Aggregated sampling output

November 20, 2020

Dataset: simulated_data_dataset1_with_error, model type: SDE

Trajectories without pathologies

e.g. no divergent transitions, no max_treedepth exceeded, no Rhat > 1.1, no n_eff < 100

```
number of trajectories without pathologies (out of 100):

[1] 8


indices of trajectories without pathologies:

[1]  6  9 13 35 64 66 81 95
```

no pathologies for a subset of the parameters

```
parameters considered:

[1] "theta[1]"              "theta[3]"              "sigma"
[4] "scale"                 "offset"                "prod_theta2_m0"
[7] "prod_theta2_m0_scale"

number of trajectories without pathologies (out of 100):

[1] 10


indices of trajectories without pathologies:

 [1]  6  9 13 32 35 42 64 66 81 95
```

Divergent transitions

num..of.div..transitions	Freq
0	88
1	4
12	2
28	2
30	1
109	1
209	1
568	1

```
total number of trajectories with div. transitions: 12
indices of trajectories with div. transitions:
5 10 11 23 27 28 46 53 54 77 78 80
```

Maximum tree depth exceeded

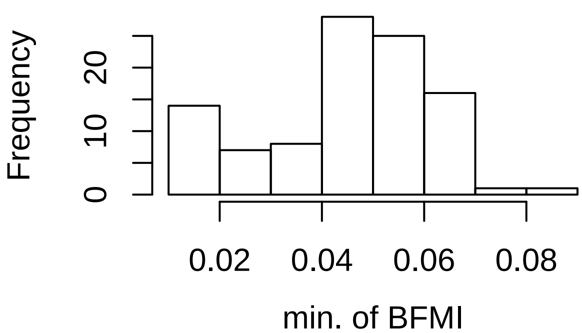
num..of.max.t.d..exceeded	Freq
0	10
1	7
2	2
4	1
5	1
6	3
7	3
8	6
9	3
13	1
14	1
16	1
19	2
22	1
26	1
29	1
33	1
35	1
43	1
48	1
52	1
54	1
62	1
63	1
76	1
77	1
78	1
86	1
88	1
106	1
115	1
121	1
124	1
149	1
165	1
186	1
192	1
239	1
249	1
251	1
298	1
305	1
306	1
308	1
316	1
332	1
375	1
377	1
394	1
409	1
440	1
550	1
564	2
566	1
597	1

num..of.max.t.d..exceeded	Freq
660	1
771	1
1053	1
1054	1
1252	1
1320	1
1340	1
1396	1
1801	1
2325	1
3154	1
4055	1
4096	1
4671	1
6363	1
7126	1

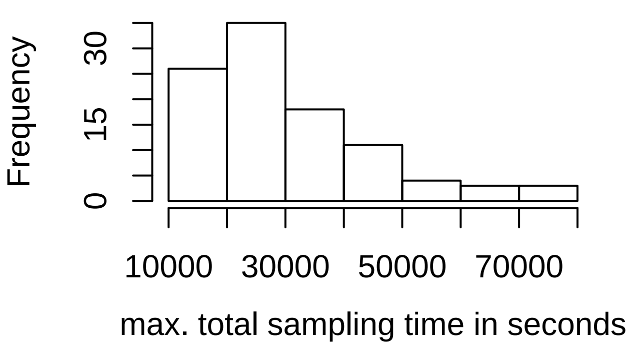
```
total number of trajectories were max. tree depth was exceeded: 90
indices of trajectories were max. tree depth was exceeded:
1 2 3 4 5 7 8 10 11 12 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 33 34 36 37 38 39 40 41 43
```

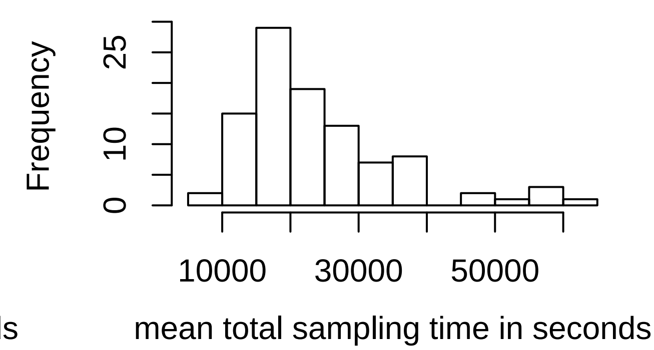
Bayesian fraction of missing information (BFMI)

num..of.low.BFMI	Freq
8	100



Total sampling time





R-hat

total number of trajectories with very high Rhat (> 1.1) (out of 100)

```
[1] 27
```

number of trajectories with high Rhat per parameter (out of 100)

