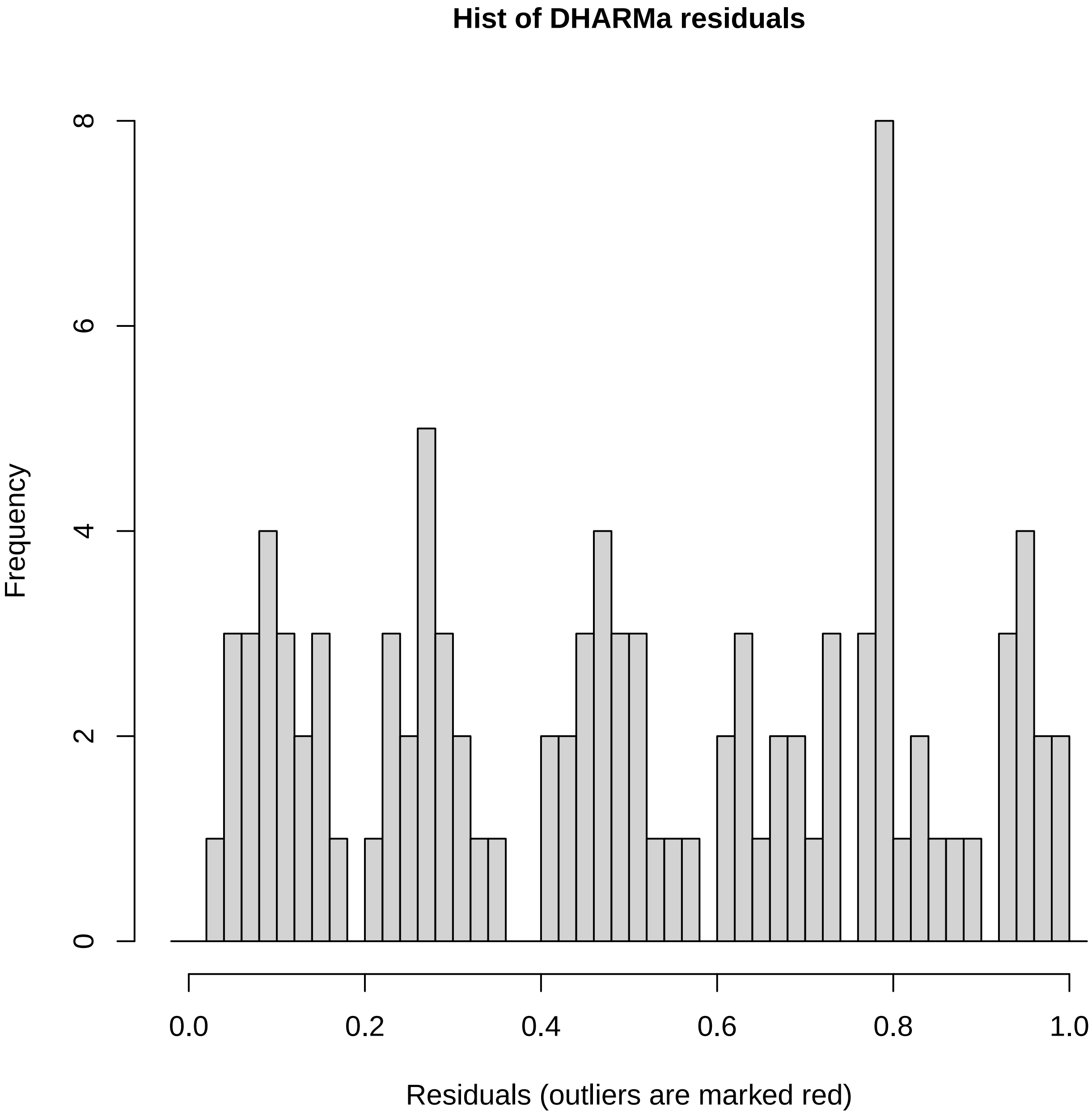

DHARMa residual diagnostics
QQ plot residuals
KS test: p= 0.9105
Deviation n.s.
Dispersion test: p= 0.736
Deviation n.s.
Outlier test: p= 1
Deviation n.s.
Observed
0.0
0.2
0.4
0.6
0.8
1.0
Expected
0.0
0.2
0.4
0.6
0.8
1.0
res
0.00
0.25
0.50
0.75
1.00
1
2
3
4
Model predictions (rank transformed)


DHARMa residual diagnostics
QQ plot residuals
KS test: p= 0.9105
Deviation n.s.
Dispersion test: p= 0.736
Deviation n.s.
Outlier test: p= 1
Deviation n.s.
Observed
Expected
0.0
0.2
0.4
0.6
0.8
1.0
res
0.00
0.25
0.50
0.75
1.00
1
2
3
4
Model predictions (rank transformed)

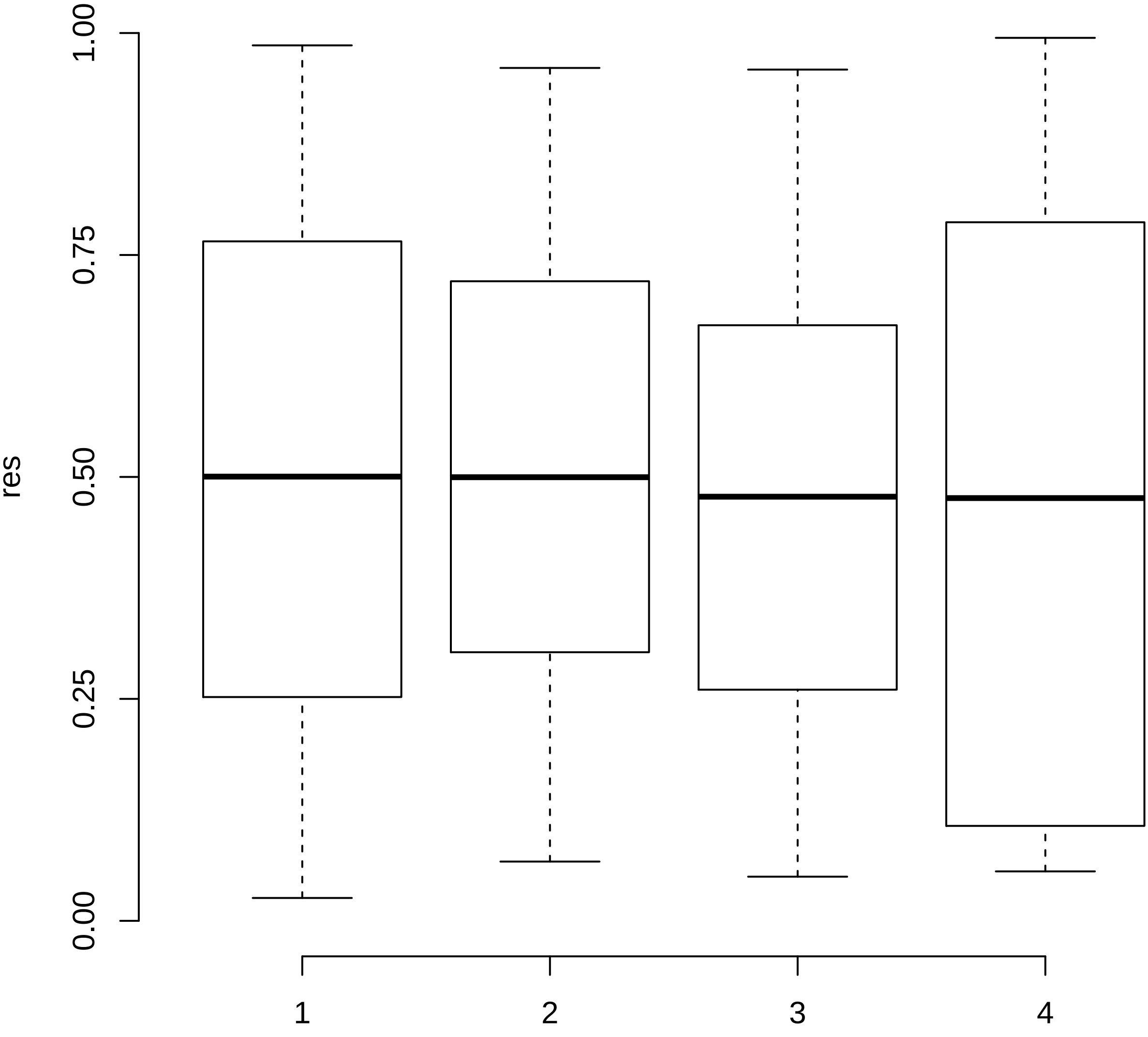

QQ plot residuals
KS test: p= 0.9105
Deviation n.s.
Dispersion test: p= 0.736
Deviation n.s.
Outlier test: p= 1
Deviation n.s.
Observed
Expected
0.0
0.2
0.4
0.6
0.8
1.0
0.0
0.2
0.4
0.6
0.8
1.0

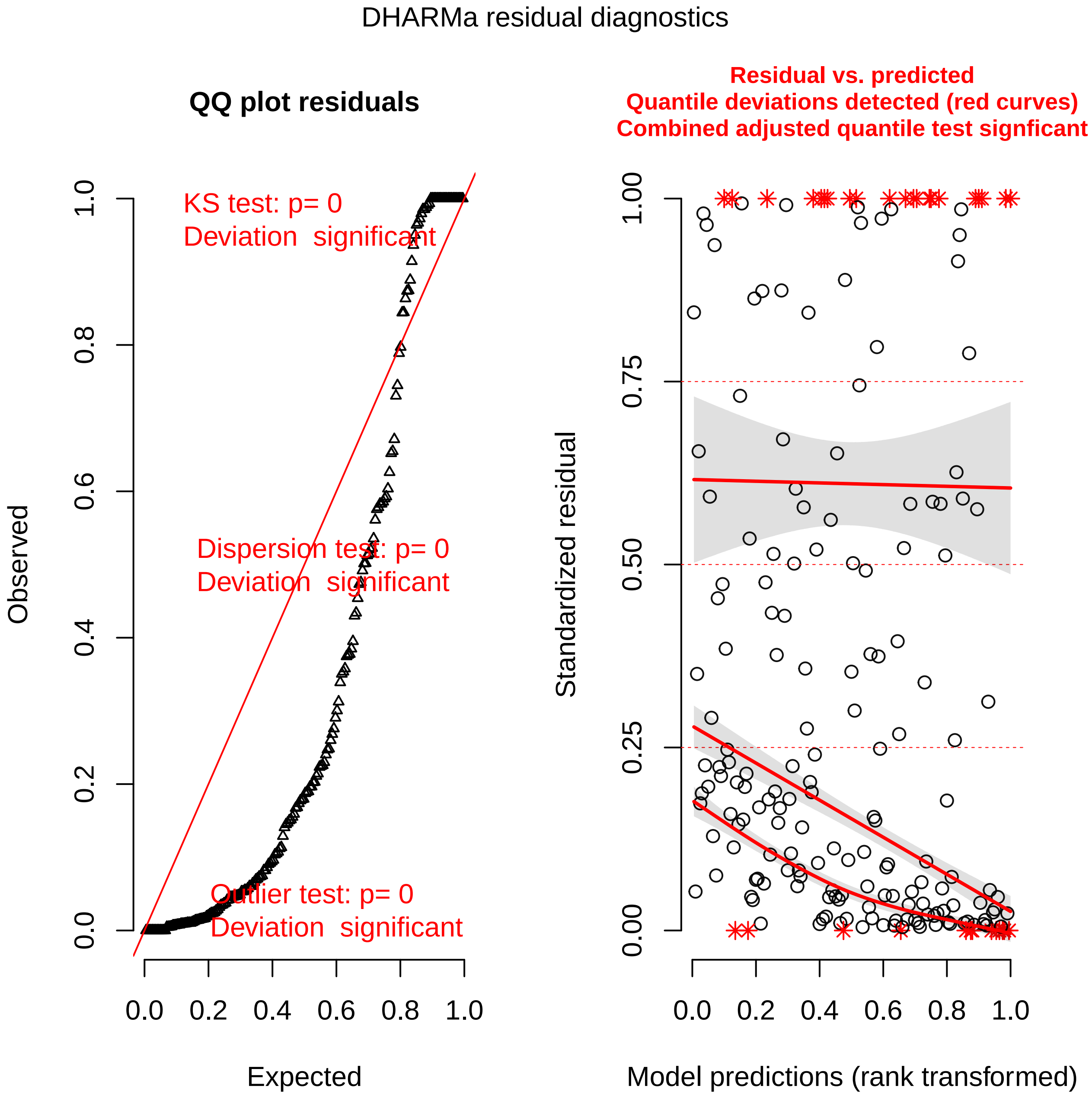

1.00
0.75
0.50
0.25
0.00
res
1
2
3
4
pred


res
0.00
0.25
0.50
0.75
1.00
1
2
3
4
pred

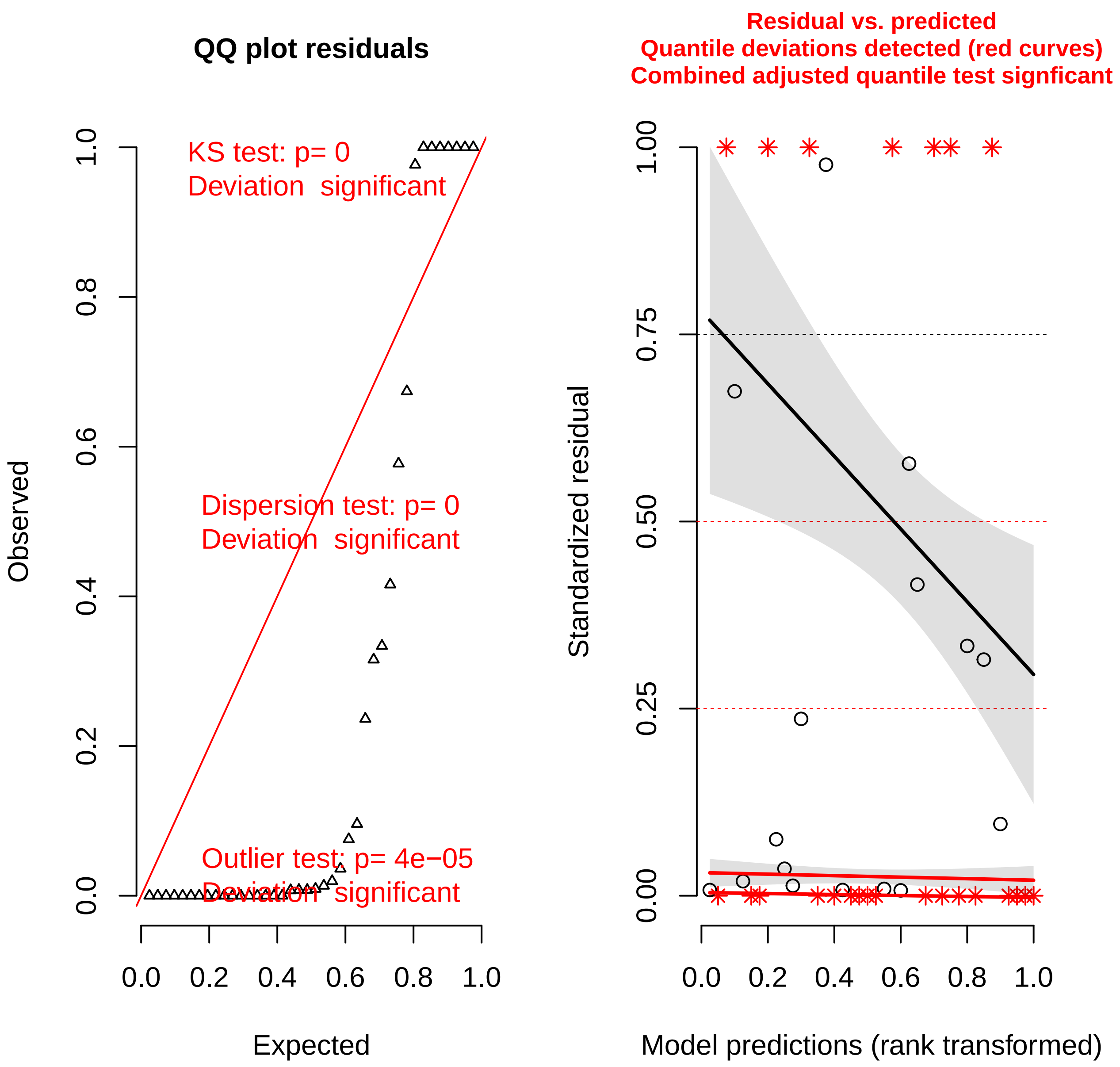


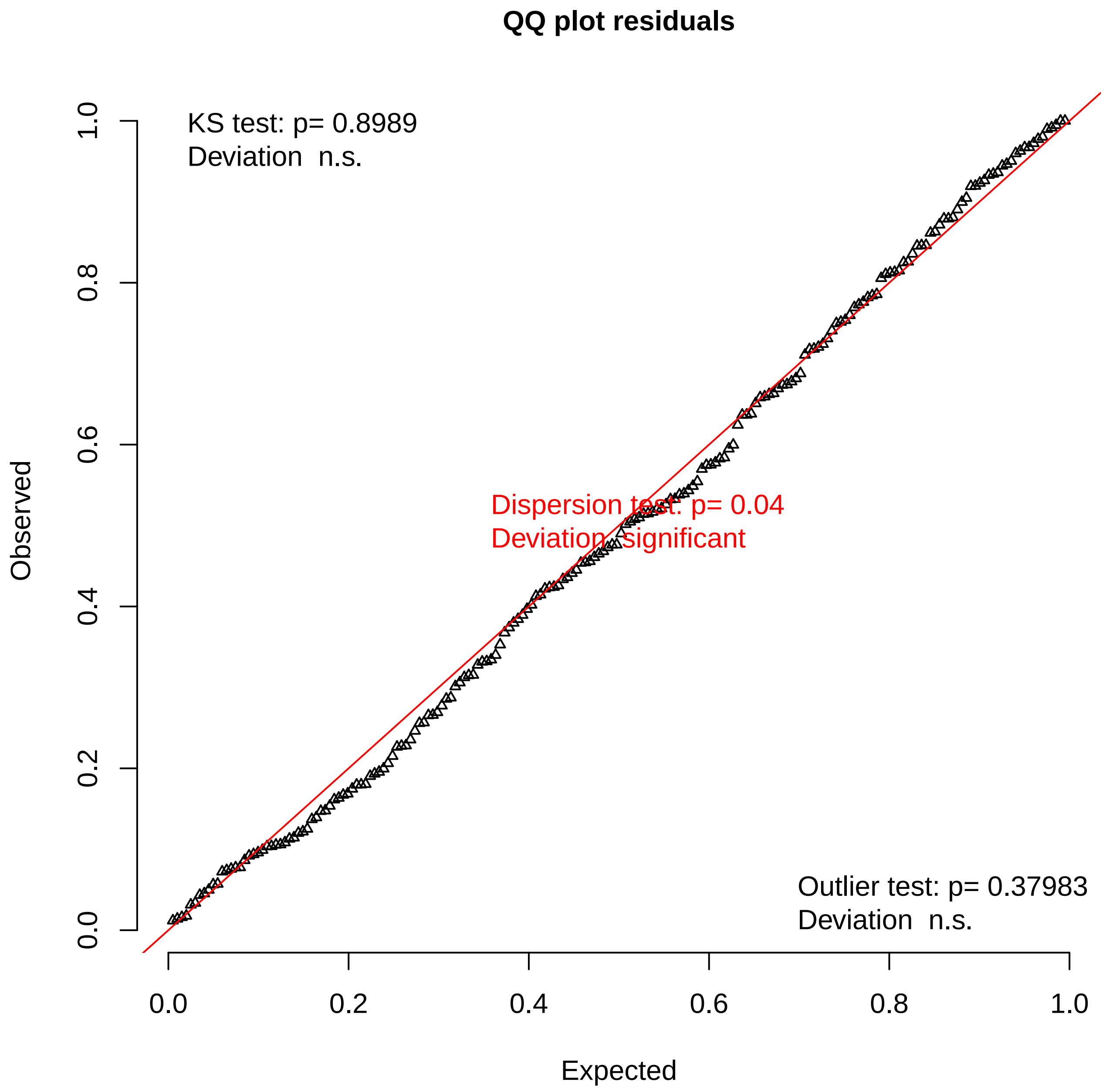
Hist of DHARMa residuals

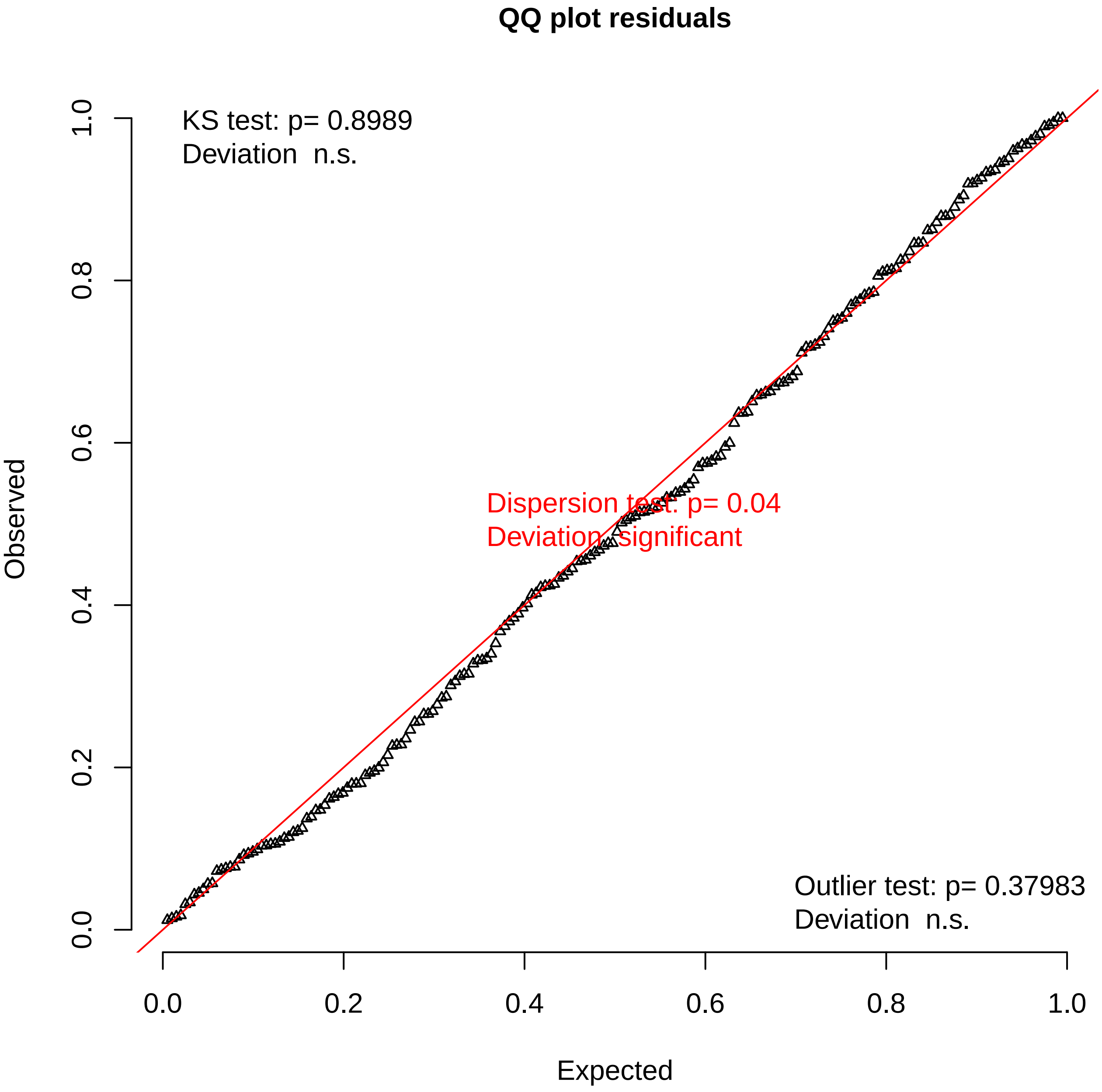

1.00
0.75
0.50
0.25
0.00
res
1
2
3
4
pred

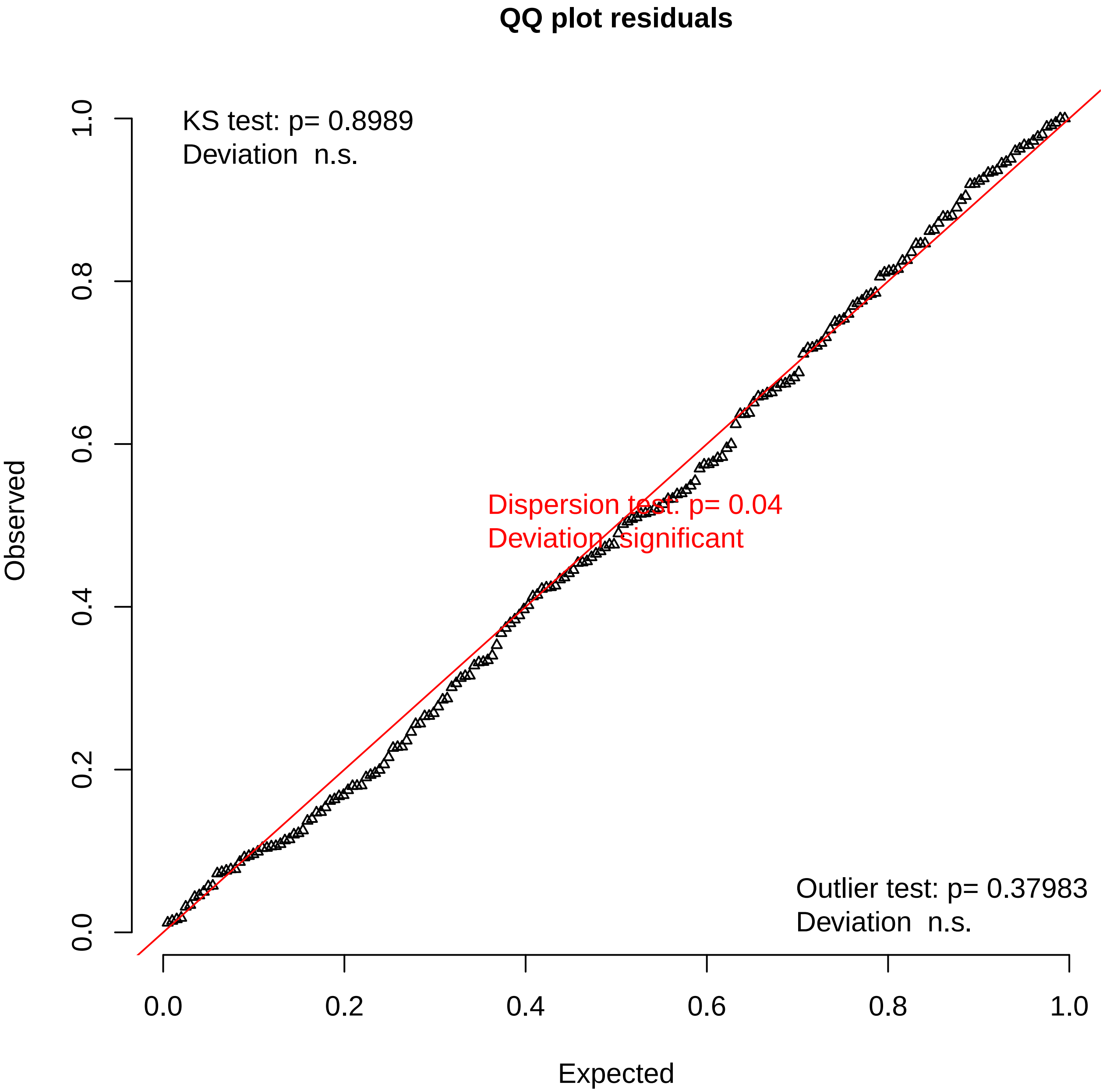

DHARMa residual diagnostics
QQ plot residuals
KS test: p= 0
Deviation significant
Dispersion test: p= 0
Deviation significant
Outlier test: p= 0
Deviation significant
Observed
0.0
0.2
0.4
0.6
0.8
1.0
Expected
0.0
0.2
0.4
0.6
0.8
1.0
Residual vs. predicted
Quantile deviations detected (red curves)
Combined adjusted quantile test signficant
Standardized residual
0.00
0.25
0.50
0.75
1.00
Model predictions (rank transformed)
0.0
0.2
0.4
0.6
0.8
1.0