	Rhat > 1.02	Rhat > 1.1
theta[1]	28	23
theta[2]	89	4
theta[3]	32	23
m0	95	6
sigma	10	0
scale	64	16
offset	0	0
prod_theta2_m0	69	18
prod_theta2_scale	95	5
prod_m0_scale	84	2
prod_theta2_m0_scale	6	0
x[180,1]	75	25
x[180,2]	70	18

number of parameters with high Rhat per trajectory (out of 13)

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Rhat > 1.02	5	5	7	7	10	10	6	5	5	10	11	7	7	8	7	11	12	7	4	8
Rhat > 1.1	0	0	1	0	6	0	0	0	0	7	9	0	0	0	0	3	8	0	0	0

	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
Rhat > 1.02	7	4	11	3	3	7	10	5	8	7	5	9	9	7	7	5	11	5	5	12
Rhat > 1.1	0	0	6	0	0	0	6	0	3	0	0	2	3	0	0	0	6	0	0	6

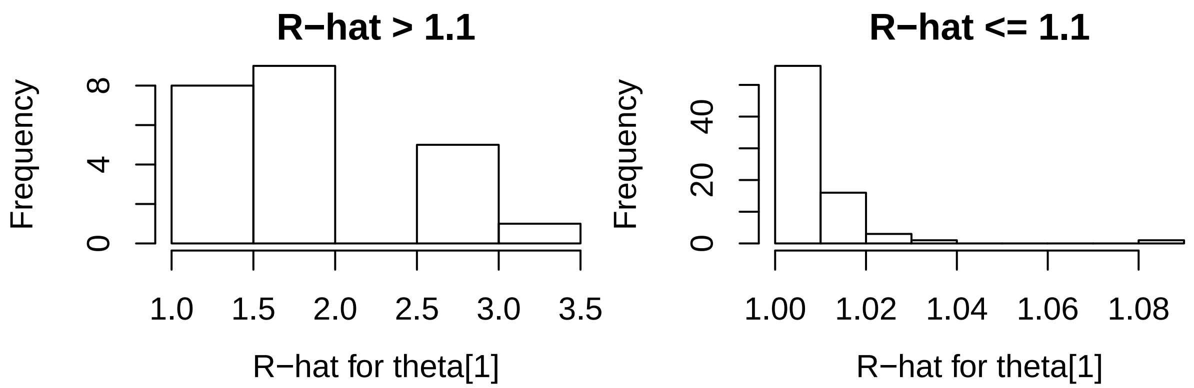
	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
Rhat > 1.02	7	6	1	6	4	9	11	5	11	9	8	6	11	8	5	8	6	6	7	11
Rhat > 1.1	0	0	0	0	0	1	5	0	6	3	0	0	7	2	0	0	0	0	0	8

	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80
Rhat > 1.02	2	8	8	5	7	5	4	5	8	11	4	8	5	6	5	6	7	10	7	10
Rhat > 1.1	0	0	0	0	0	0	0	0	0	9	0	0	0	0	0	0	0	3	0	3

	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100
Rhat > 1.02	5	8	10	7	7	8	7	5	9	3	10	9	8	8	5	12	7	10	8	3
Rhat > 1.1	0	0	7	0	0	0	0	0	0	0	6	0	0	0	0	8	0	6	0	0