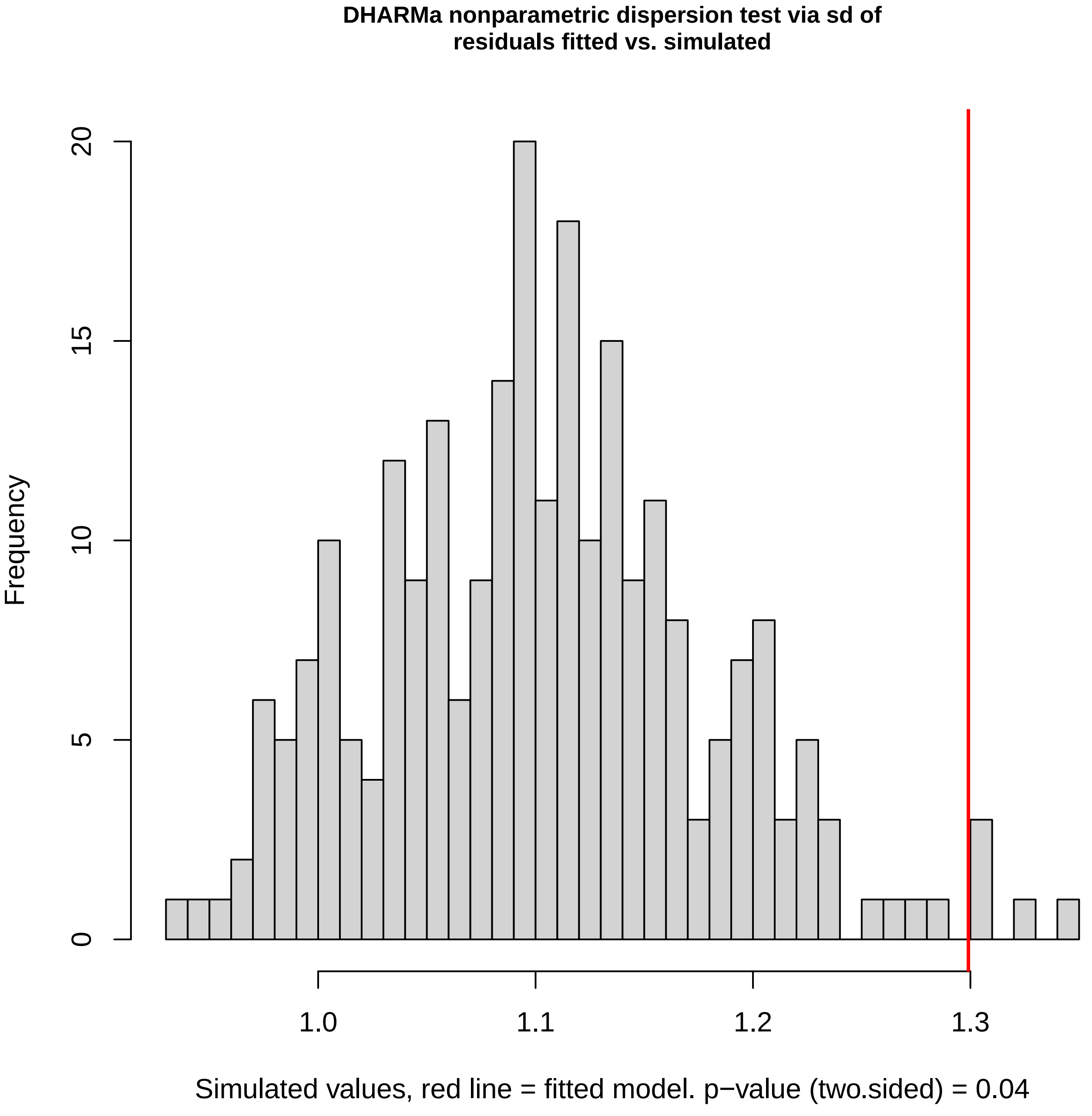
DHARMa residual diagnostics

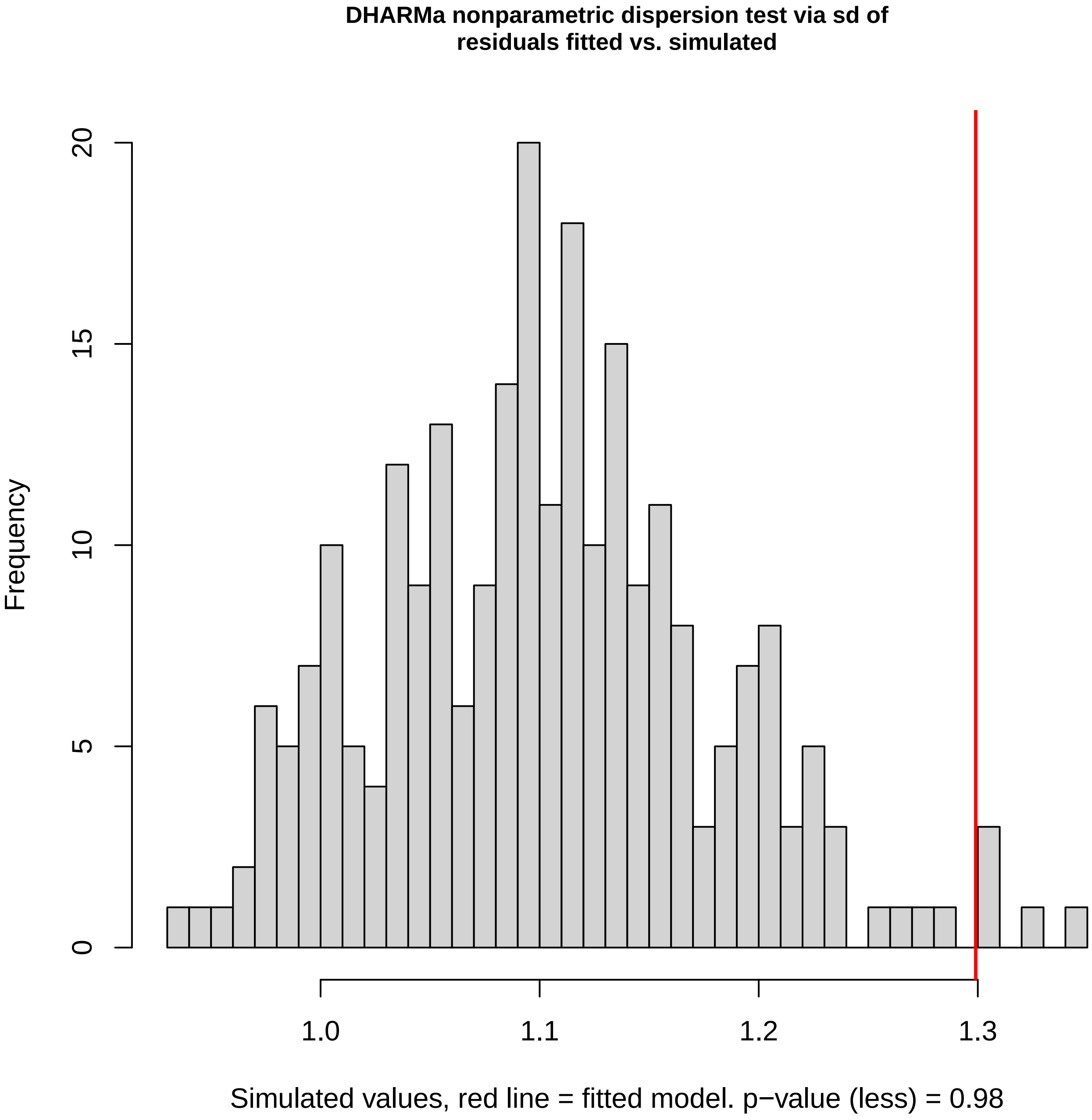


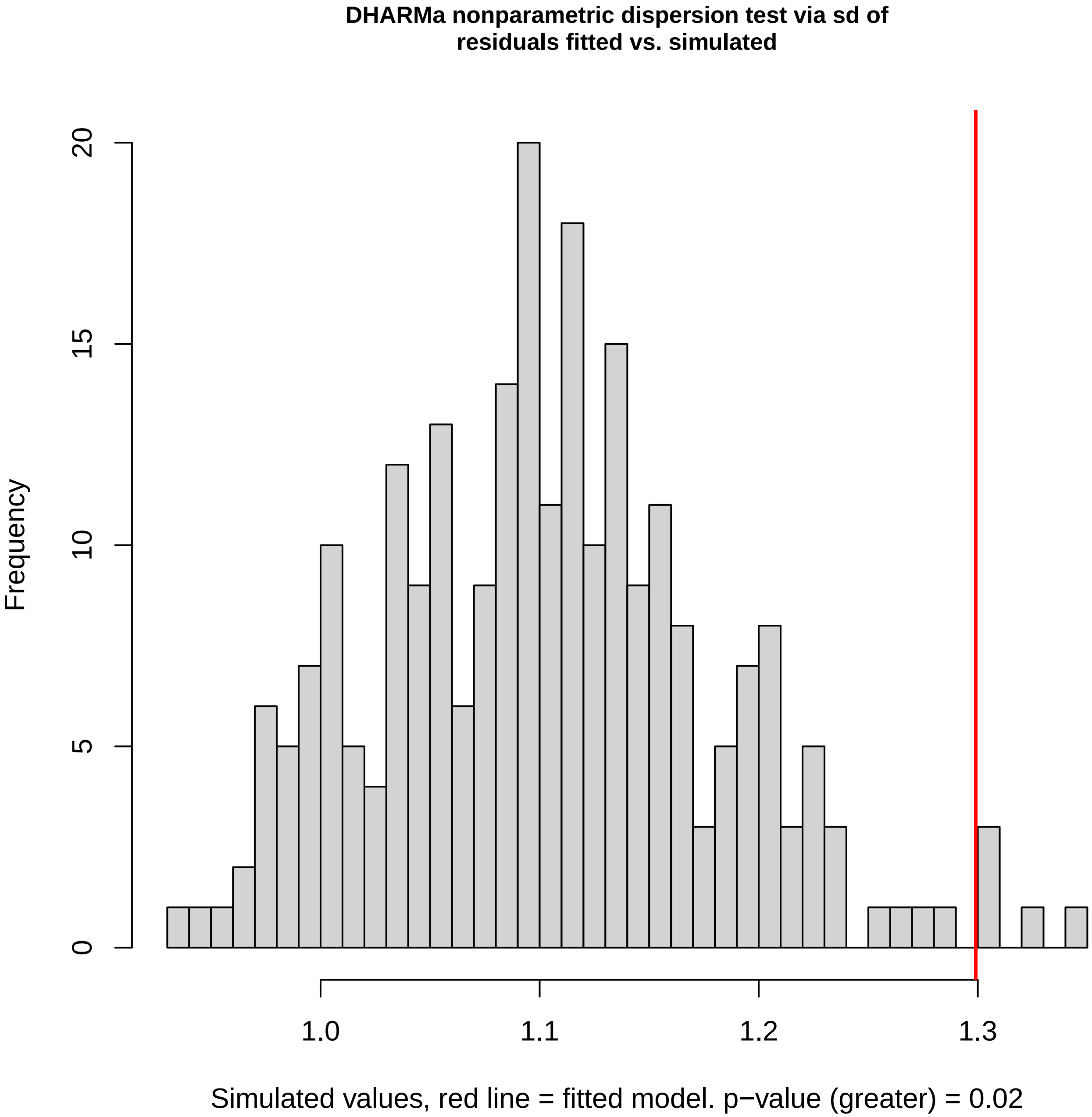

QQ plot residuals
KS test: p= 0.8989
Deviation n.s.
Dispersion test: p= 0.04
Deviation significant
Outlier test: p= 0.37983
Deviation n.s.
Observed
0.0
0.2
0.4
0.6
0.8
1.0
Expected
0.0
0.2
0.4
0.6
0.8
1.0

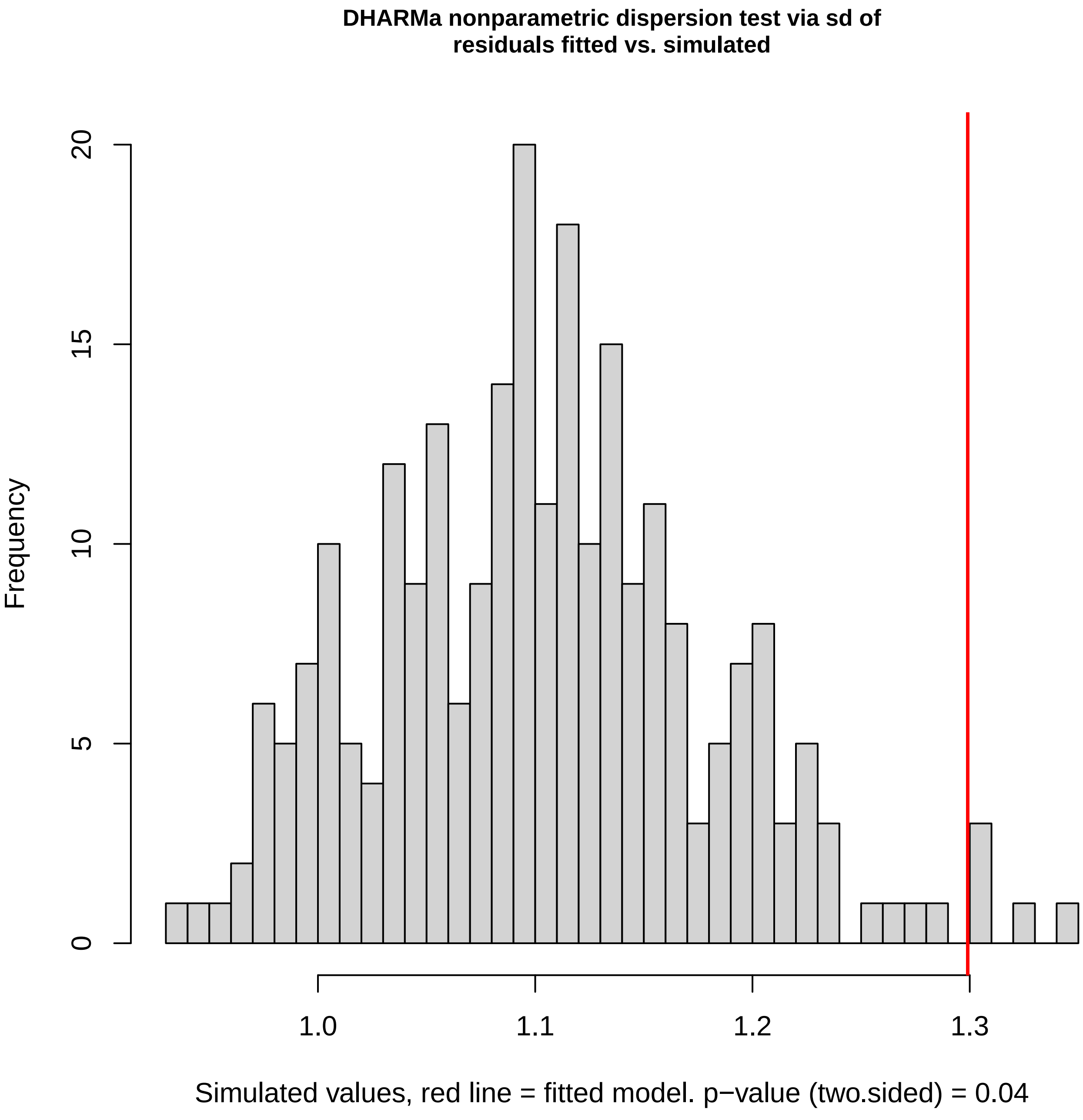

QQ plot residuals
KS test: p= 0.8989
Deviation n.s.
Dispersion test: p= 0.04
Deviation significant
Outlier test: p= 0.37983
Deviation n.s.
Observed
Expected
0.0
0.2
0.4
0.6
0.8
1.0
0.0
0.2
0.4
0.6
0.8
1.0

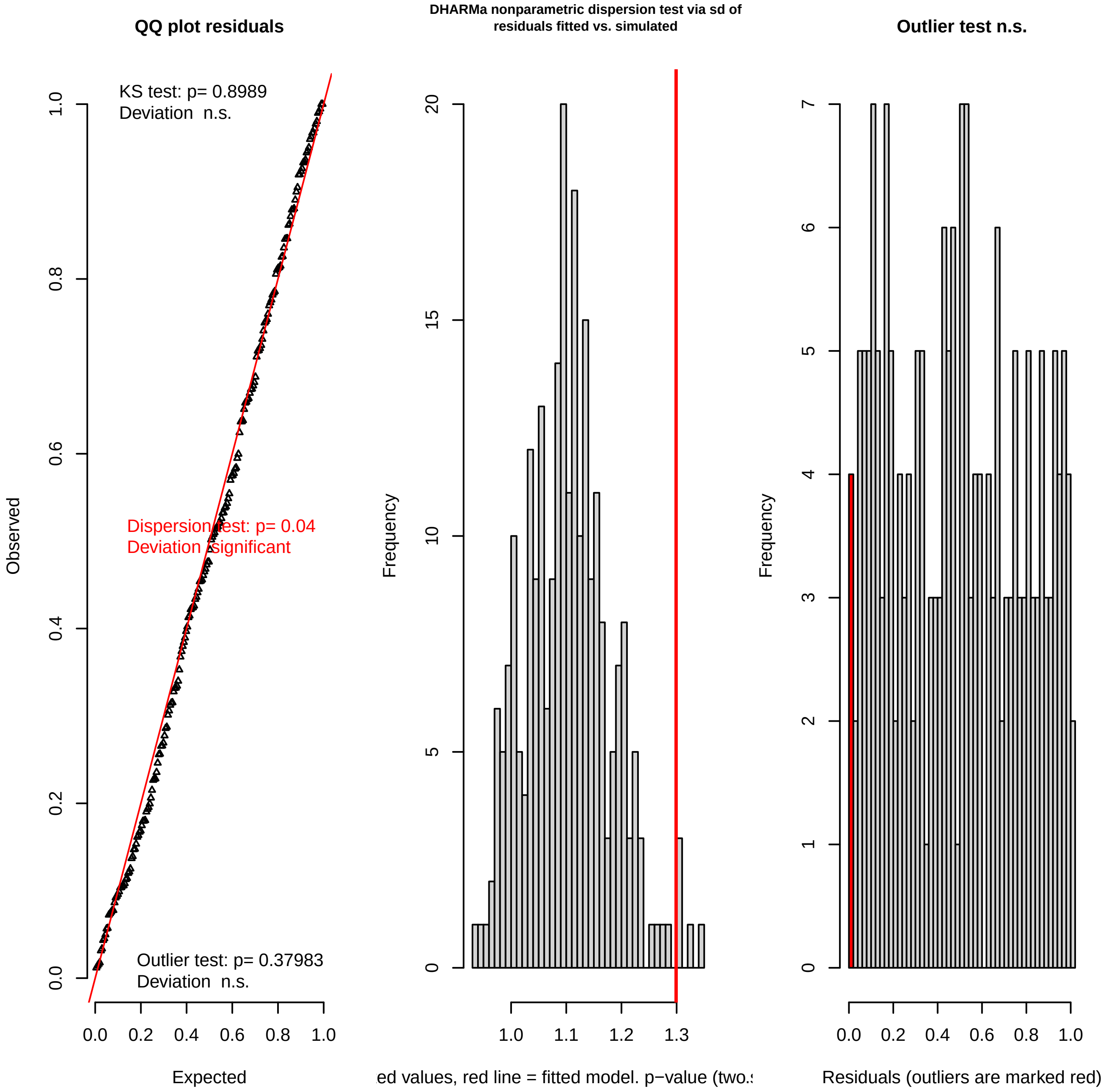

QQ plot residuals
KS test: p= 0.8989
Deviation n.s.
Dispersion test: p= 0.04
Deviation significant
Outlier test: p= 0.37983
Deviation n.s.
Observed
Expected
0.0
0.2
0.4
0.6
0.8
1.0
0.0
0.2
0.4
0.6
0.8
1.0

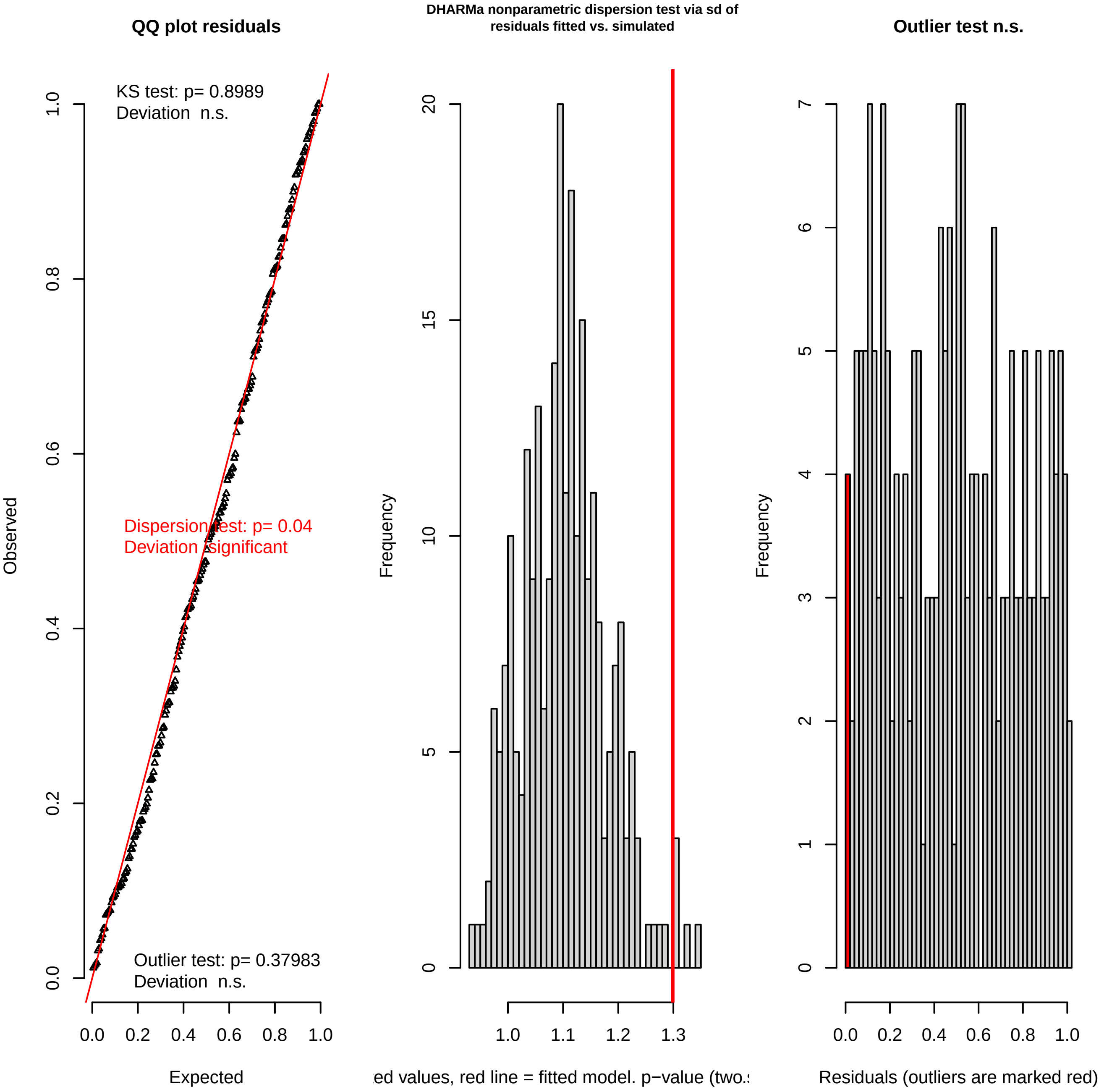

DHARMa nonparametric dispersion test via sd of
residuals fitted vs. simulated
Frequency
0
5
10
15
20
1.0
1.1
1.2
1.3
Simulated values, red line = fitted model. p−value (two.sided) = 0.04