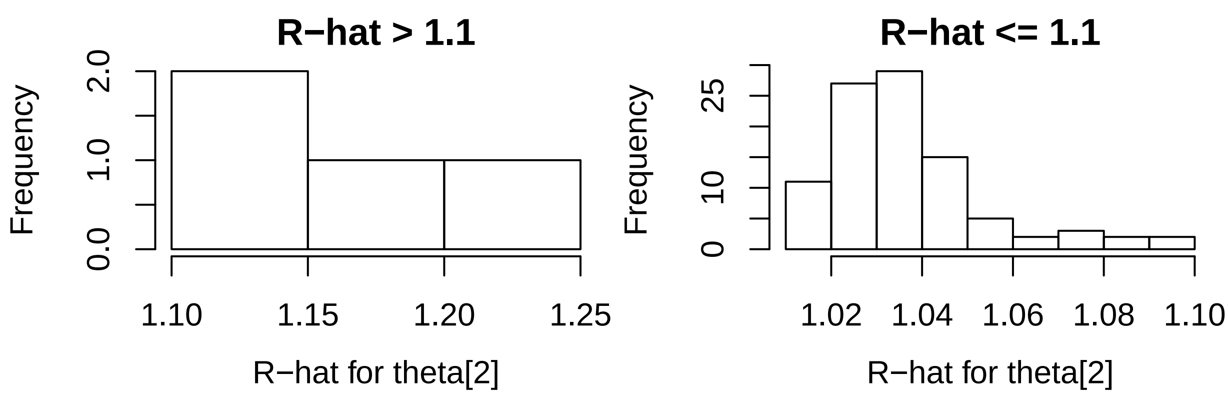
theta[1]

```
number of trajectories with Rhat > 1.02:    28

indizes of trajectories with Rhat > 1.02:
3 5 6 10 11 16 17 23 27 29 33 35 37 40 46 47 49 50 53 60 70 78 79 80 83 91 96 98

number of trajectories with Rhat > 1.1: 23

indices of trajectories with Rhat > 1.1:
5 10 11 16 17 23 27 29 33 37 40 47 49 50 53 60 70 78 80 83 91 96 98
```



theta[2]

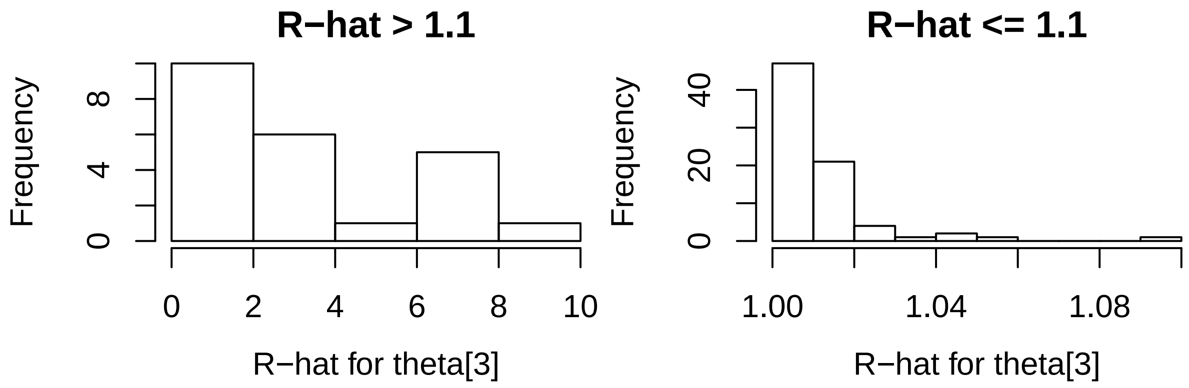
```
number of trajectories with Rhat > 1.02:    89

indizes of trajectories with Rhat > 1.02:
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 26 27 28 30 31 32 33 36 37 38 39 40 41 42 4

number of trajectories with Rhat > 1.1: 4

indices of trajectories with Rhat > 1.1:
10 11 32 70
```



theta[3]

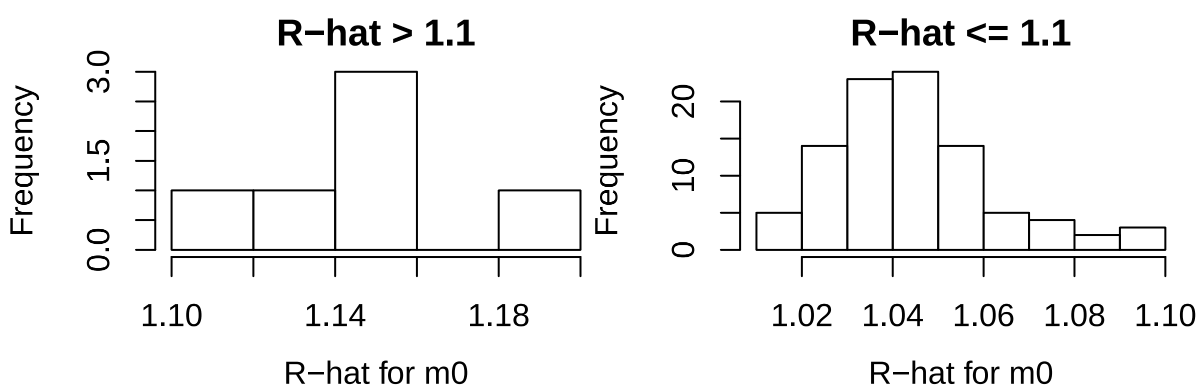
```
number of trajectories with Rhat > 1.02:    32

indizes of trajectories with Rhat > 1.02:
3 5 6 10 11 16 17 23 27 29 33 35 37 40 42 46 47 49 50 53 60 70 78 79 80 83 86 89 91 92 96 98
```

```
number of trajectories with Rhat > 1.1: 23

indices of trajectories with Rhat > 1.1:
5 10 11 16 17 23 27 29 33 37 40 47 49 50 53 60 70 78 80 83 91 96 98
```



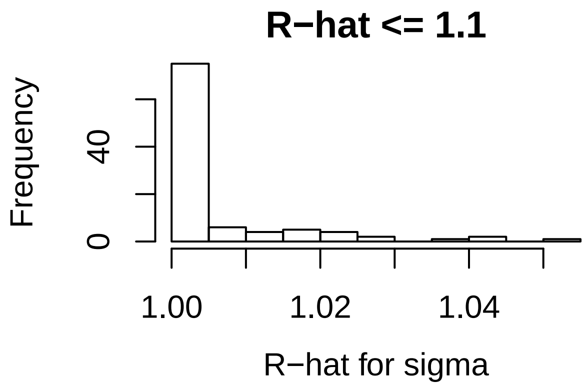
m0

```
number of trajectories with Rhat > 1.02:    95

indizes of trajectories with Rhat > 1.02:
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40

number of trajectories with Rhat > 1.1: 6

indices of trajectories with Rhat > 1.1:
11 17 60 70 83 96
```



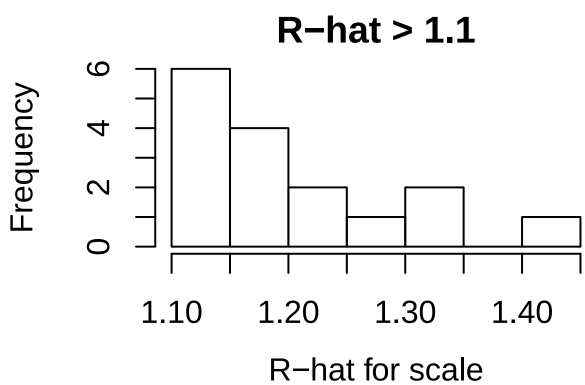
sigma

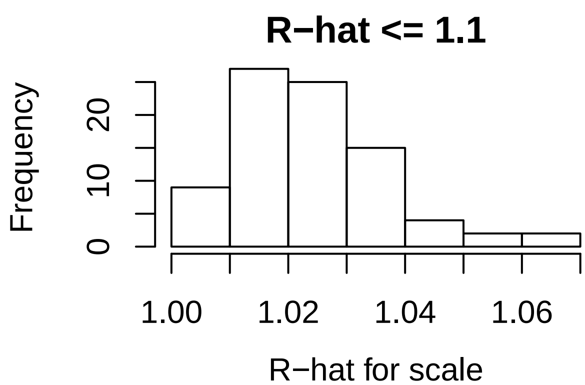
```
number of trajectories with Rhat > 1.02:    10

indizes of trajectories with Rhat > 1.02:
16 17 23 37 40 47 49 60 70 96
```