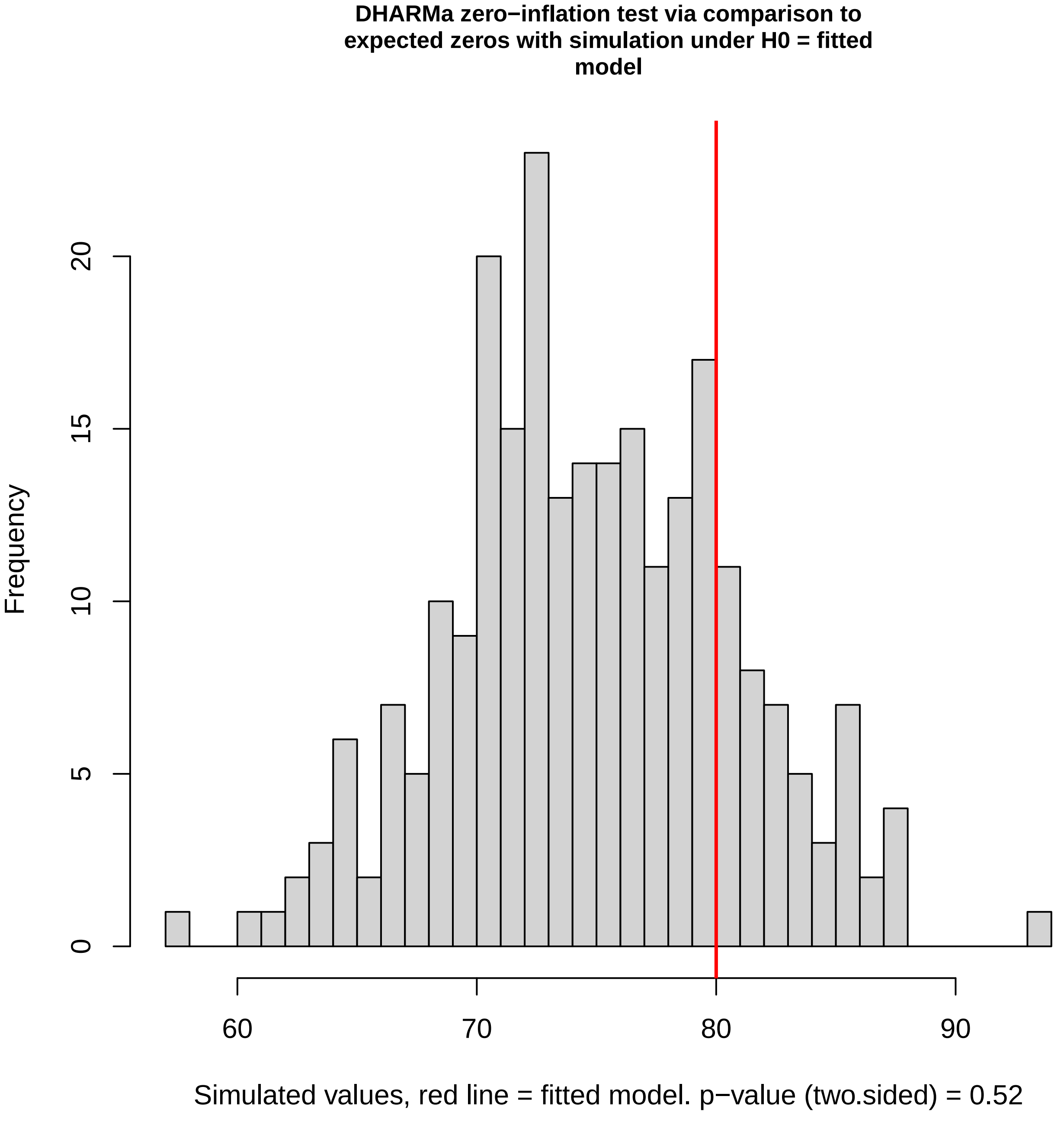

DHARMa nonparametric dispersion test via sd of residuals fitted vs. simulated
Frequency
0
5
10
15
20
1.0
1.1
1.2
1.3
Simulated values, red line = fitted model. p−value (less) = 0.98

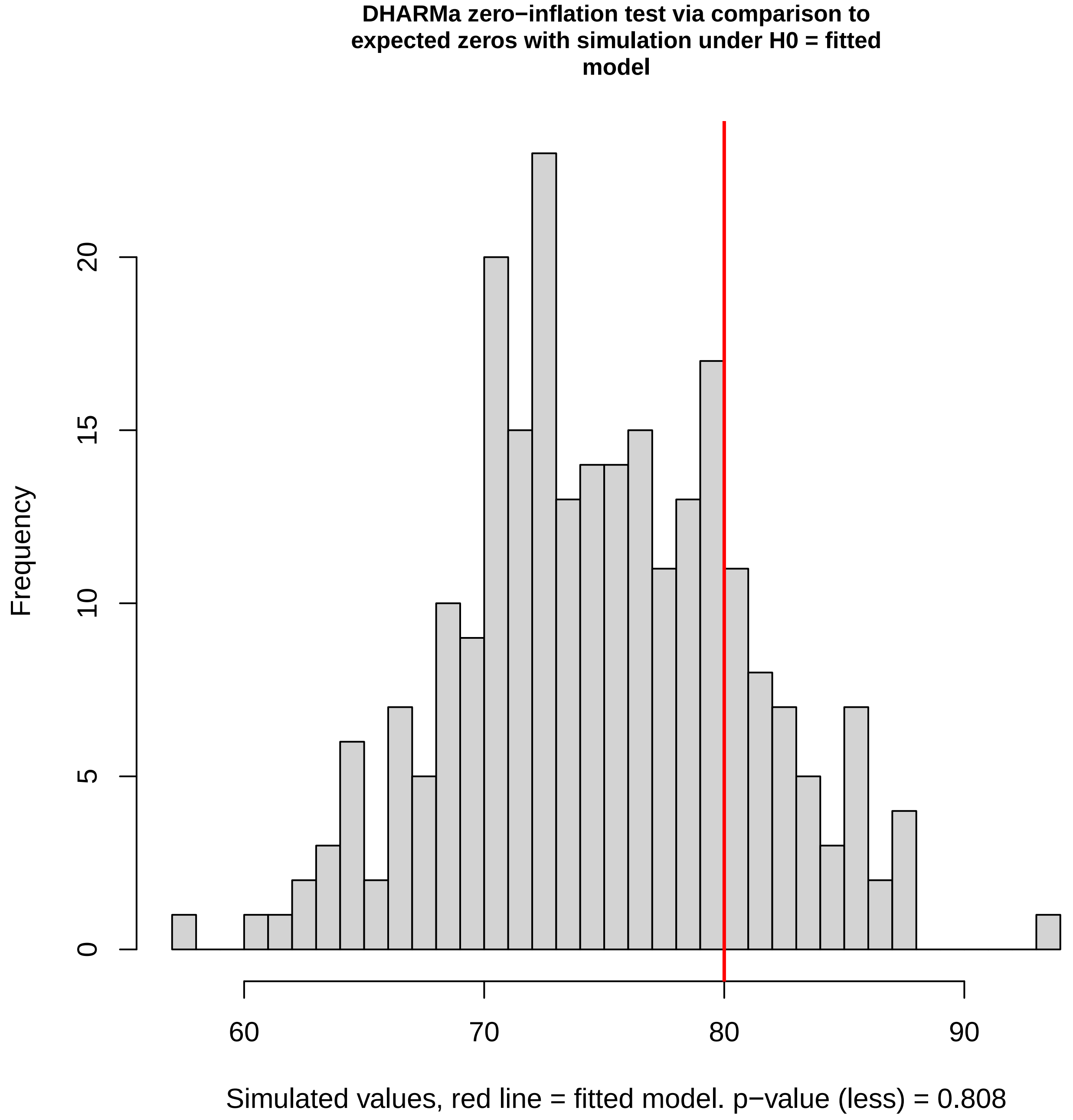

DHARMa nonparametric dispersion test via sd of
residuals fitted vs. simulated
Frequency
0
5
10
15
20
1.0
1.1
1.2
1.3
Simulated values, red line = fitted model. p−value (greater) = 0.02

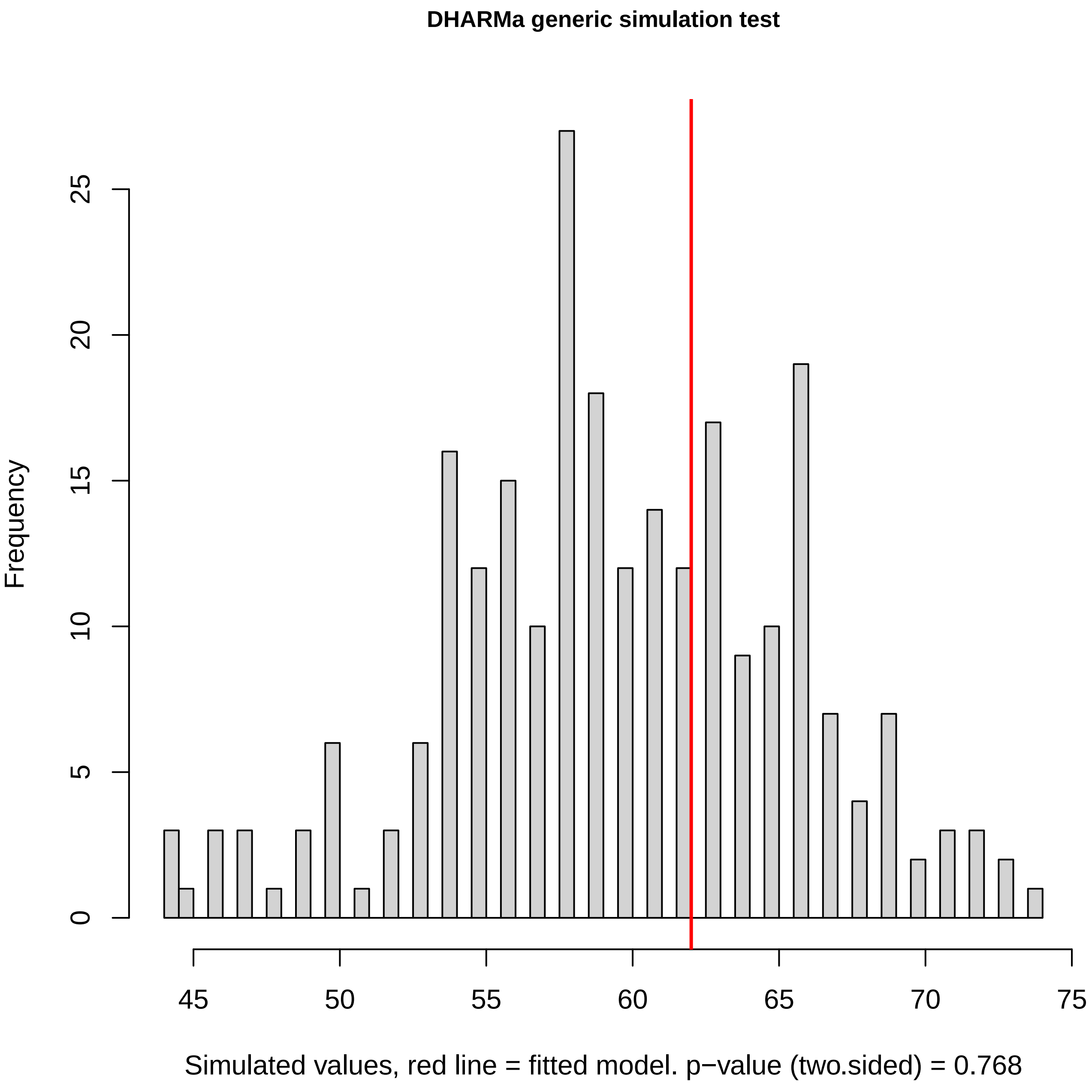

DHARMa nonparametric dispersion test via sd of
residuals fitted vs. simulated
Frequency
0
5
10
15
20
1.0
1.1
1.2
1.3
Simulated values, red line = fitted model. p−value (two.sided) = 0.04

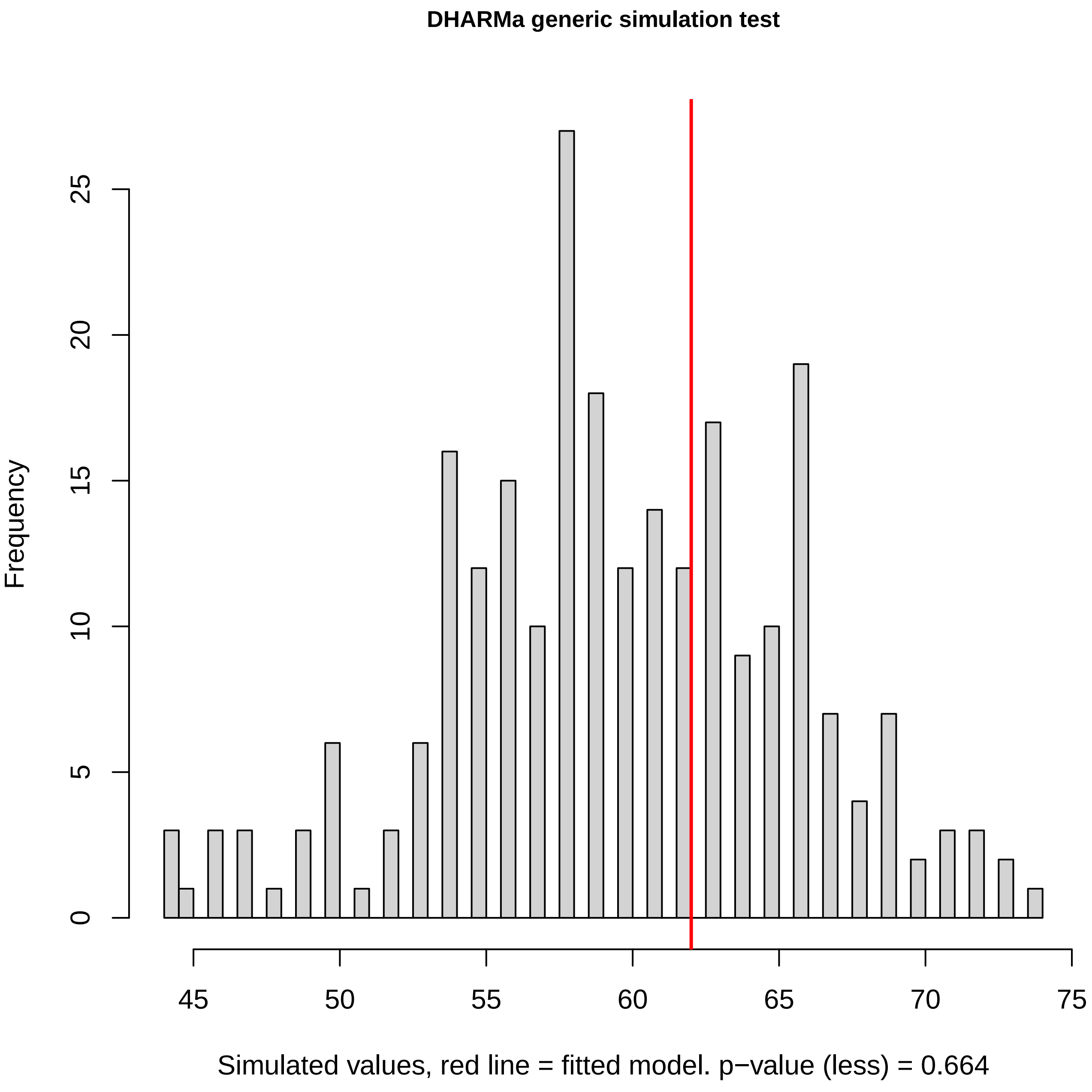

QQ plot residuals
KS test: p= 0.8989
Deviation n.s.
Dispersion test: p= 0.04
Deviation significant
Outlier test: p= 0.37983
Deviation n.s.
Observed
Expected
0.0
0.2
0.4
0.6
0.8
1.0
DHARMa nonparametric dispersion test via sd of
residuals fitted vs. simulated
Frequency
0
5
10
15
20
1.0
1.1
1.2
1.3
ed values, red line = fitted model. p−value (two.s
Outlier test n.s.
Frequency
0
1
2
3
4
5
6
7
0.0
0.2
0.4
0.6
0.8
1.0
Residuals (outliers are marked red)

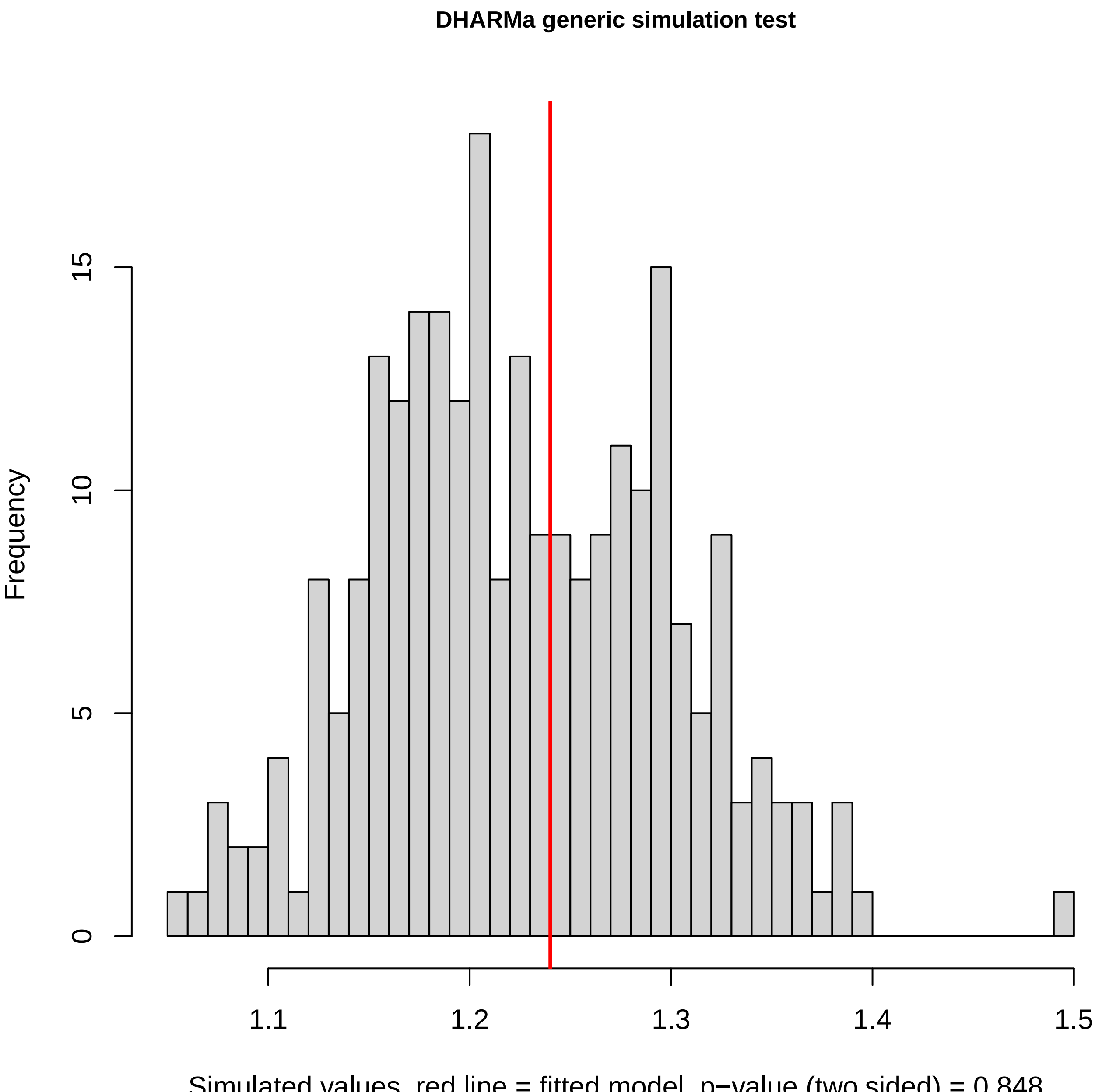

QQ plot residuals
KS test: p= 0.8989
Deviation n.s.
Dispersion test: p= 0.04
Deviation significant
Outlier test: p= 0.37983
Deviation n.s.
Observed
Expected
0.0
0.2
0.4
0.6
0.8
1.0
DHARMa nonparametric dispersion test via sd of
residuals fitted vs. simulated
Frequency
0
5
10
15
20
1.0
1.1
1.2
1.3
ed values, red line = fitted model. p−value (two.s
Outlier test n.s.
Frequency
0
1
2
3
4
5
6
7
0.0
0.2
0.4
0.6
0.8
1.0
Residuals (outliers are marked red)

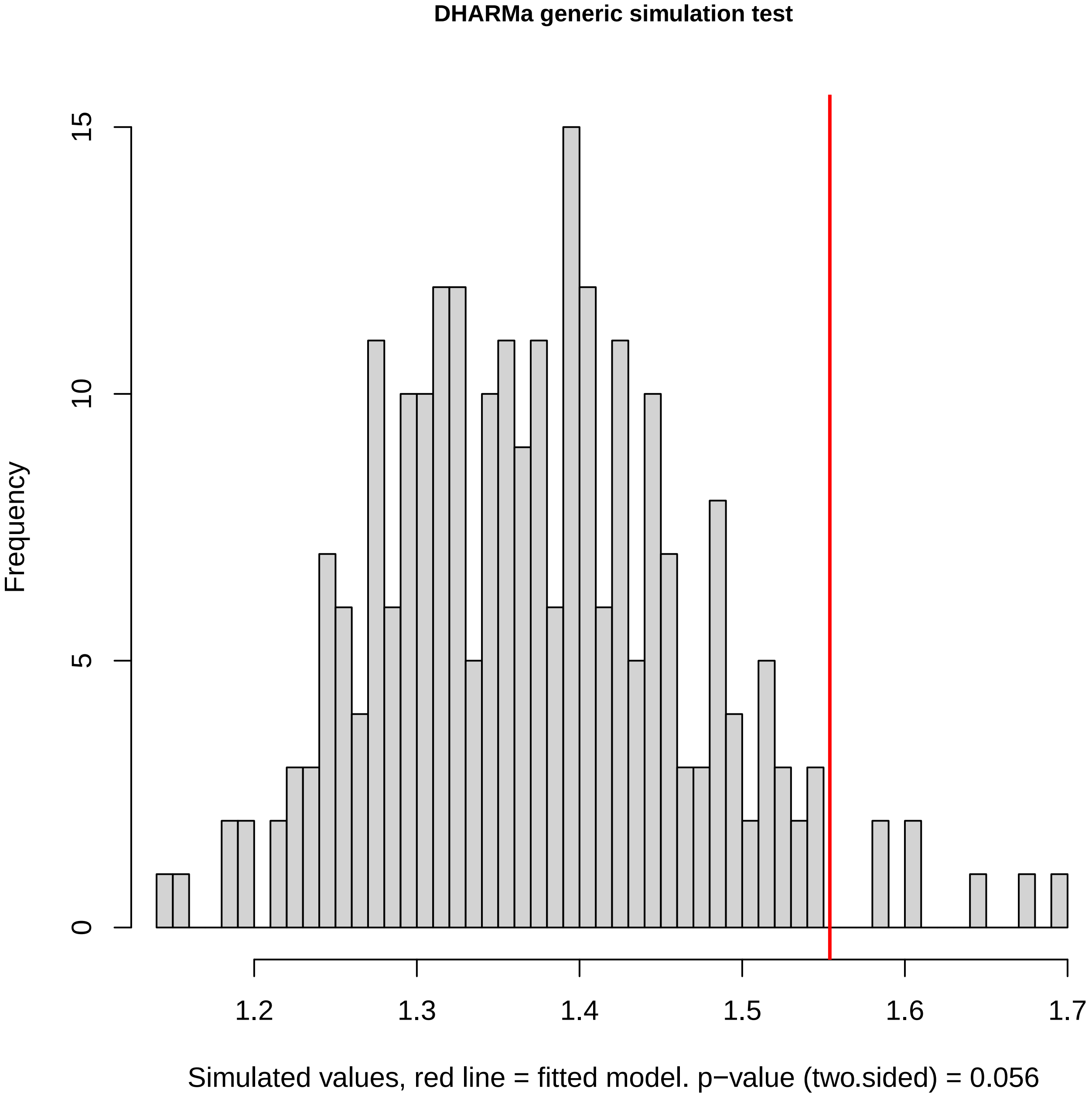

DHARMa zero−inflation test via comparison to expected zeros with simulation under H0 = fitted model
Frequency
0
5
10
15
20
60
70
80
90
Simulated values, red line = fitted model. p−value (two.sided) = 0.52