scale

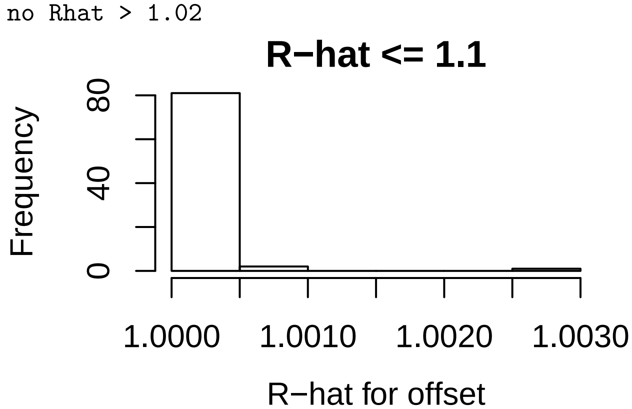
```
number of trajectories with Rhat > 1.02:    64

indizes of trajectories with Rhat > 1.02:
4 5 6 10 11 12 14 15 16 17 18 20 21 23 24 26 27 29 30 32 33 34 37 40 41 44 46 47 48 49 51 52 53 54 56 57

number of trajectories with Rhat > 1.1: 16

indices of trajectories with Rhat > 1.1:
5 10 11 17 23 27 37 40 49 53 60 70 83 91 96 98
```





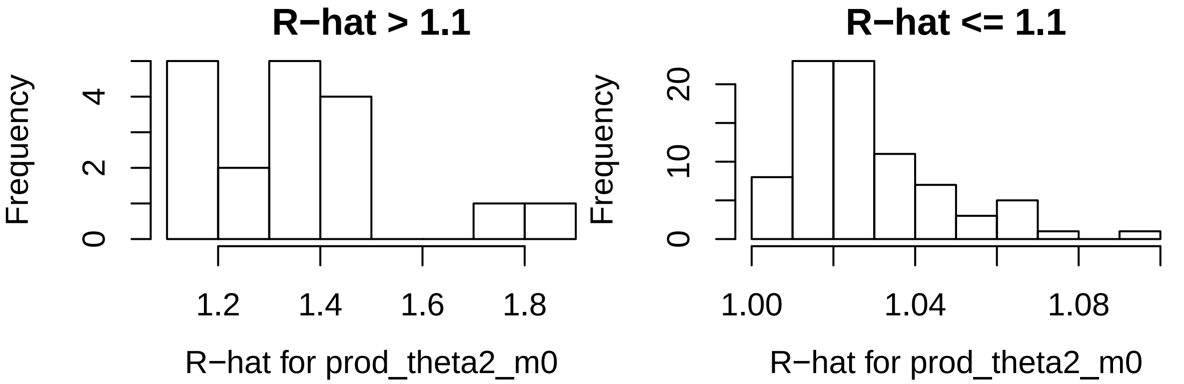
offset

```
no Rhat > 1.02
```



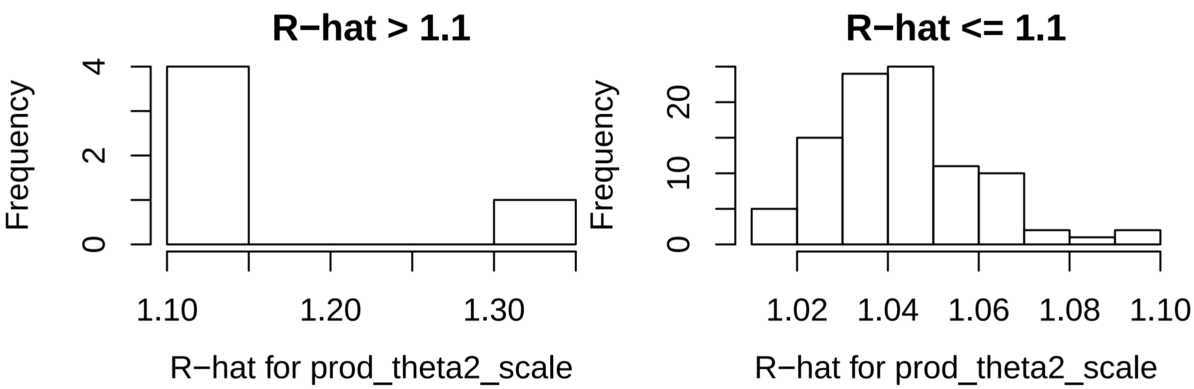
prod_theta2_m0

```
number of trajectories with Rhat > 1.02:    69

indizes of trajectories with Rhat > 1.02:
4 5 6 7 8 10 11 12 13 14 15 16 17 18 20 21 23 24 25 26 27 29 30 32 33 34 35 37 40 41 44 46 47 49 50 51 5

number of trajectories with Rhat > 1.1: 18

indices of trajectories with Rhat > 1.1:
5 10 11 17 23 27 37 40 47 49 53 54 60 70 83 91 96 98
```