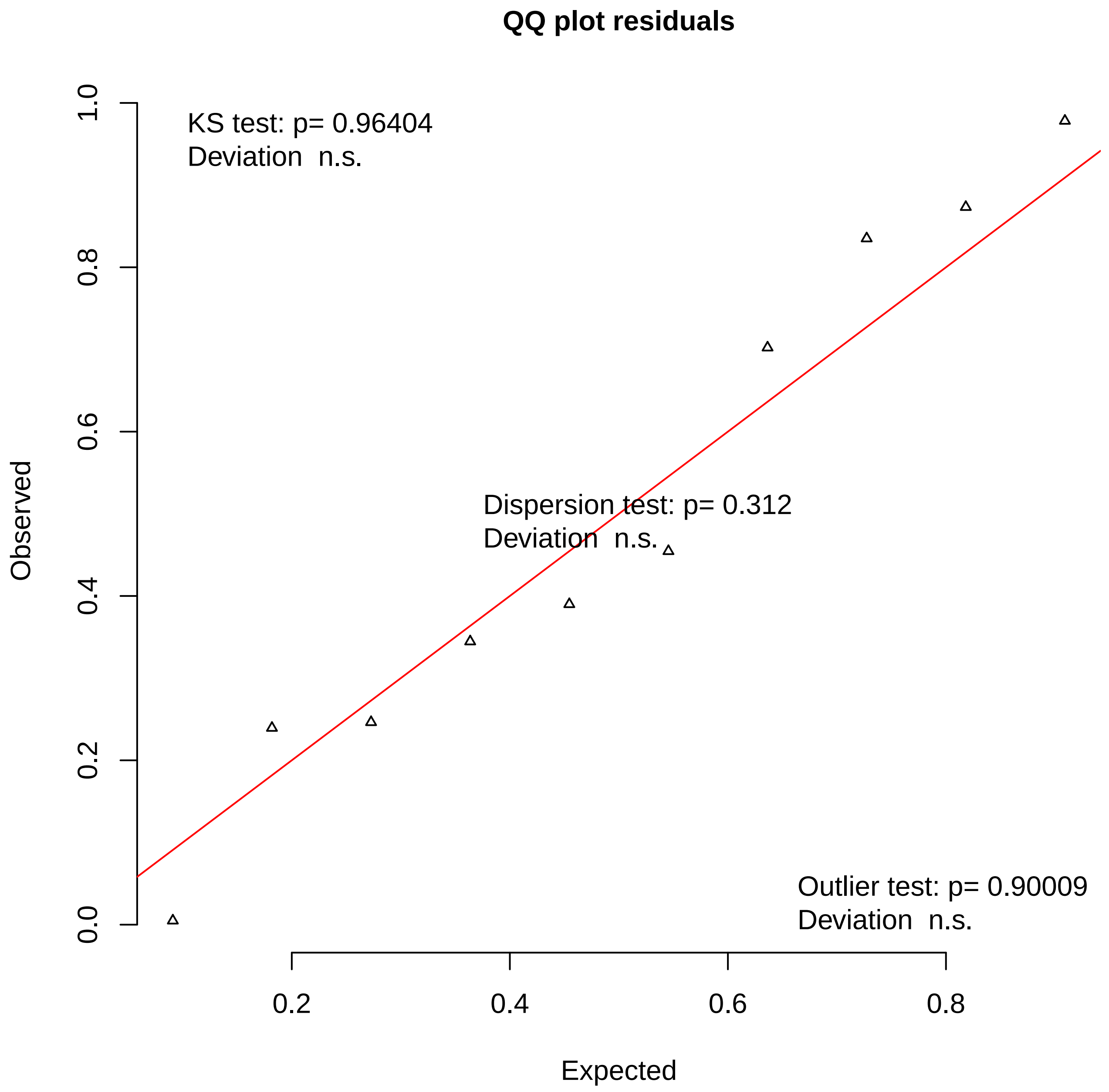

DHARMa zero−inflation test via comparison to expected zeros with simulation under H0 = fitted model
Frequency
0
5
10
15
20
60
70
80
90
Simulated values, red line = fitted model. p−value (less) = 0.808

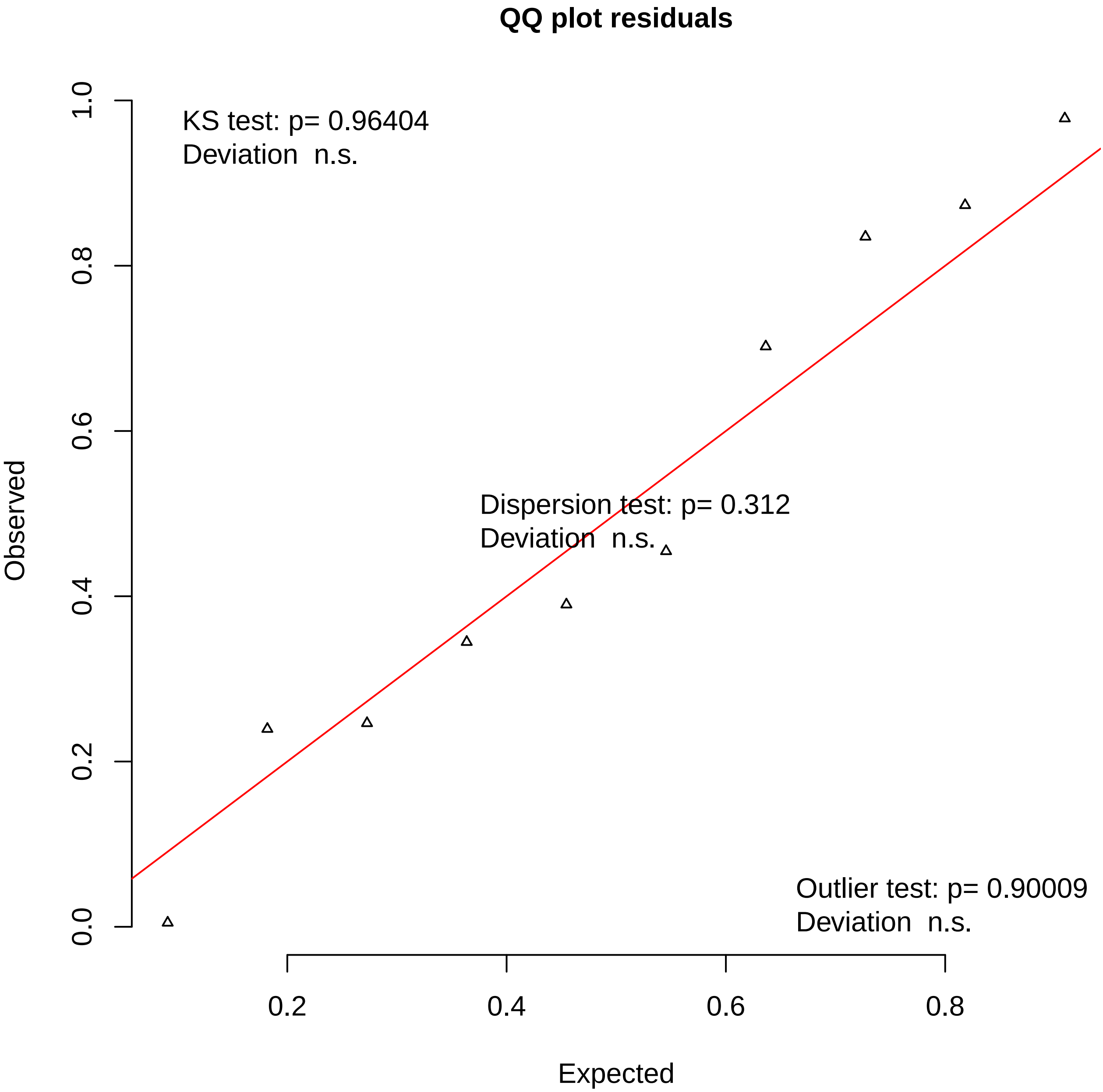

DHARMa generic simulation test
Frequency
0
5
10
15
20
25
45
50
55
60
65
70
75
Simulated values, red line = fitted model. p−value (two.sided) = 0.768

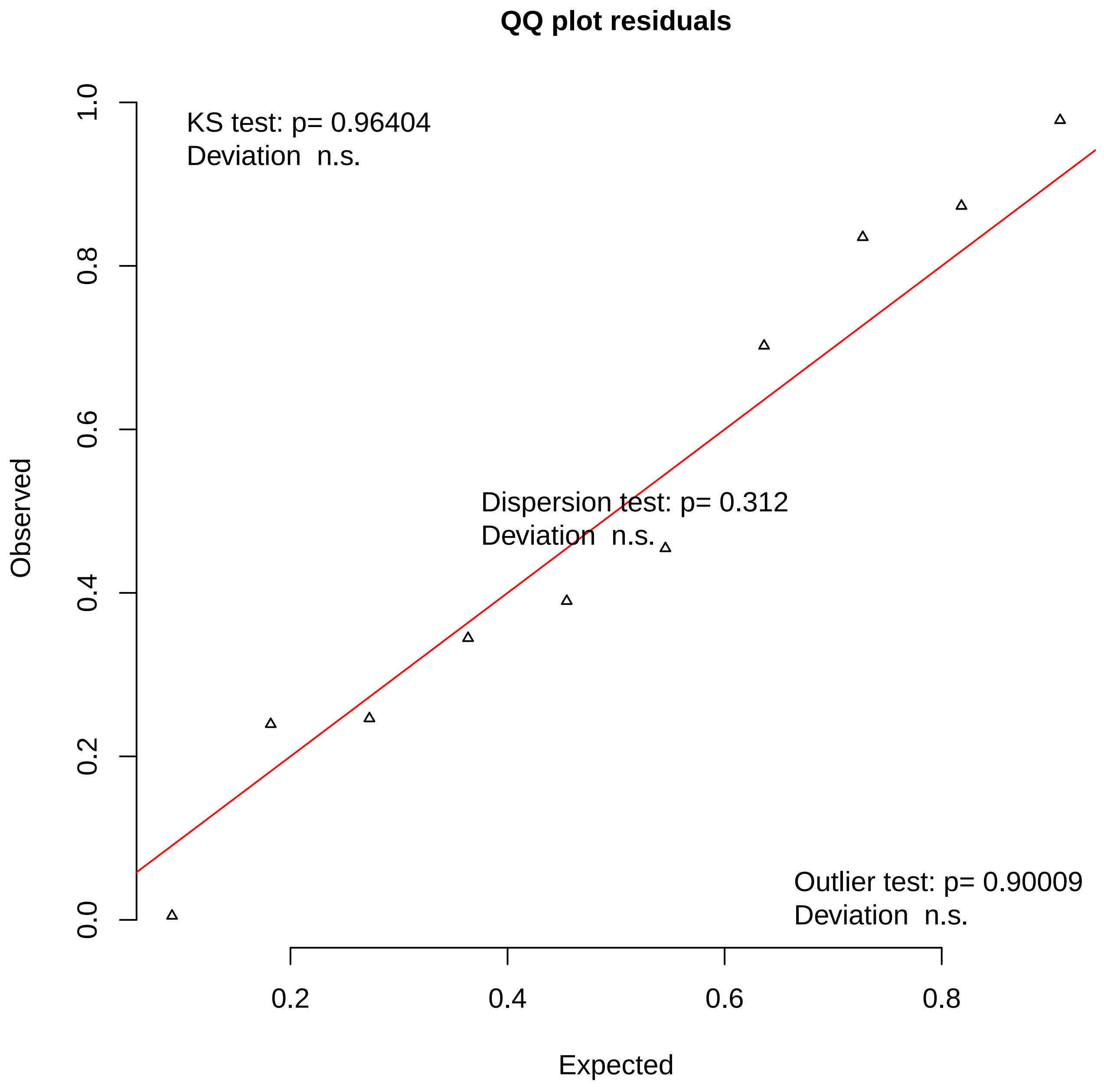

DHARMa generic simulation test
Frequency
0
5
10
15
20
25
45
50
55
60
65
70
75
Simulated values, red line = fitted model. p−value (less) = 0.664

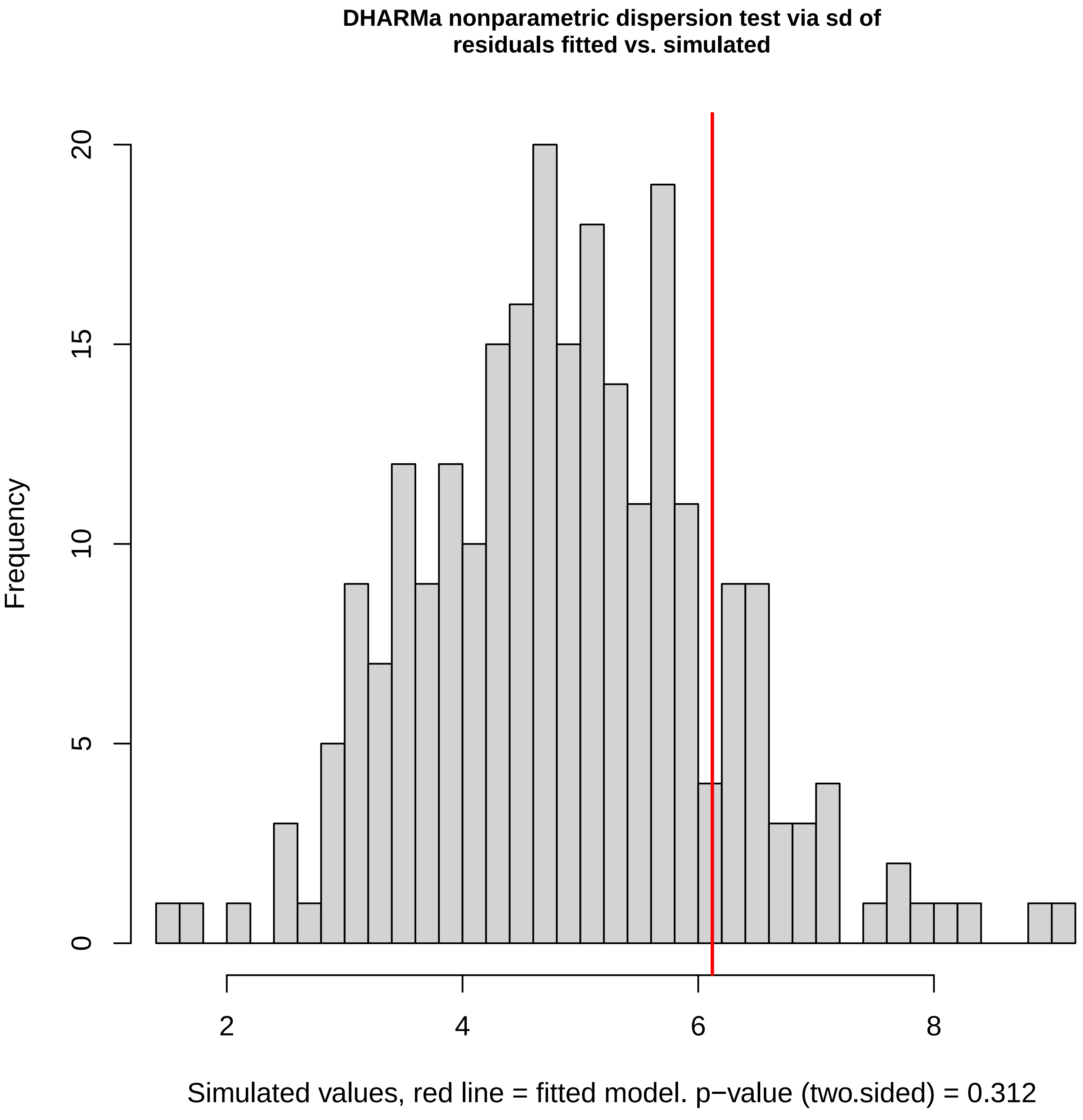

DHARMa generic simulation test
Frequency
0
5
10
15
1.1
1.2
1.3
1.4
1.5
Simulated values, red line = fitted model. p−value (two.sided) = 0.848

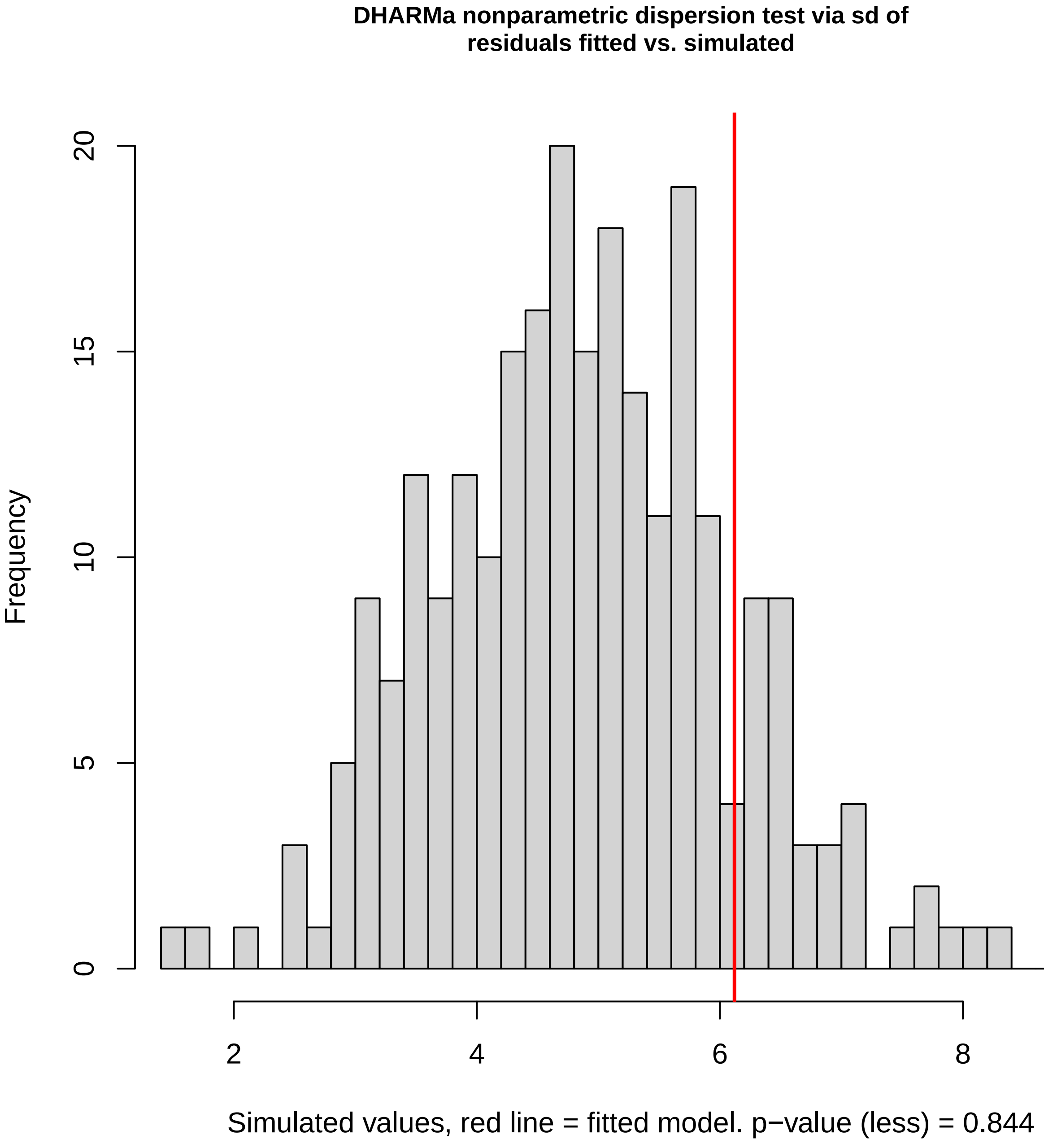

DHARMa generic simulation test
Frequency
0
5
10
15
1.2
1.3
1.4
1.5
1.6
1.7
Simulated values, red line = fitted model. p−value (two.sided) = 0.056

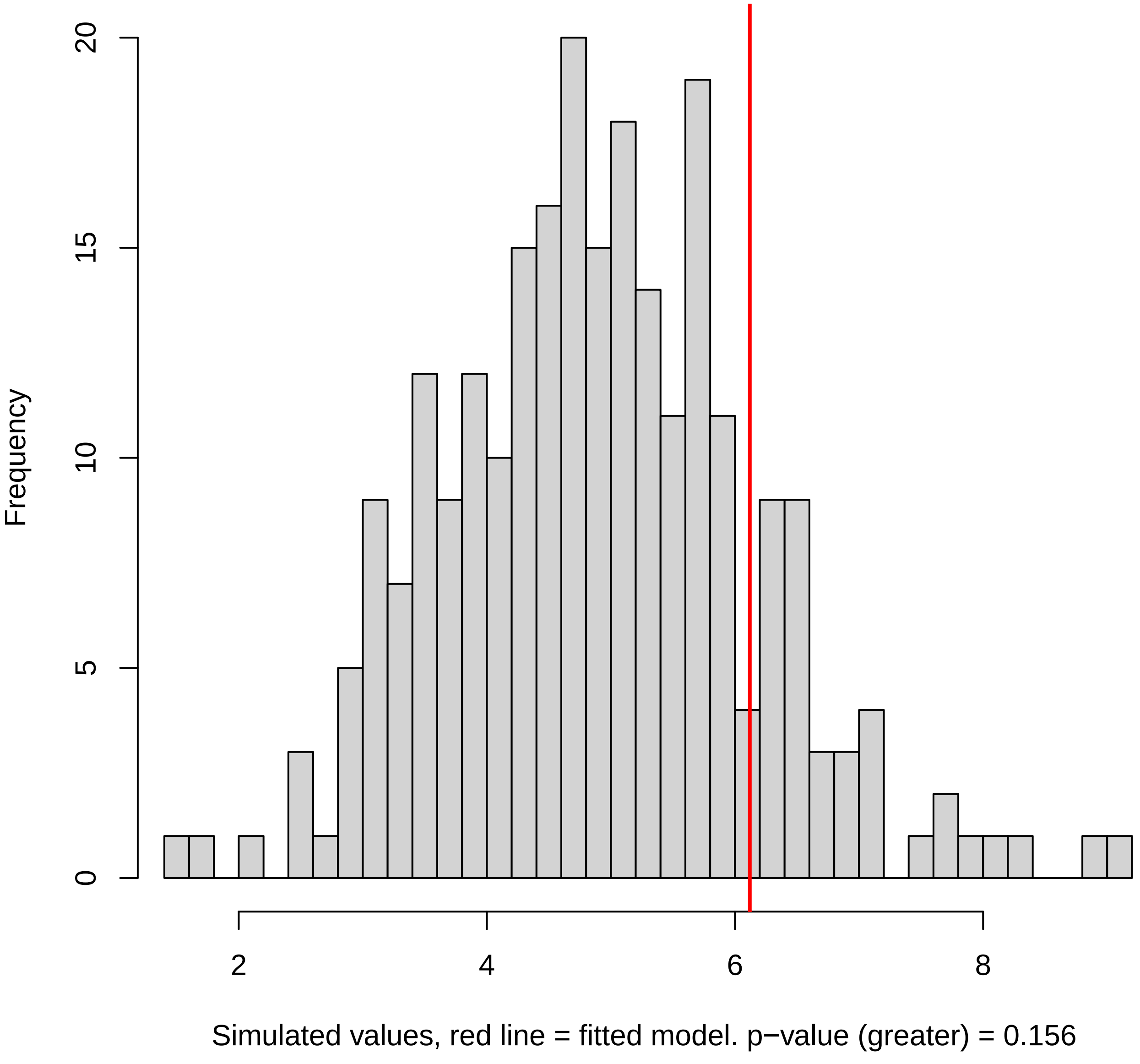

QQ plot residuals
KS test: p= 0.96404
Deviation n.s.
Dispersion test: p= 0.312
Deviation n.s.
Outlier test: p= 0.90009
Deviation n.s.
Observed
0.0
0.2
0.4
0.6
0.8
1.0
Expected
0.2
0.4
0.6
0.8


QQ plot residuals
KS test: p= 0.96404
Deviation n.s.
Dispersion test: p= 0.312
Deviation n.s.
Outlier test: p= 0.90009
Deviation n.s.
Observed
0.0
0.2
0.4
0.6
0.8
1.0
Expected
0.2
0.4
0.6
0.8

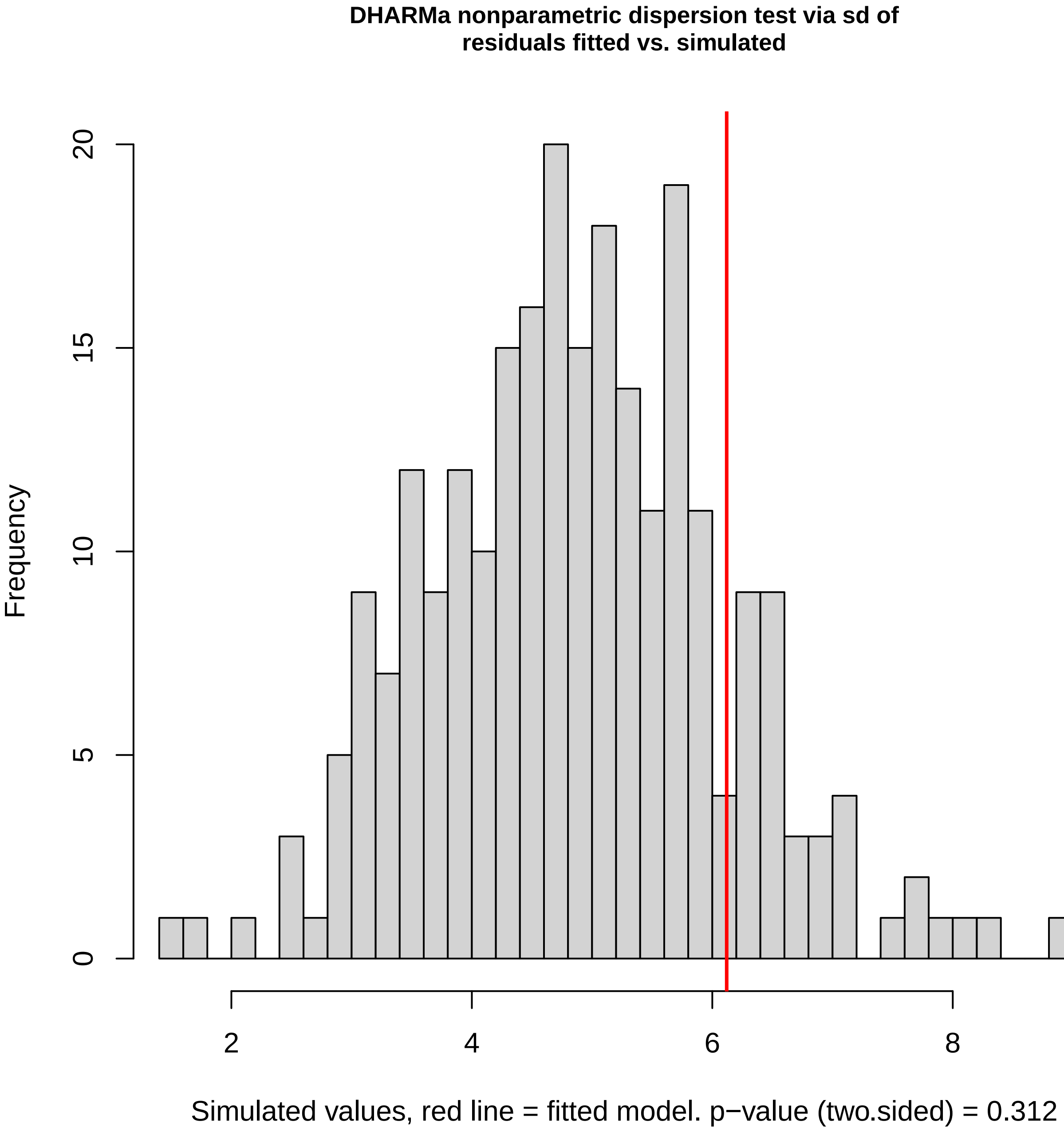

QQ plot residuals
KS test: p= 0.96404
Deviation n.s.
Dispersion test: p= 0.312
Deviation n.s.
Outlier test: p= 0.90009
Deviation n.s.
Observed
0.0
0.2
0.4
0.6
0.8
1.0
Expected
0.2
0.4
0.6
0.8

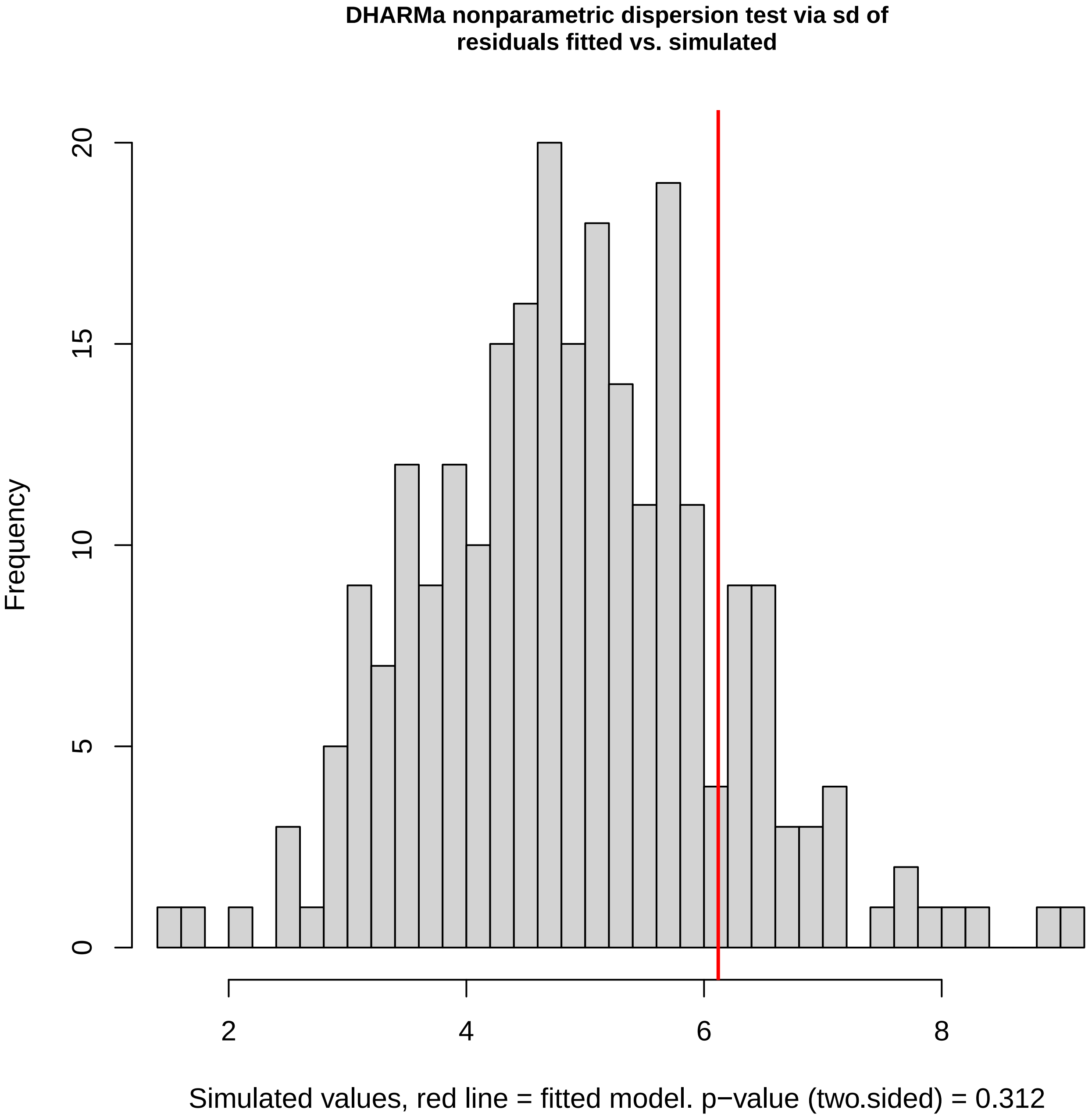

DHARMa nonparametric dispersion test via sd of
residuals fitted vs. simulated
Frequency
0
5
10
15
20
2
4
6
8
Simulated values, red line = fitted model. p−value (two.sided) = 0.312


DHARMa nonparametric dispersion test via sd of
residuals fitted vs. simulated
Frequency
0
5
10
15
20
2
4
6
8
Simulated values, red line = fitted model. p−value (less) = 0.844

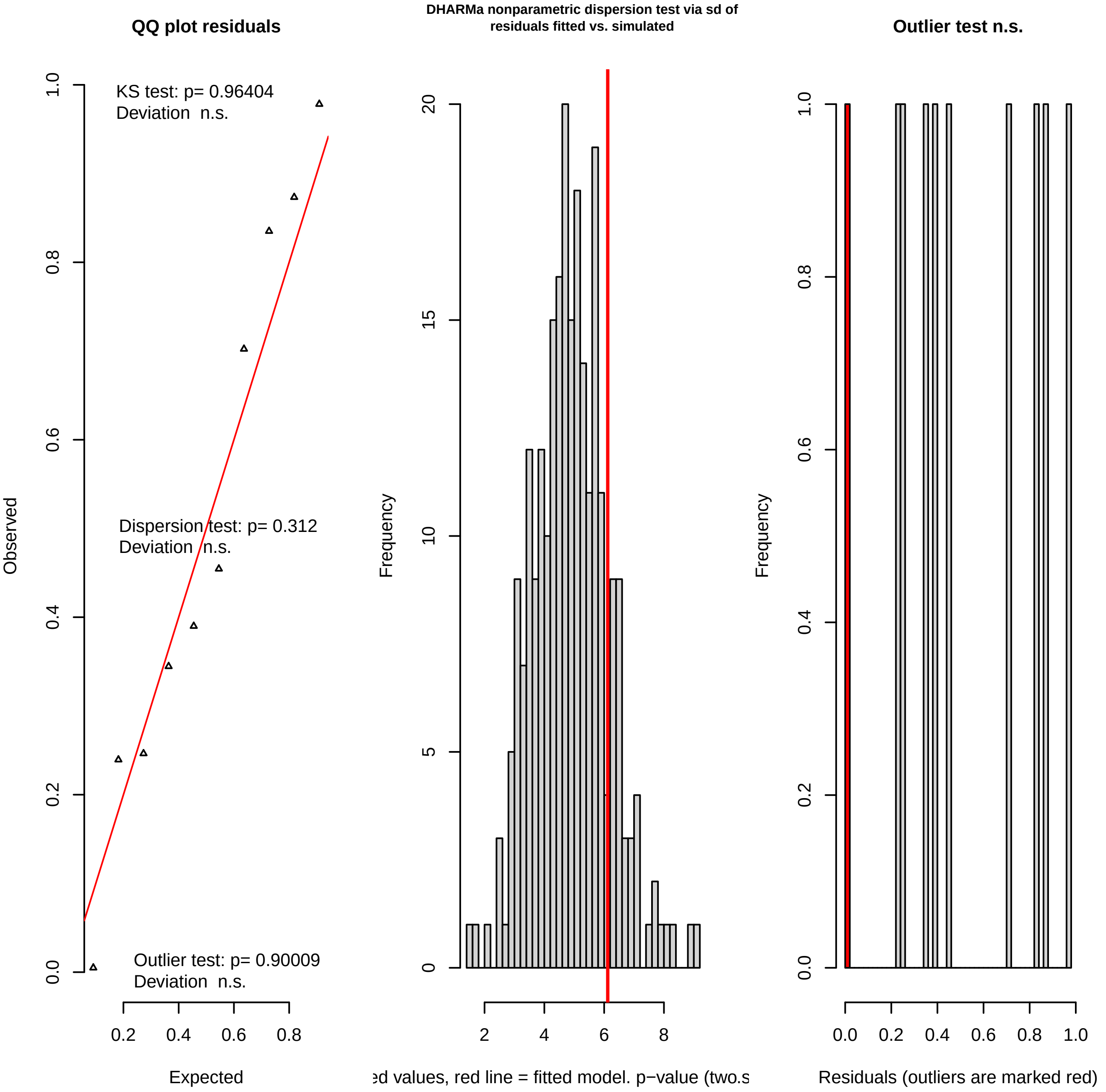


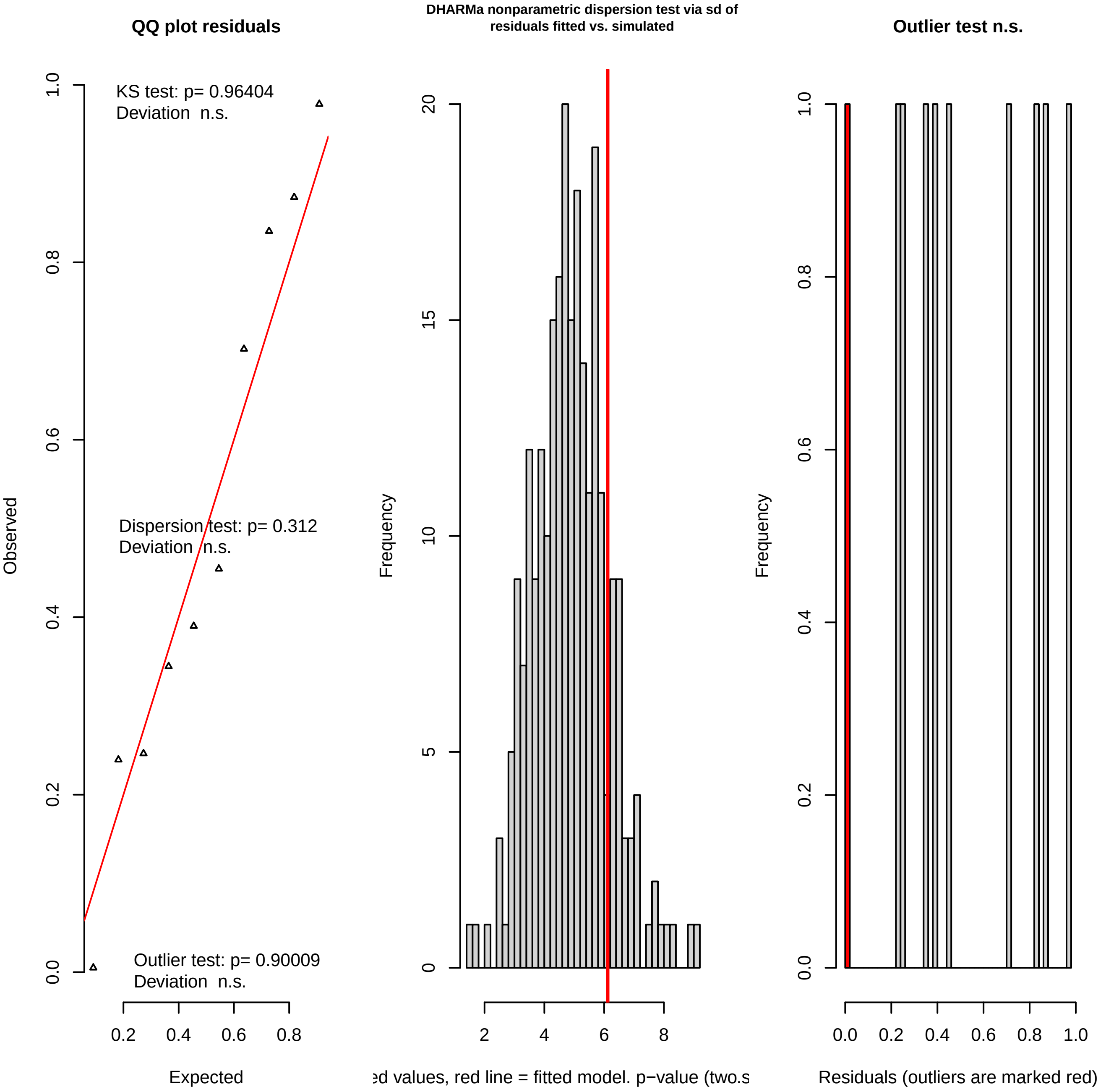
DHARMa nonparametric dispersion test via sd of residuals fitted vs. simulated


DHARMa nonparametric dispersion test via sd of
residuals fitted vs. simulated
Frequency
0
5
10
15
20
2
4
6
8
Simulated values, red line = fitted model. p−value (two.sided) = 0.312



DHARMa nonparametric dispersion test via sd of residuals fitted vs. simulated

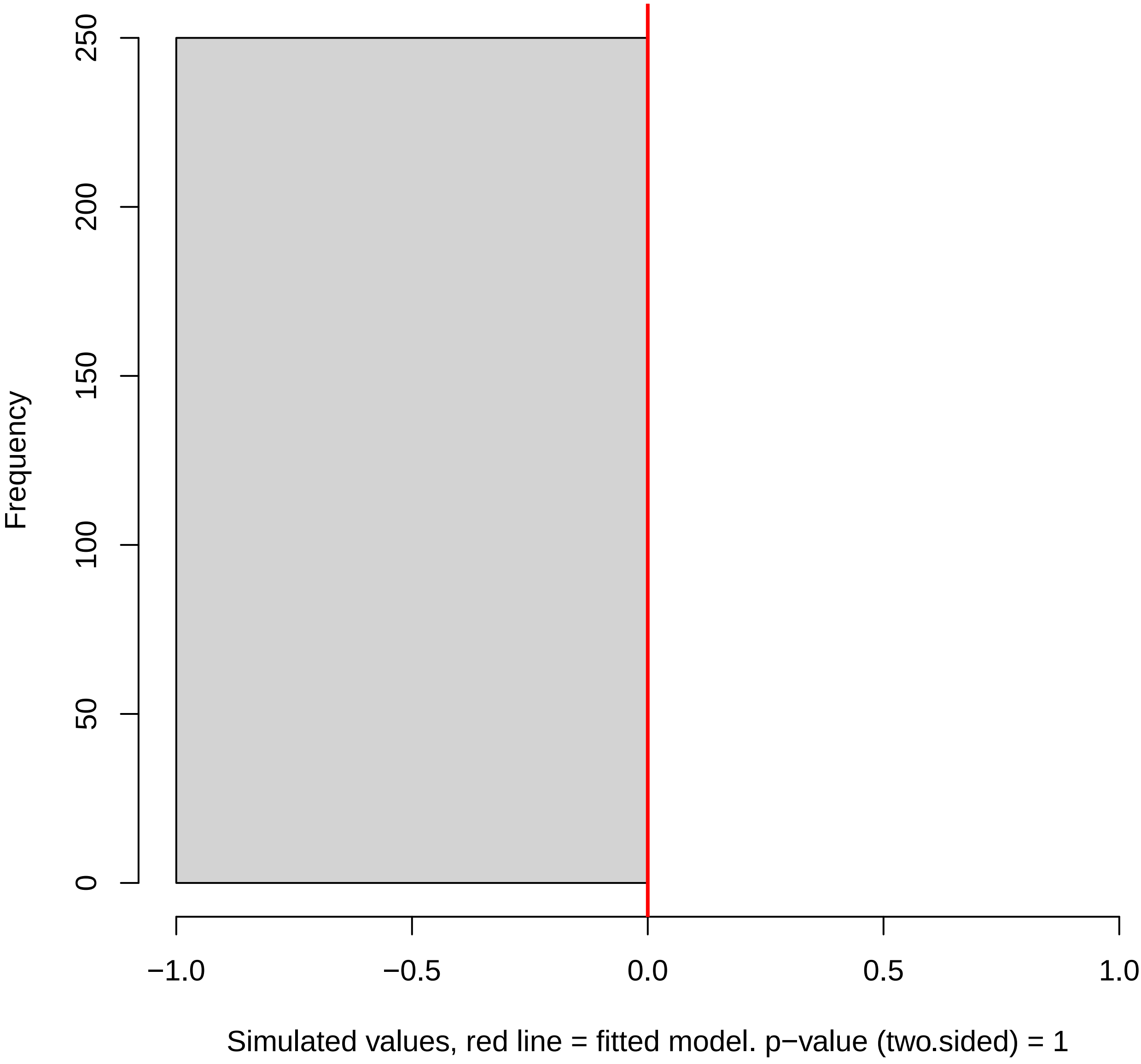

QQ plot residuals
KS test: p= 0.96404
Deviation n.s.
Dispersion test: p= 0.312
Deviation n.s.
Outlier test: p= 0.90009
Deviation n.s.
Observed
0.0
0.2
0.4
0.6
0.8
1.0
Expected
0.2
0.4
0.6
0.8
DHARMa nonparametric dispersion test via sd of
residuals fitted vs. simulated
Frequency
0
5
10
15
20
2
4
6
8
ed values, red line = fitted model. p−value (two.s
Outlier test n.s.
Frequency
0.0
0.2
0.4
0.6
0.8
1.0
0.0
0.2
0.4
0.6
0.8
1.0
Residuals (outliers are marked red)



QQ plot residuals

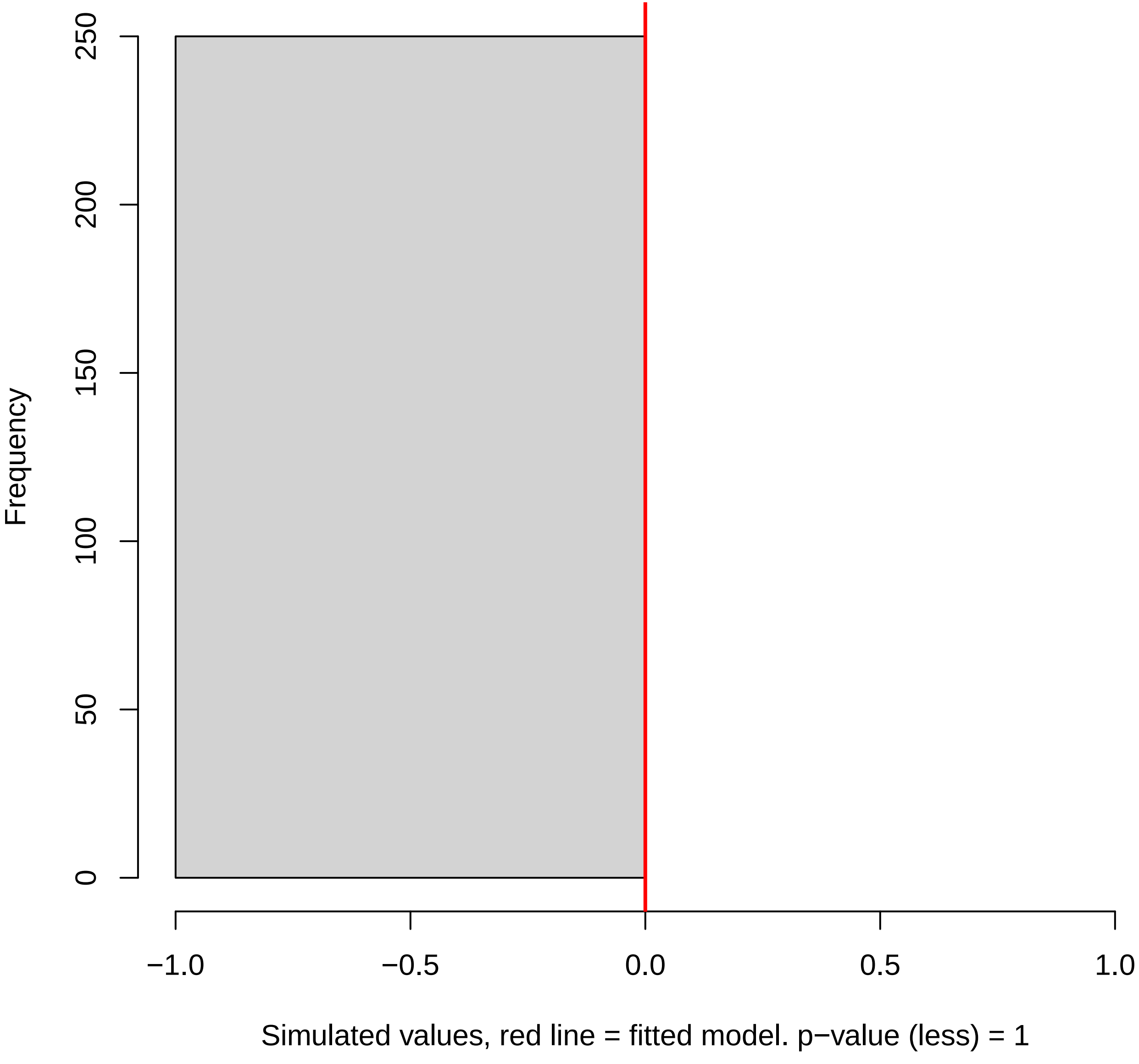
DHARMa nonparametric dispersion test via sd of residuals fitted vs. simulated

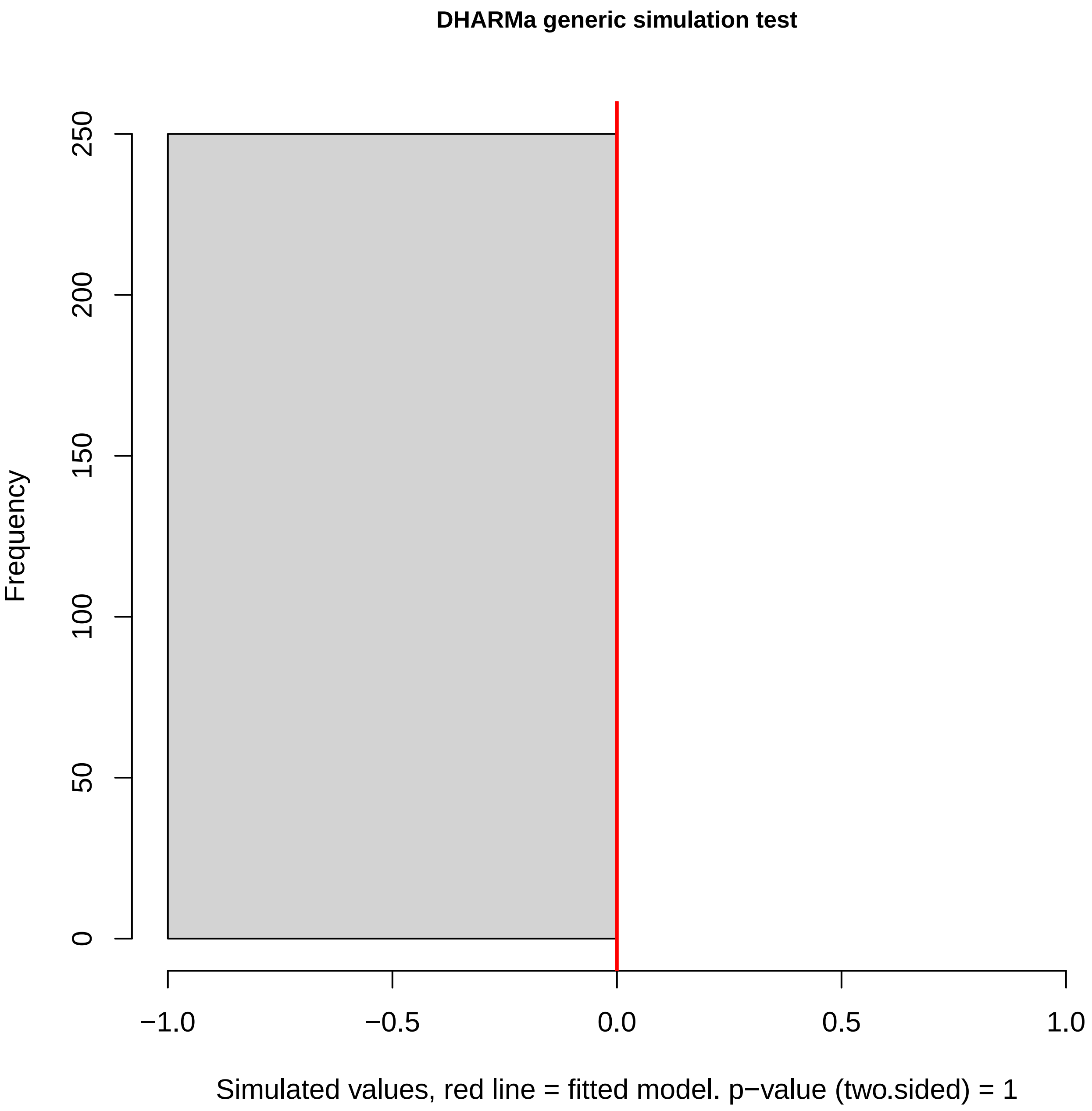
Outlier test n.s.