prod_theta2_scale

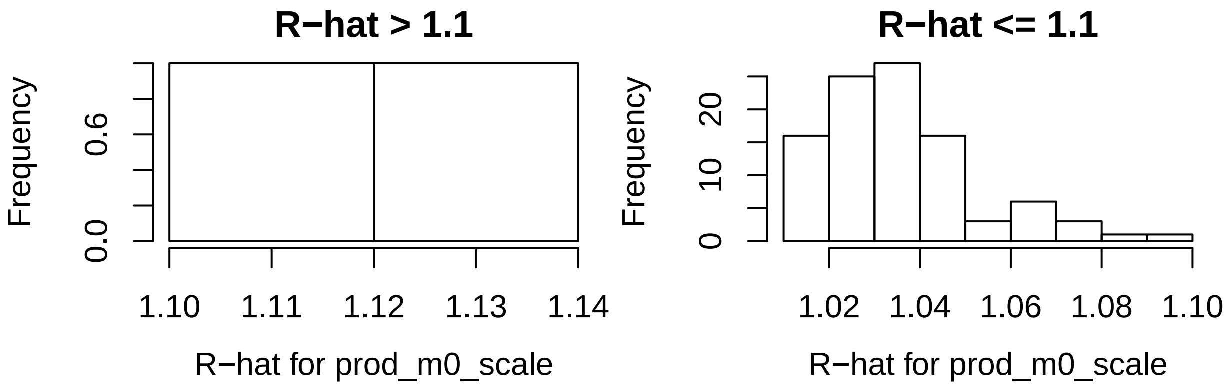
```
number of trajectories with Rhat > 1.02:    95

indizes of trajectories with Rhat > 1.02:
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 25 26 27 28 29 30 31 32 33 34 36 37 38 39 40

number of trajectories with Rhat > 1.1: 5

indices of trajectories with Rhat > 1.1:
11 17 32 53 70
```



prod_m0_scale

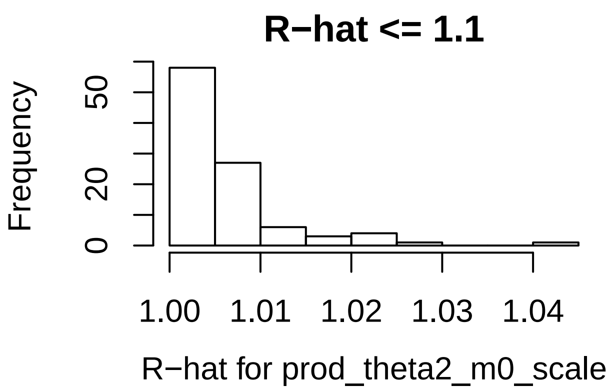
```
number of trajectories with Rhat > 1.02:    84

indizes of trajectories with Rhat > 1.02:
1 2 3 4 5 6 9 10 11 12 13 14 16 17 18 19 20 21 22 23 26 27 28 30 31 32 34 35 36 37 38 39 40 41 42 44 45
```

```
number of trajectories with Rhat > 1.1: 2

indices of trajectories with Rhat > 1.1:
60 96
```