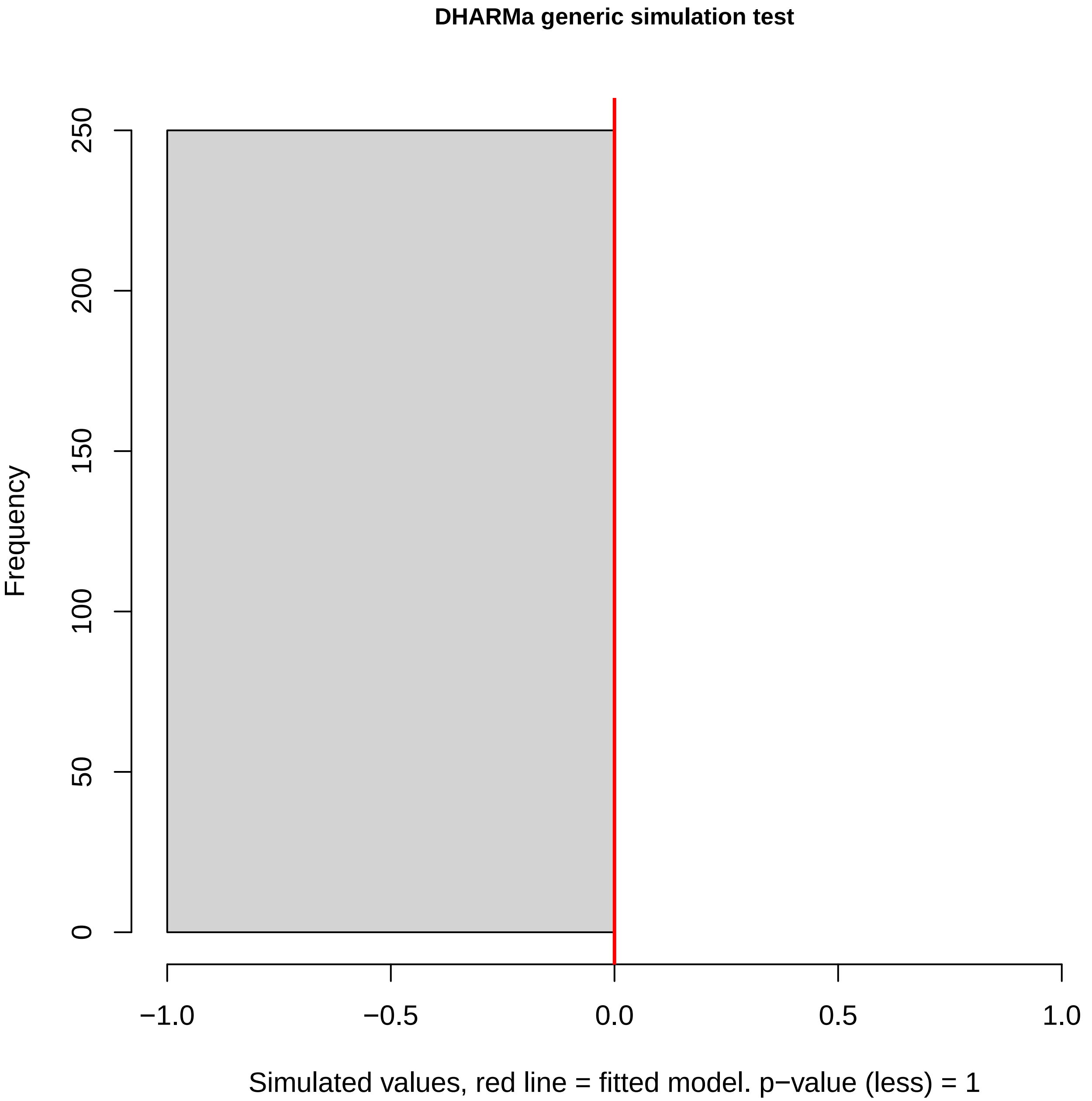


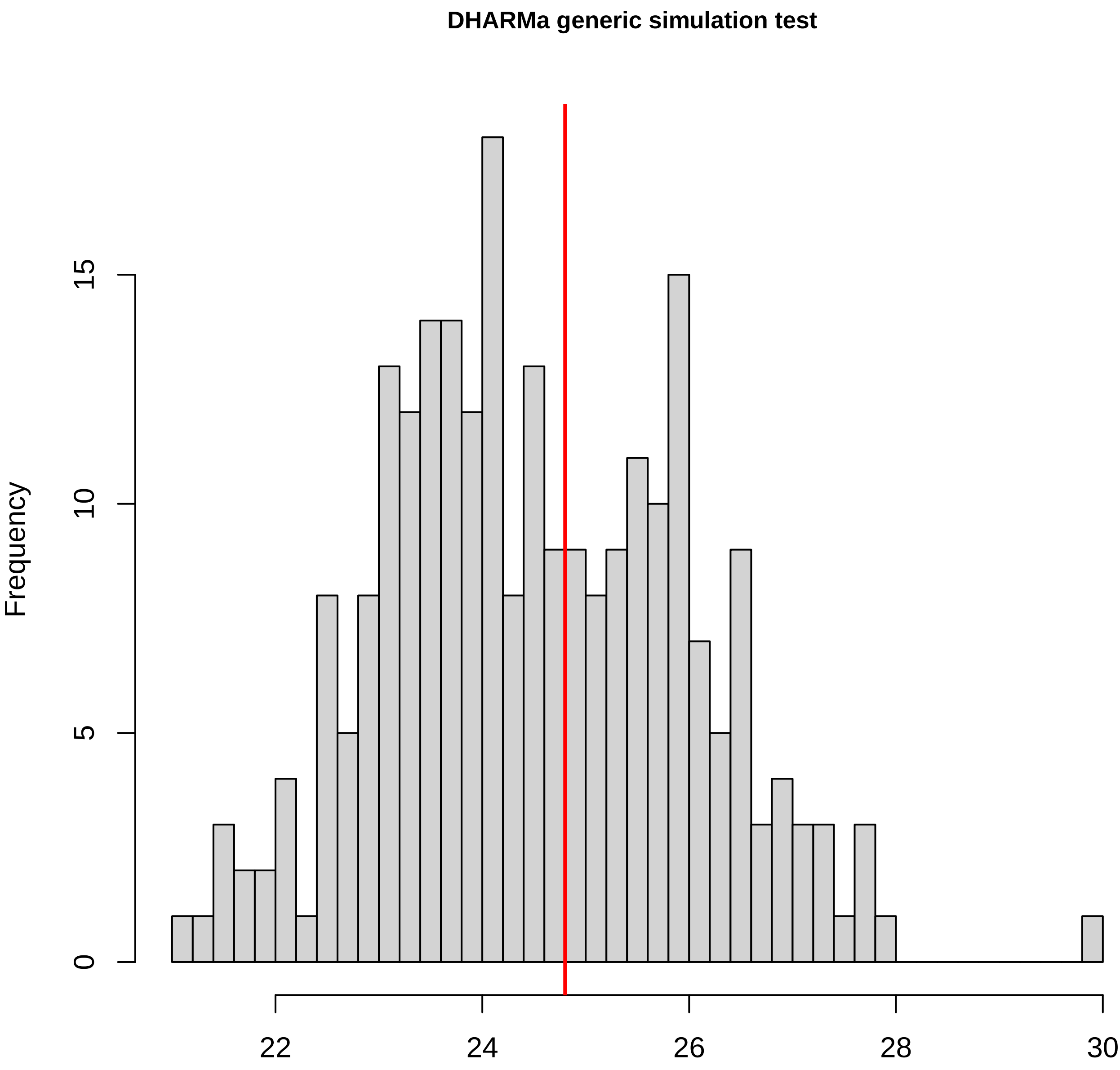
DHARMa zero−inflation test via comparison to expected zeros with simulation under H0 = fitted model

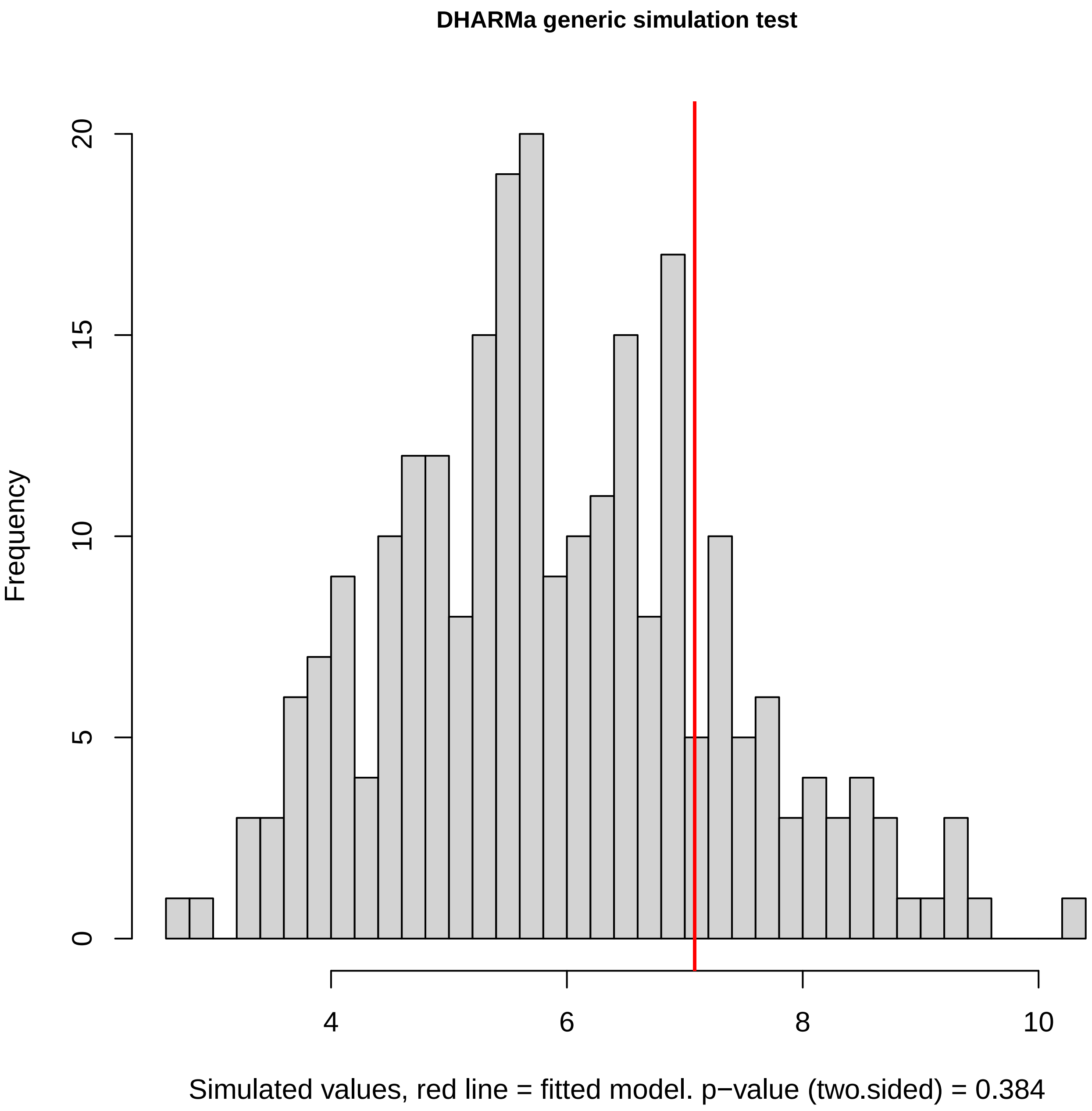
DHARMa zero−inflation test via comparison to expected zeros with simulation under H0 = fitted model

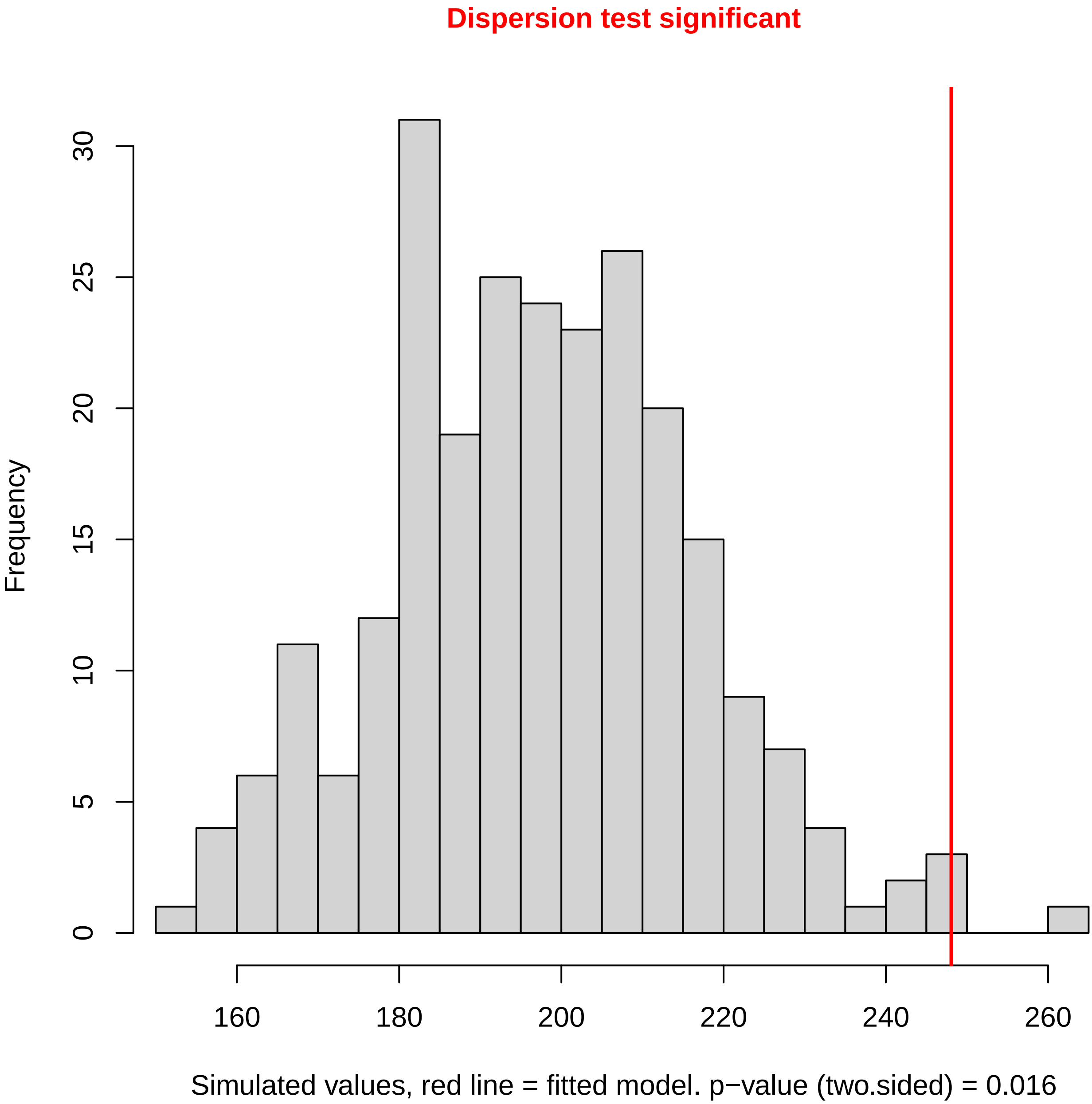


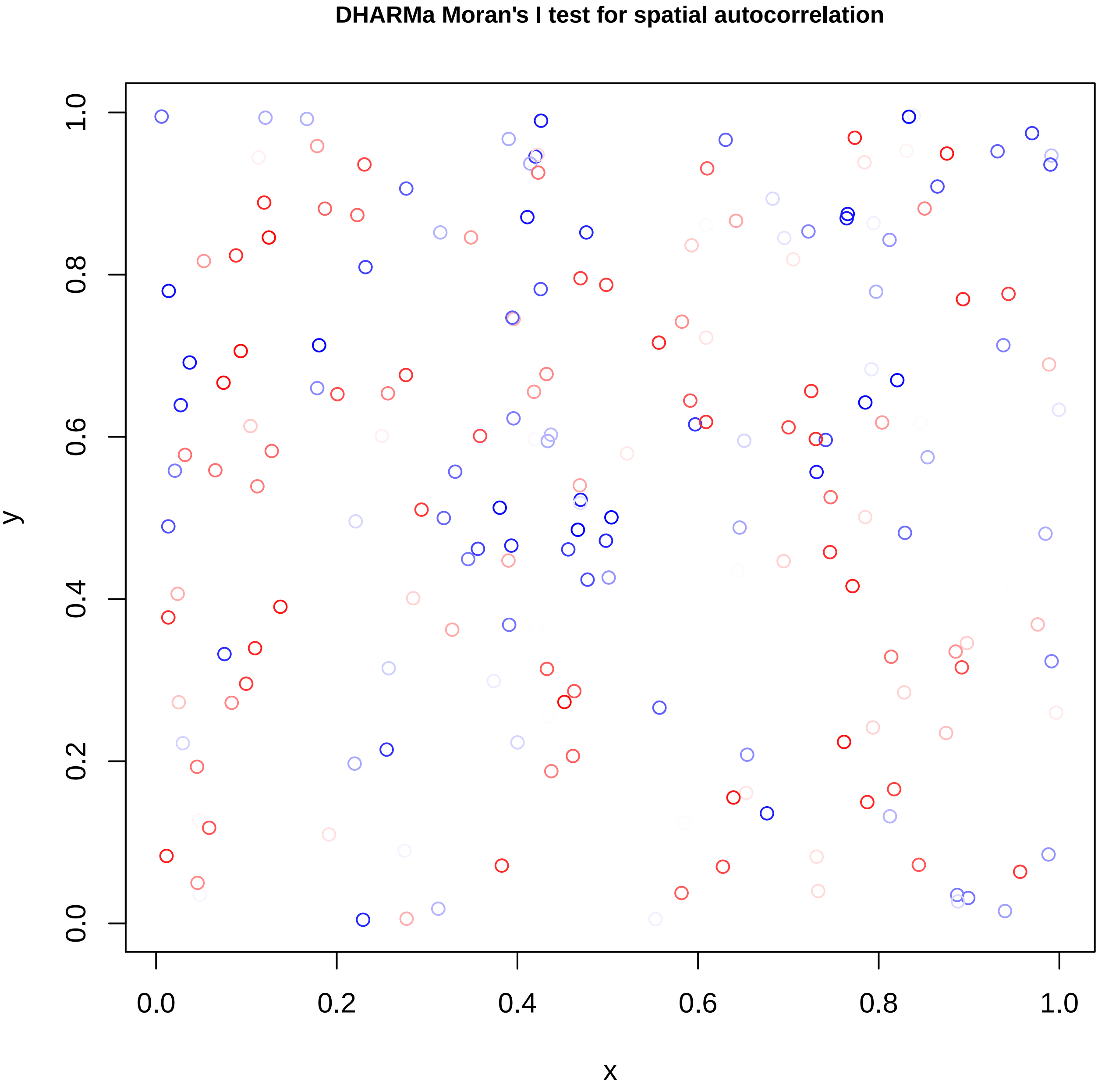

DHARMa generic simulation test
Frequency
0
50
100
150
200
250
−1.0
−0.5
0.0
0.5
1.0
Simulated values, red line = fitted model. p−value (two.sided) = 1


DHARMa generic simulation test
Frequency
0
50
100
150
200
250
−1.0
−0.5
0.0
0.5
1.0
Simulated values, red line = fitted model. p−value (less) = 1

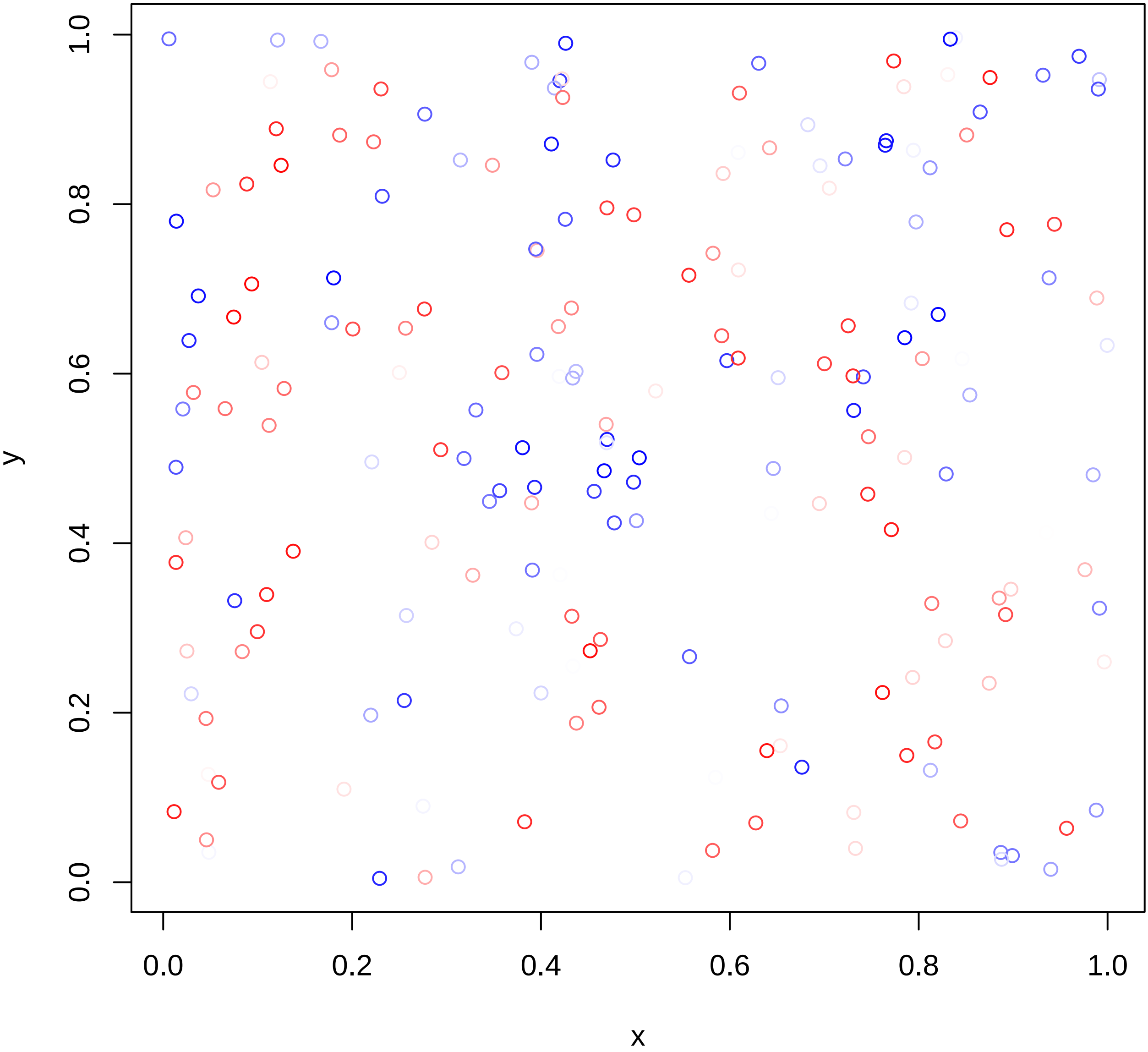

DHARMa generic simulation test
Frequency
0
5
10
15
22
24
26
28
30
Simulated values, red line = fitted model. p−value (two.sided) = 0.848

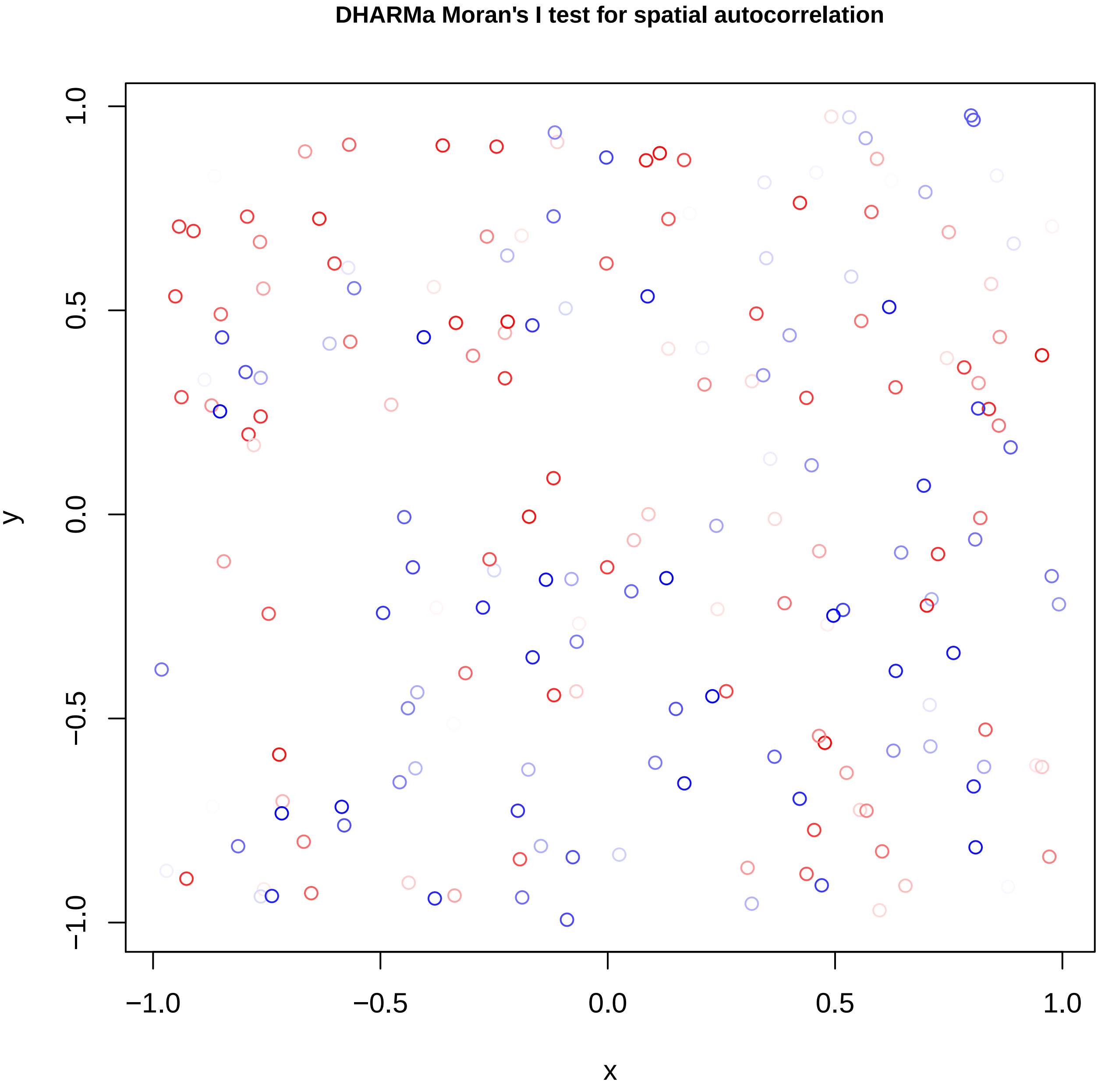

DHARMa generic simulation test
Frequency
0
5
10
15
20
4
6
8
10
Simulated values, red line = fitted model. p−value (two.sided) = 0.384


Dispersion test significant
Frequency
0
5
10
15
20
25
30
160
180
200
220
240
260
Simulated values, red line = fitted model. p−value (two.sided) = 0.016

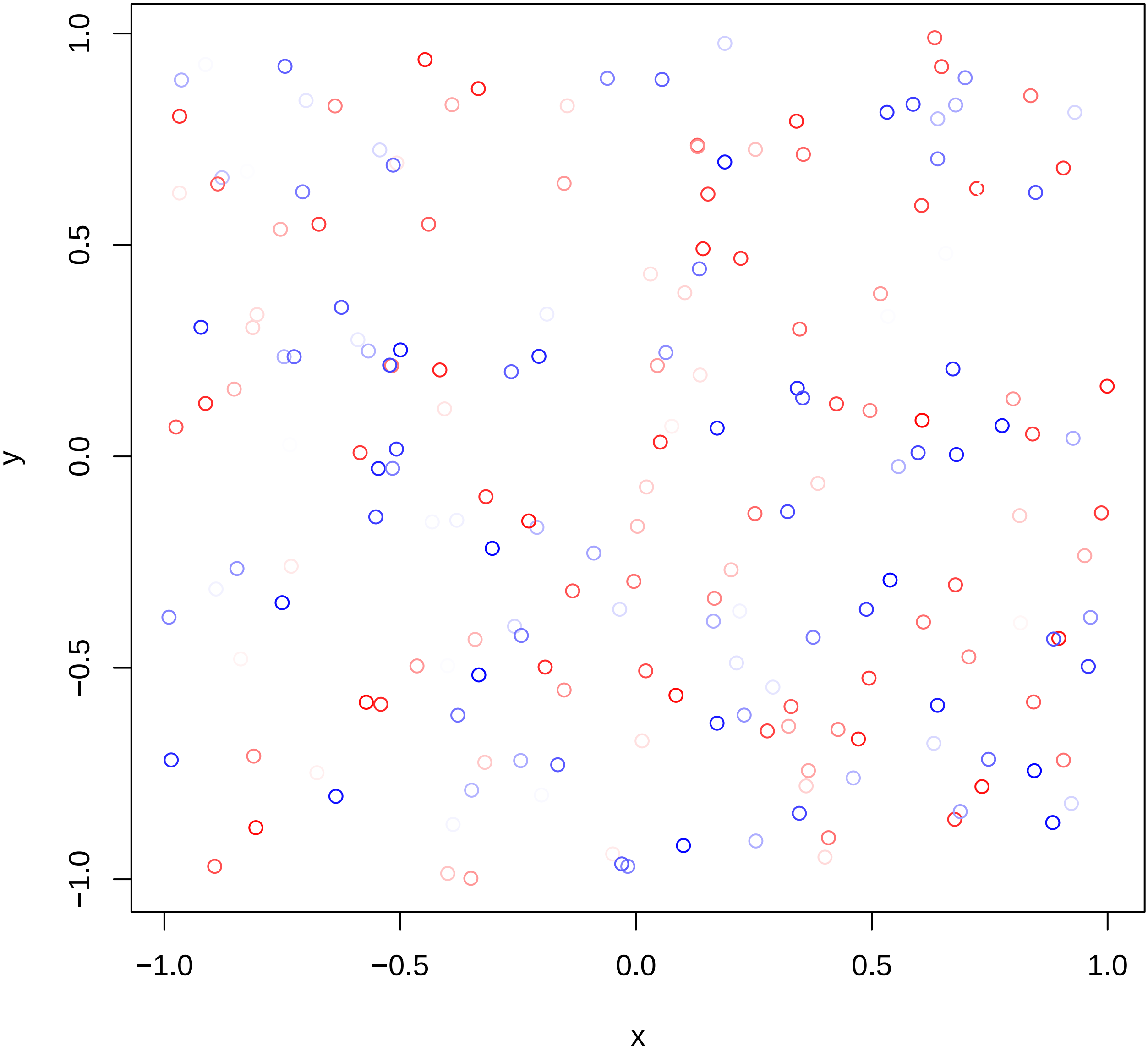

DHARMa Moran's I test for spatial autocorrelation
y
1.0
0.8
0.6
0.4
0.2
0.0
x
0.0
0.2
0.4
0.6
0.8
1.0

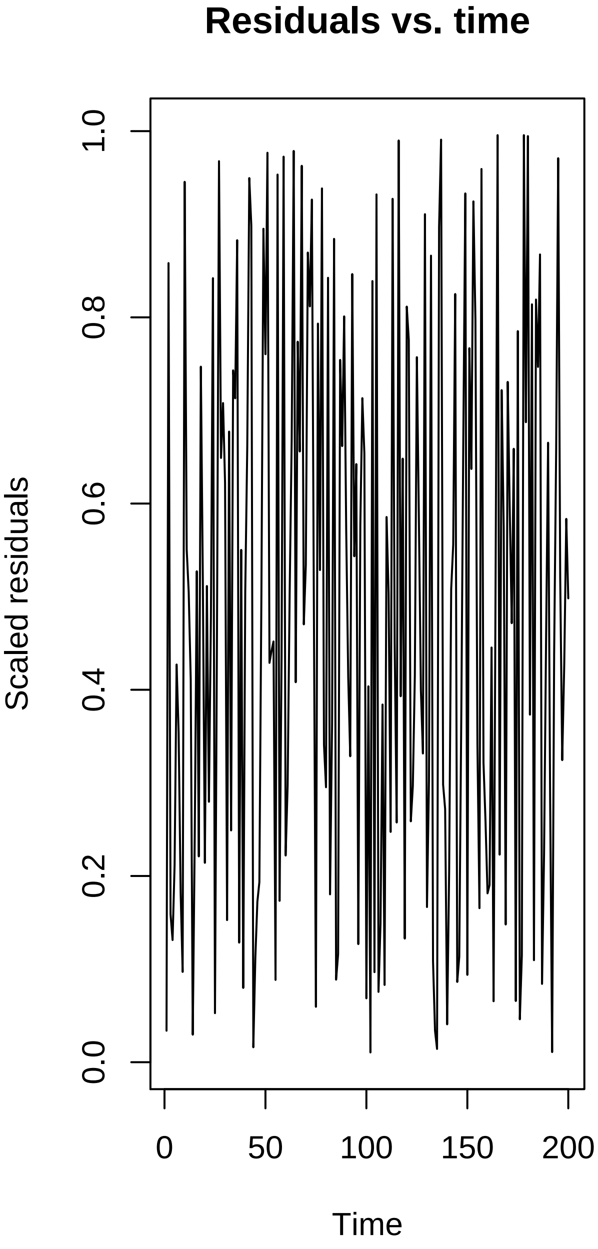
DHARMa Moran's I test for spatial autocorrelation

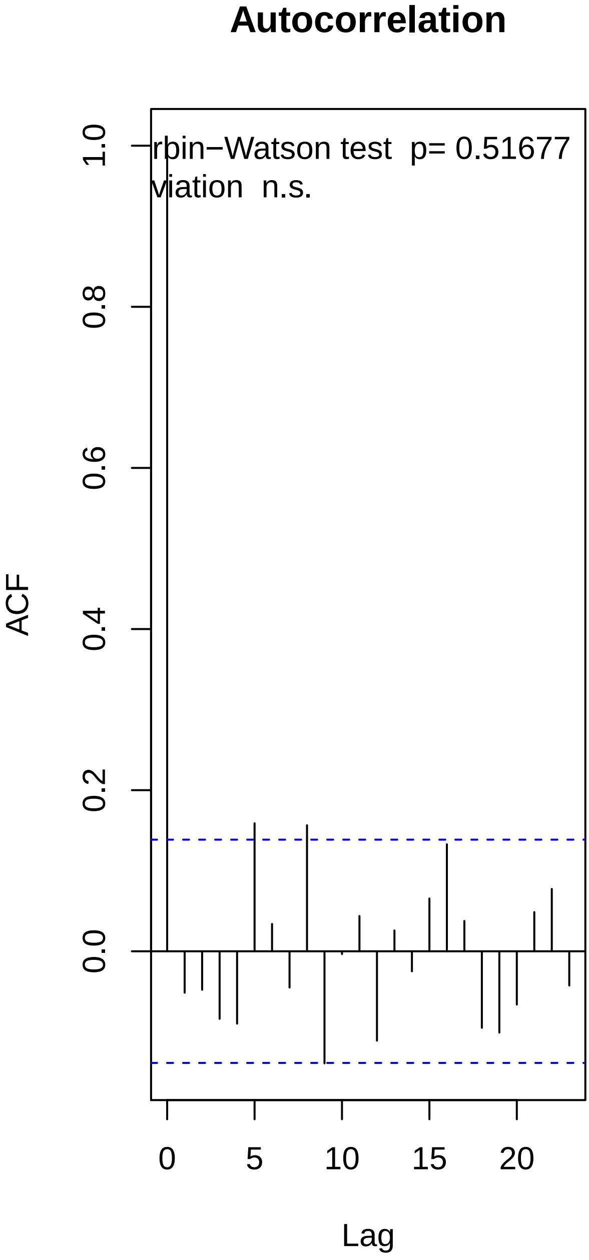


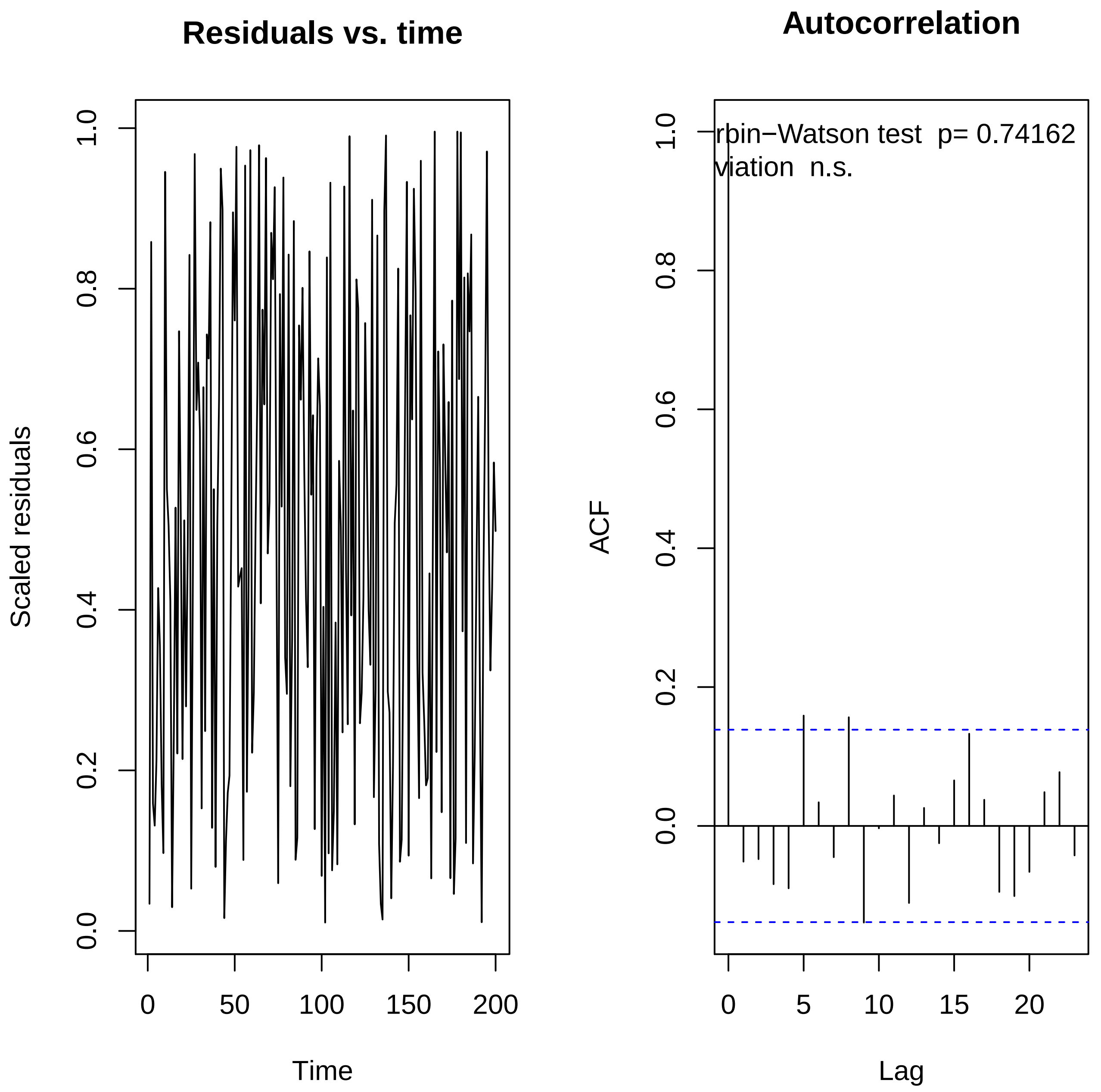

DHARMa Moran's I test for spatial autocorrelation
y
1.0
0.5
0.0
−0.5
−1.0
x
−1.0
−0.5
0.0
0.5
1.0

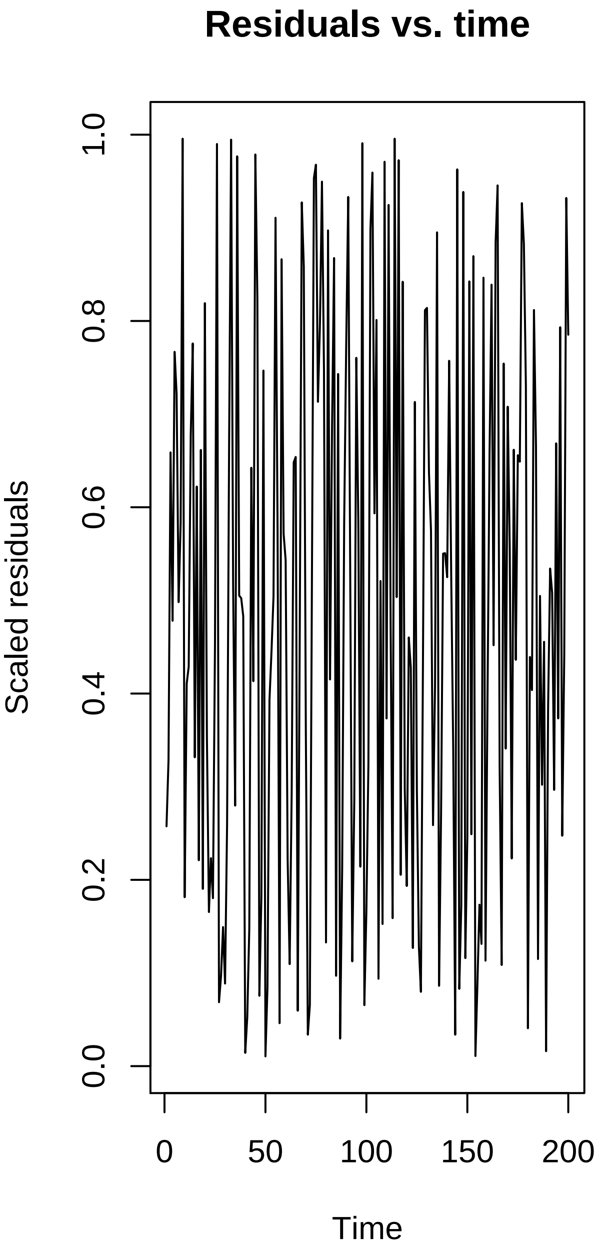
DHARMa Moran's I test for spatial autocorrelation

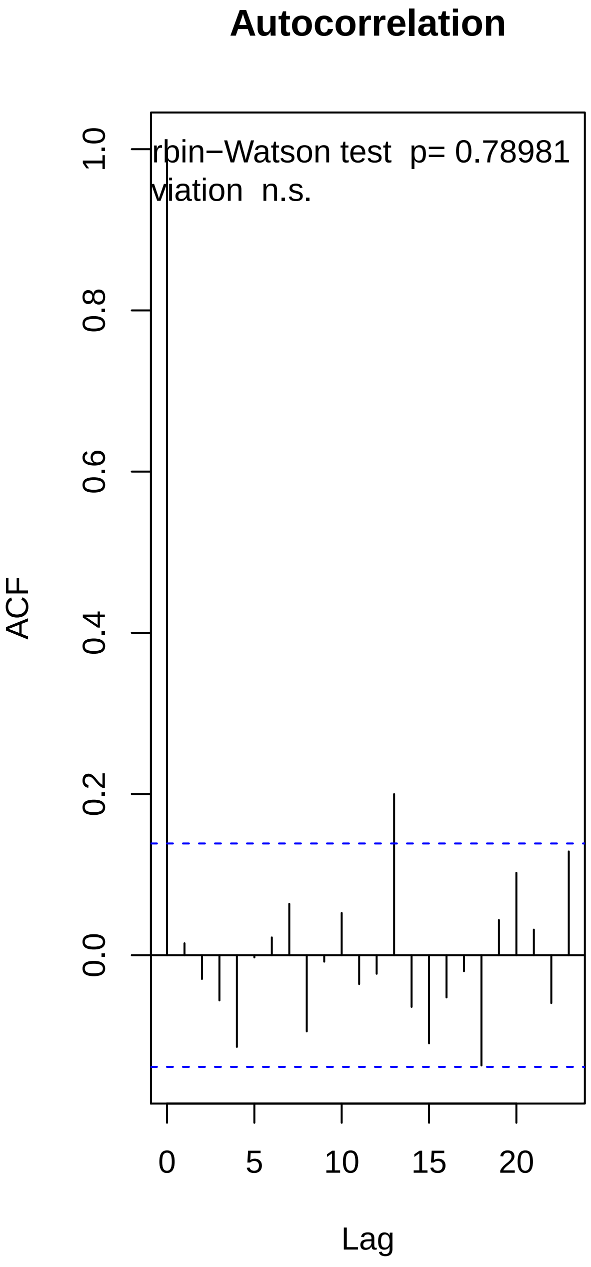


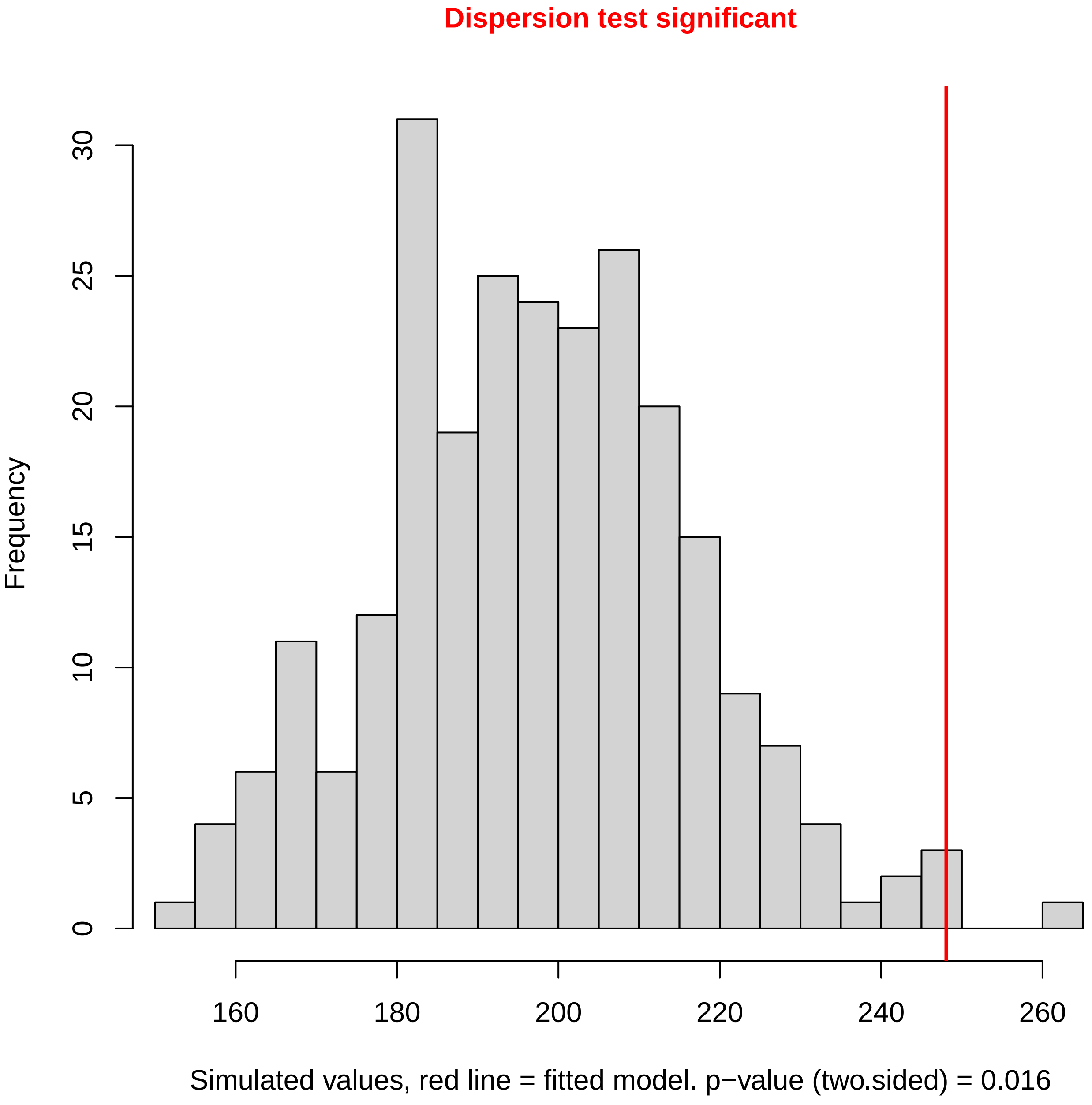

Residuals vs. time
Scaled residuals
0.0
0.2
0.4
0.6
0.8
1.0
Time
0
50
100
150
200


Autocorrelation
rbin−Watson test p= 0.51677
viation n.s.
ACF
0.0
0.2
0.4
0.6
0.8
1.0
Lag
0
5
10
15
20

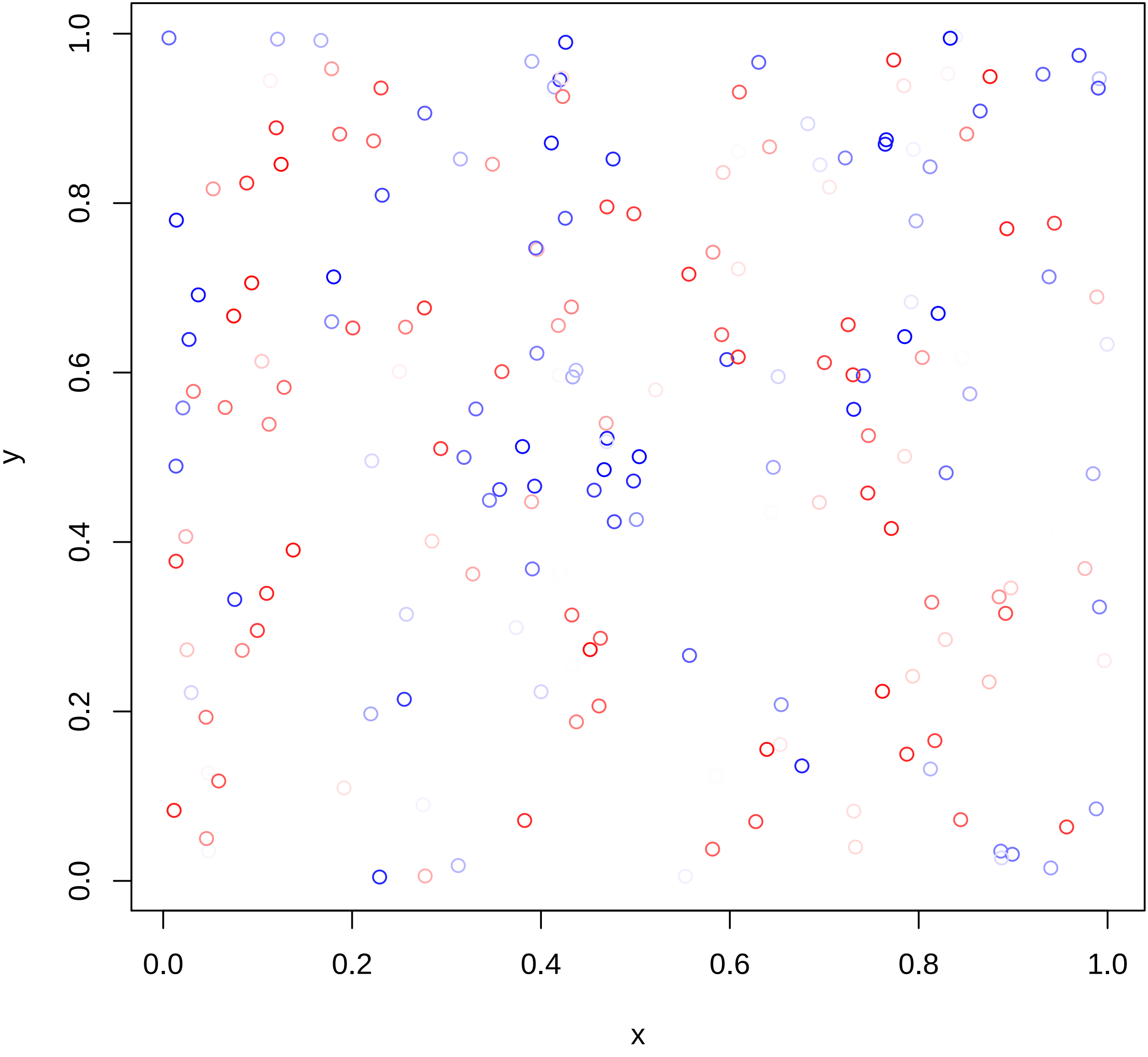

Residuals vs. time
Scaled residuals
0.0
0.2
0.4
0.6
0.8
1.0
Time
0
50
100
150
200
Autocorrelation
rbin−Watson test p= 0.74162
viation n.s.
ACF
0.0
0.2
0.4
0.6
0.8
1.0
Lag
0
5
10
15
20

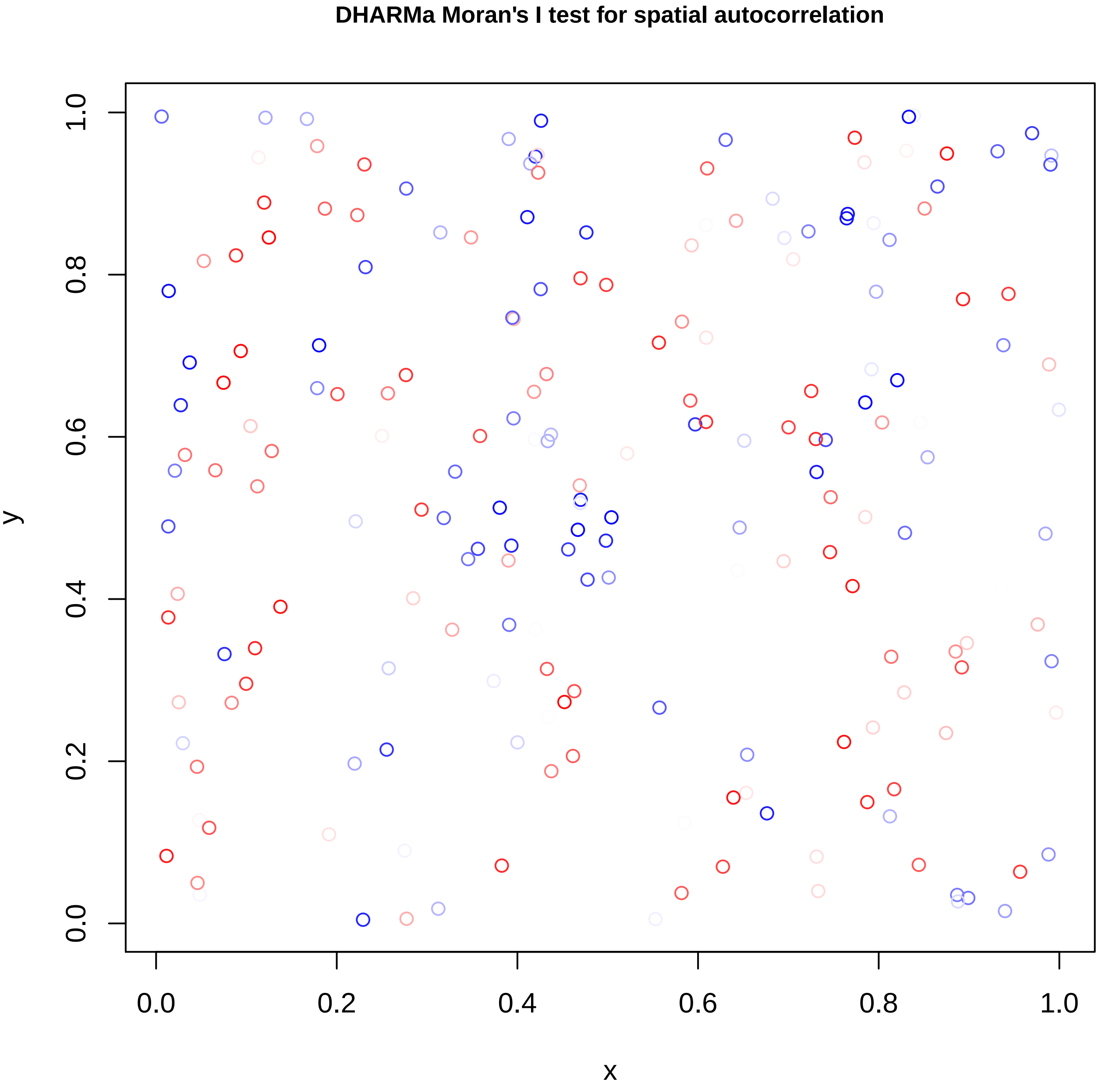

Residuals vs. time
Scaled residuals
Time
0.0
0.2
0.4
0.6
0.8
1.0
0
50
100
150
200

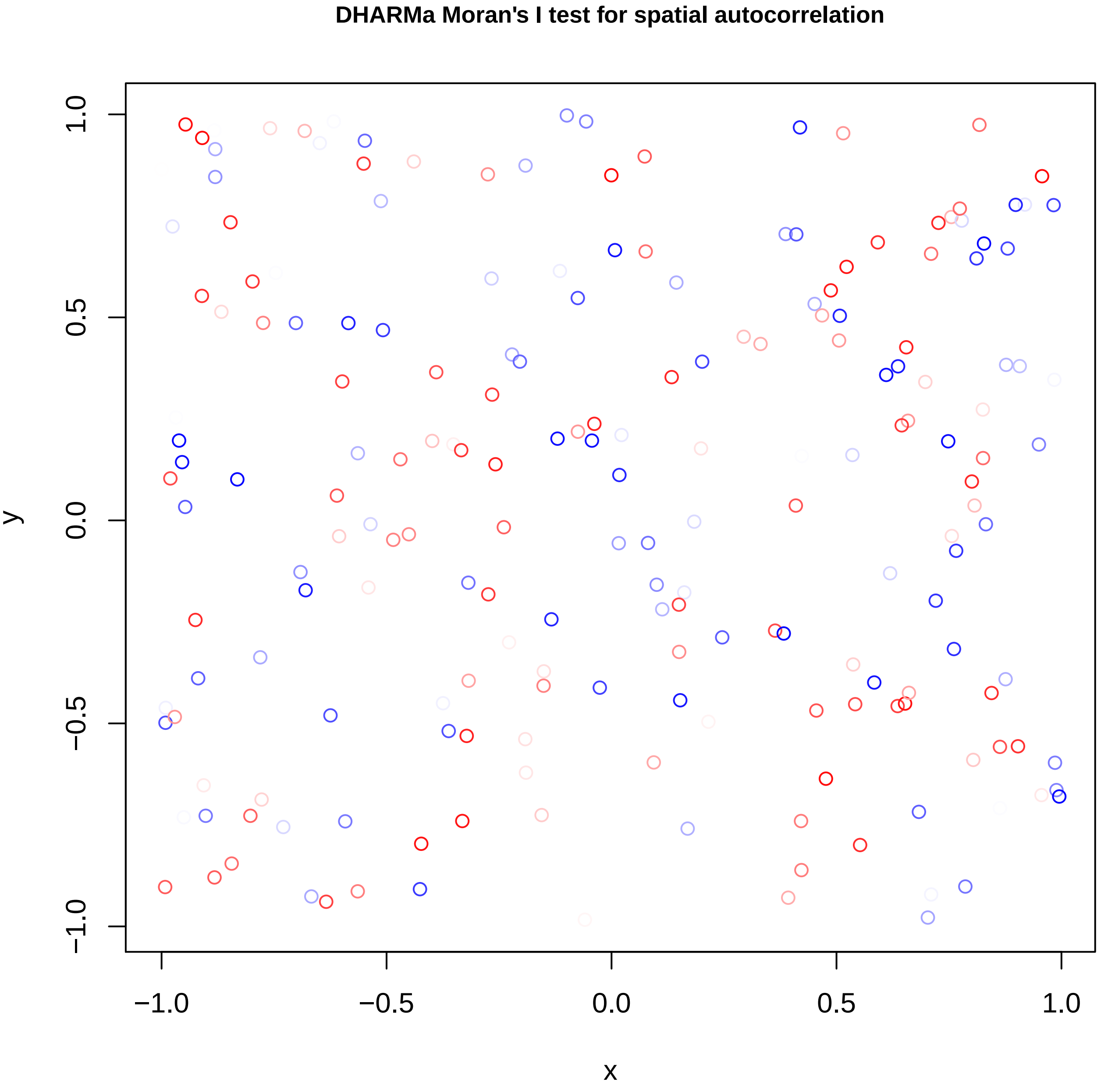

Autocorrelation
rbin−Watson test p= 0.78981
viation n.s.
ACF
Lag
0.0
0.2
0.4
0.6
0.8
1.0
0
5
10
15
20

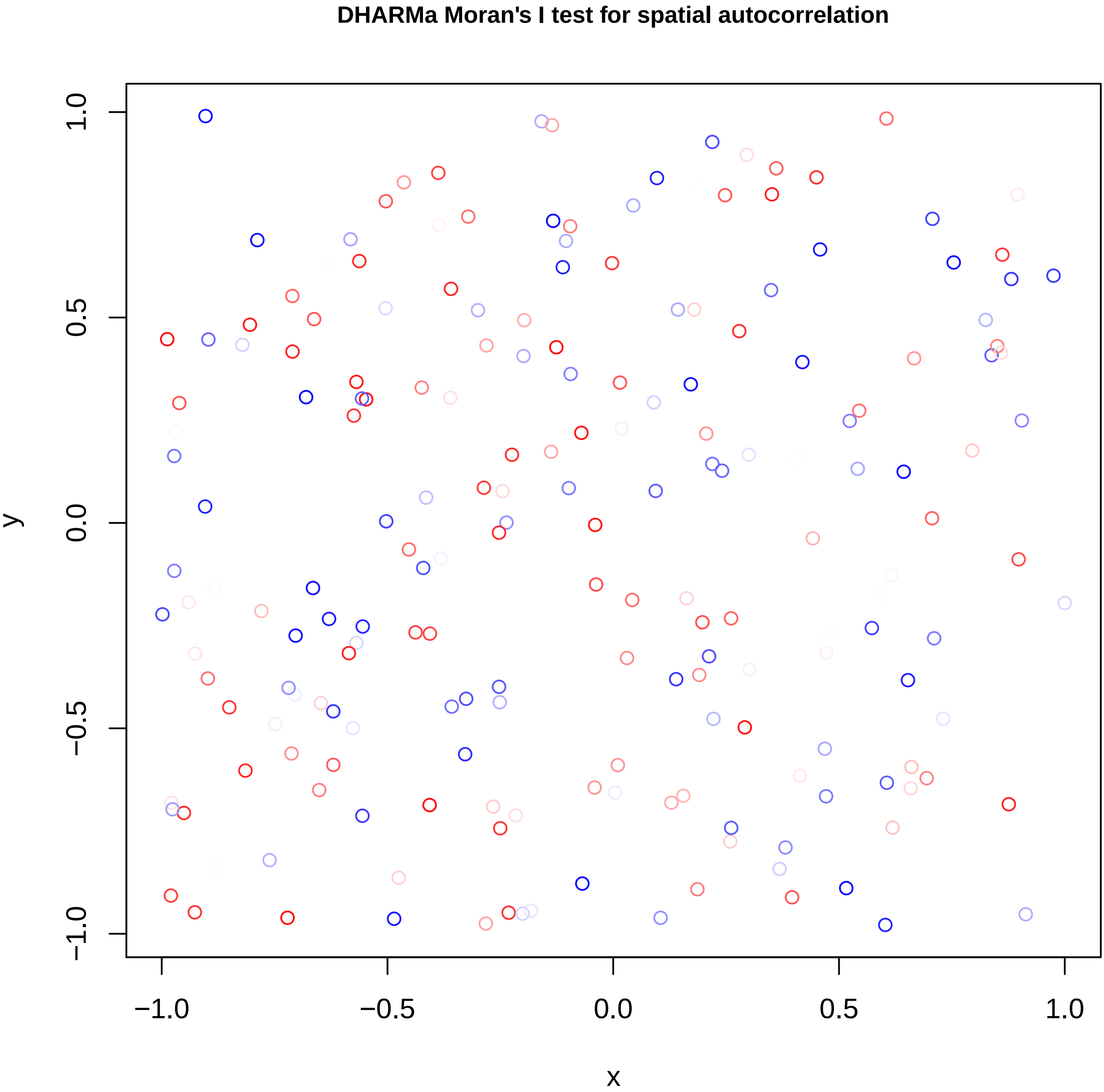

Dispersion test significant
Frequency
0
5
10
15
20
25
30
160
180
200
220
240
260
Simulated values, red line = fitted model. p−value (two.sided) = 0.016

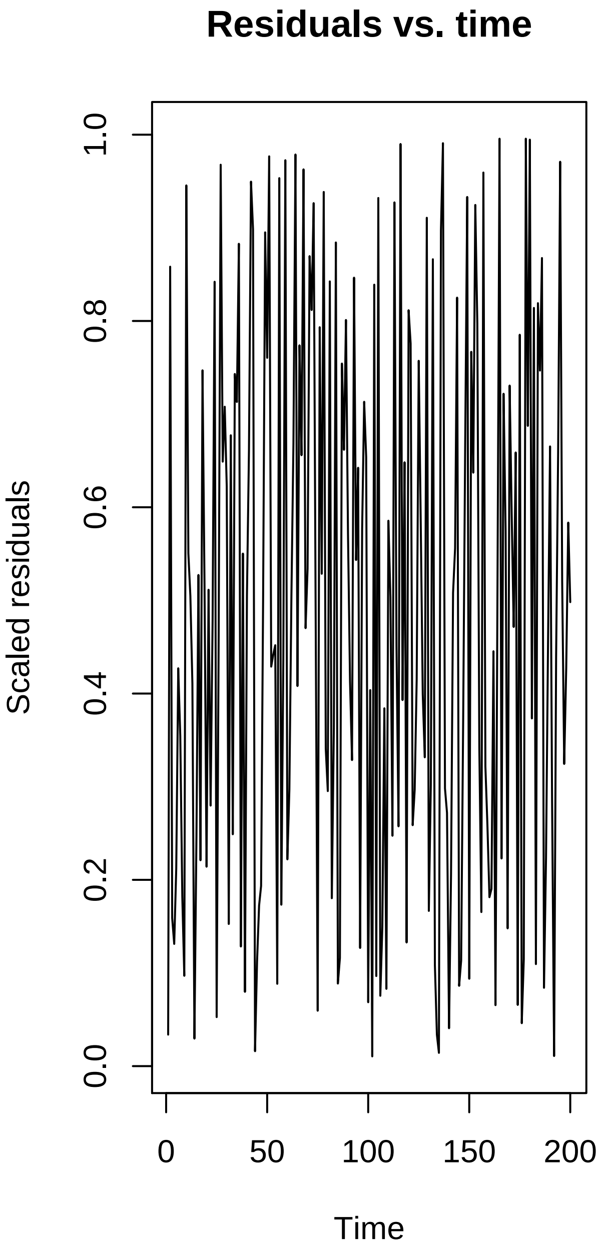
DHARMa Moran's I test for spatial autocorrelation

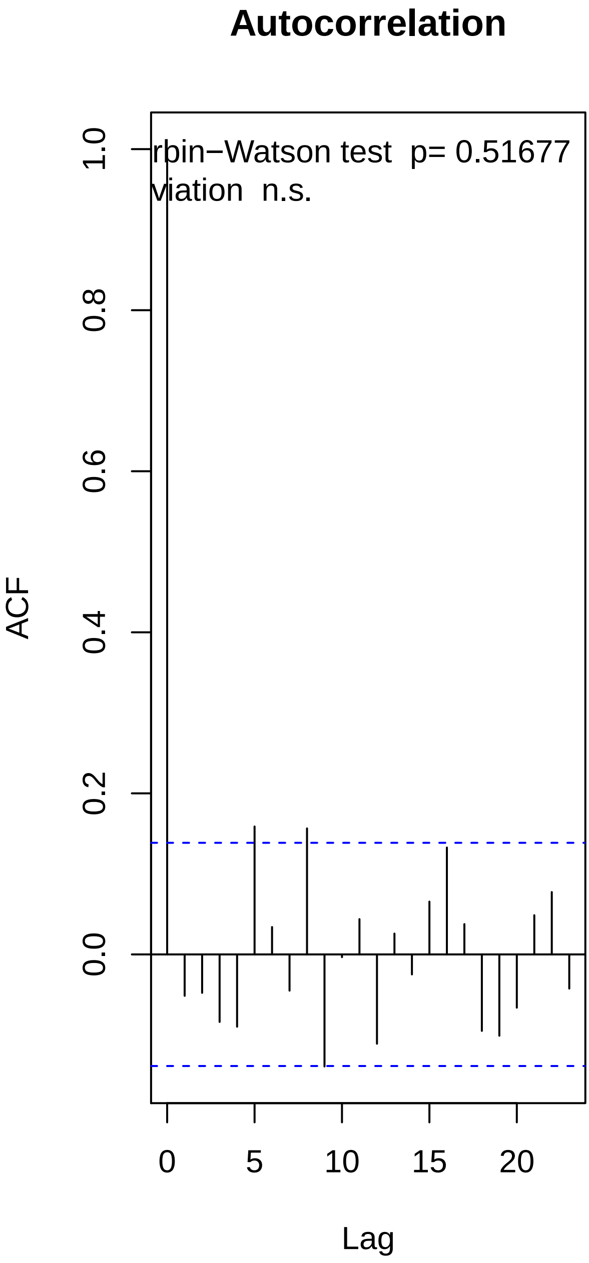


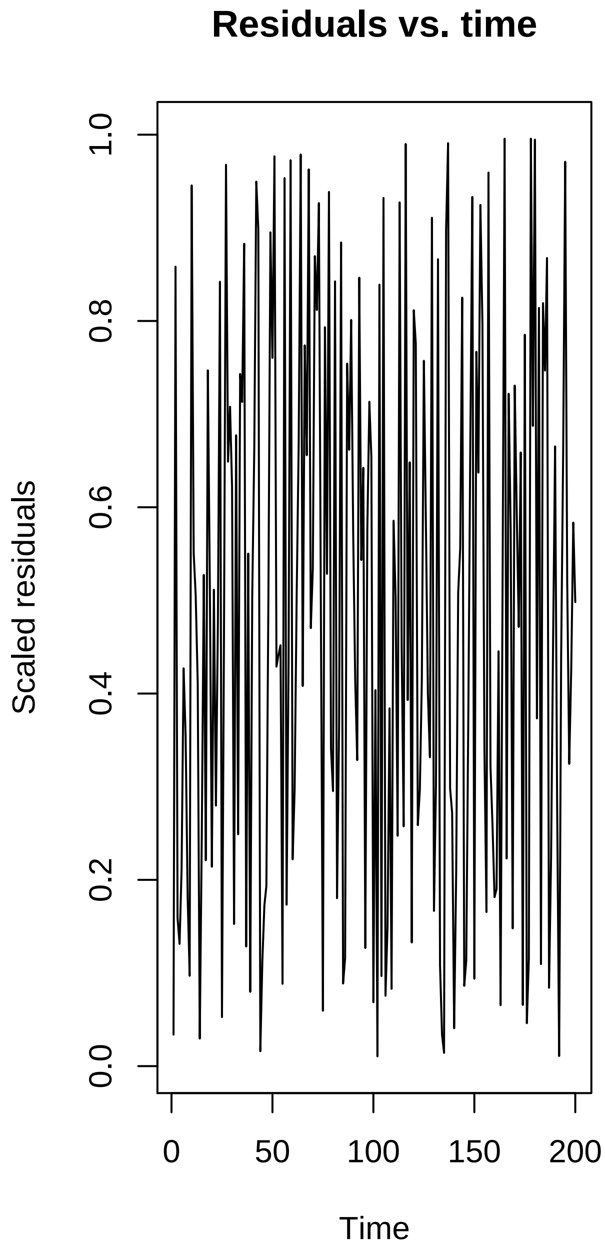

DHARMa Moran's I test for spatial autocorrelation
y
0.0
0.2
0.4
0.6
0.8
1.0
x
0.0
0.2
0.4
0.6
0.8
1.0

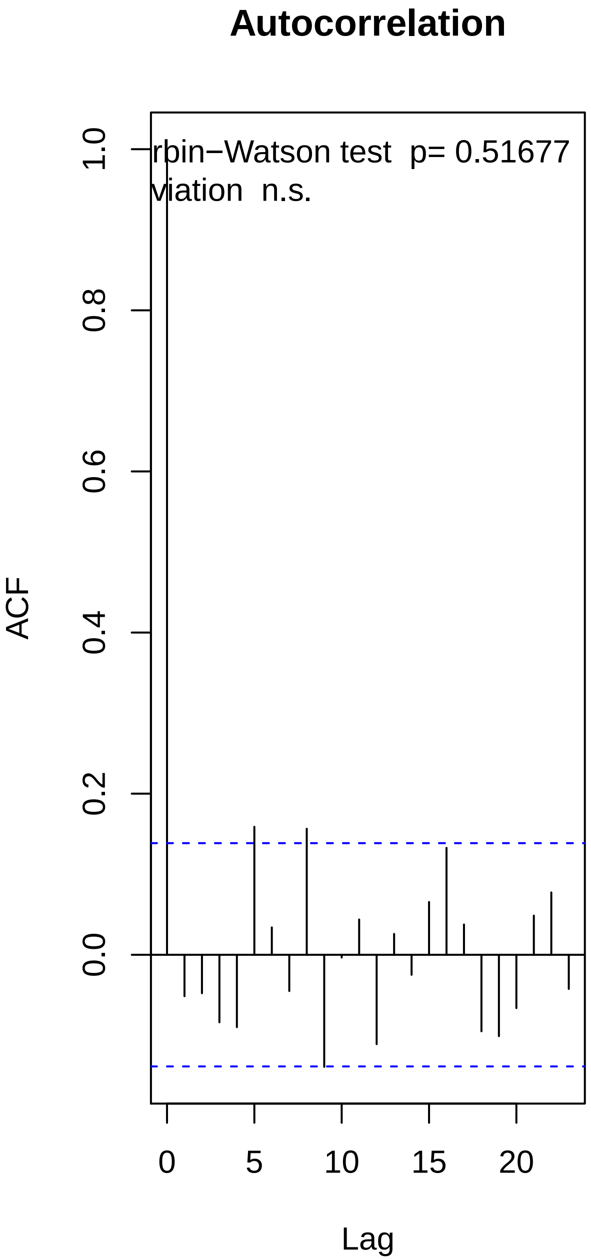

DHARMa Moran's I test for spatial autocorrelation
y
1.0
0.5
0.0
−0.5
−1.0
x
−1.0
−0.5
0.0
0.5
1.0

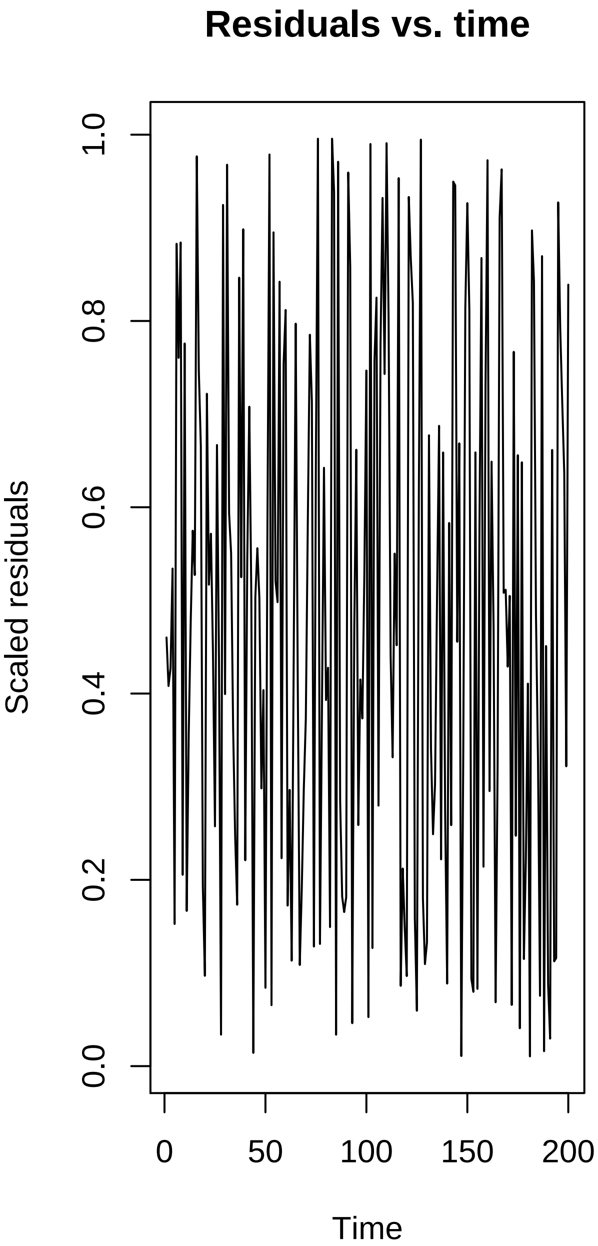

DHARMa Moran's I test for spatial autocorrelation
y
1.0
0.5
0.0
−0.5
−1.0
x
−1.0
−0.5
0.0
0.5
1.0

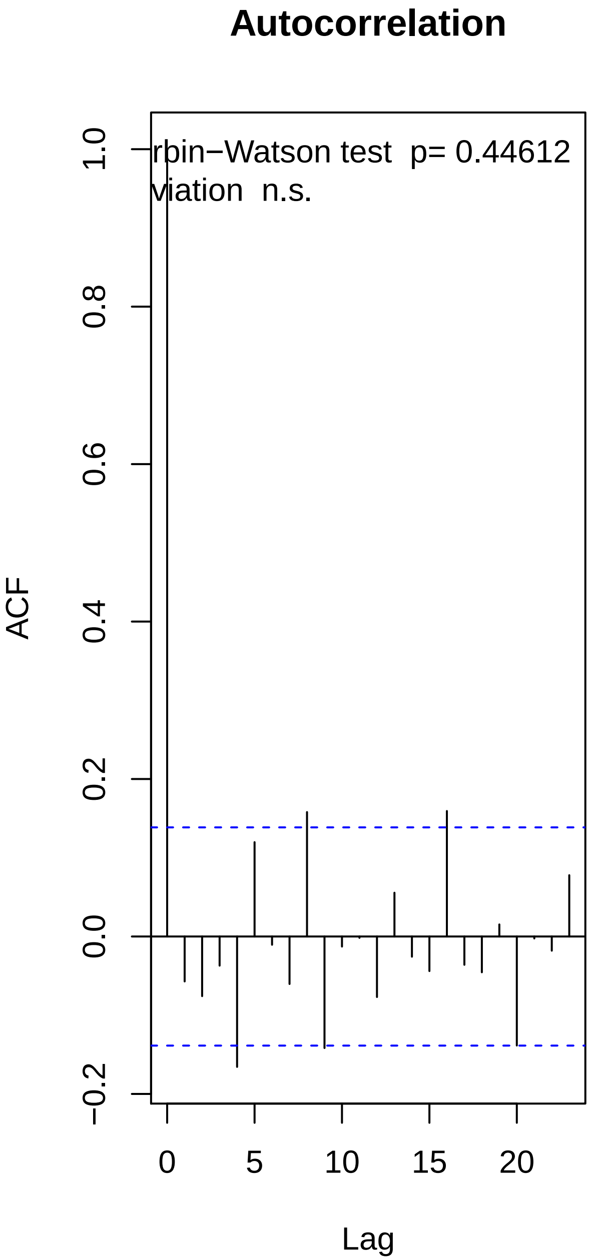

Residuals vs. time


Autocorrelation


Residuals vs. time


Autocorrelation


Residuals vs. time
Scaled residuals
0.0
0.2
0.4
0.6
0.8
1.0
Time
0
50
100
150
200


Autocorrelation
rbin−Watson test p= 0.44612
viation n.s.
ACF
−0.2
0.0
0.2
0.4
0.6
0.8
1.0
Lag
0
5
10
15
20