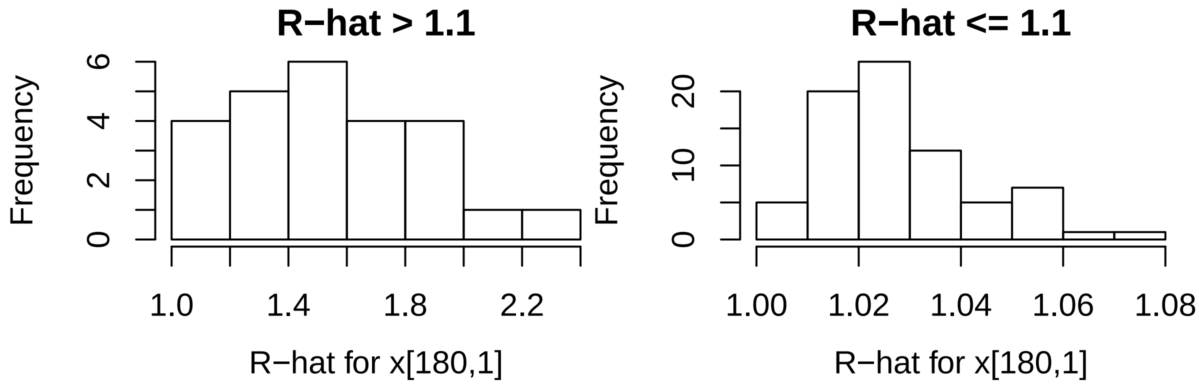
prod_theta2_m0_scale

```
number of trajectories with Rhat > 1.02:    6

indizes of trajectories with Rhat > 1.02:
11 17 32 40 53 96
```



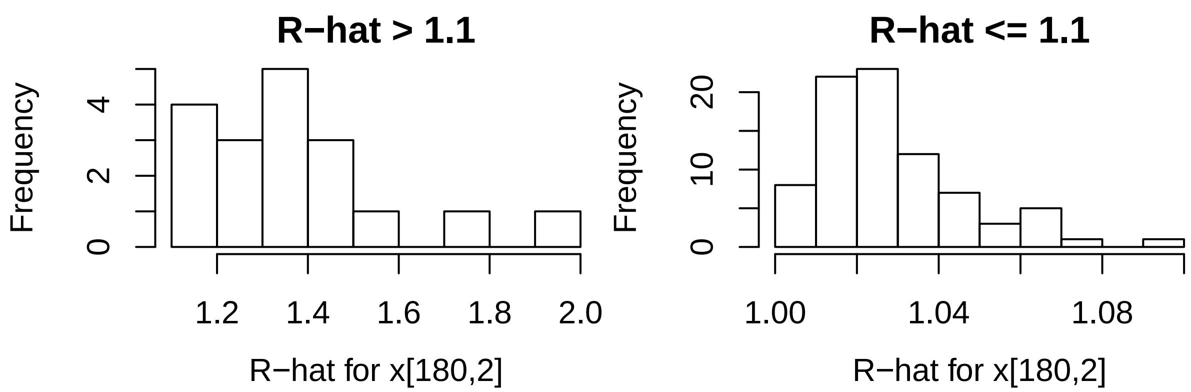
x[180,1]

```
number of trajectories with Rhat > 1.02:    75

indizes of trajectories with Rhat > 1.02:
1 2 3 5 6 7 9 10 11 13 14 15 16 17 20 23 27 28 29 31 32 33 34 35 36 37 39 40 42 46 47 48 49 50 51 52 53

number of trajectories with Rhat > 1.1: 25

indices of trajectories with Rhat > 1.1:
3 5 10 11 16 17 23 27 29 33 37 40 46 47 49 50 53 60 70 78 80 83 91 96 98
```



x[180,2]

```
number of trajectories with Rhat > 1.02:    70

indizes of trajectories with Rhat > 1.02:
4 5 6 7 8 10 11 12 13 14 15 16 17 18 20 21 23 24 25 26 27 29 30 32 33 34 35 37 38 40 41 44 46 47 49 50 5

number of trajectories with Rhat > 1.1: 18

indices of trajectories with Rhat > 1.1:
5 10 11 17 23 27 37 40 47 49 53 54 60 70 83 91 96 98
```



Effective sample size (ESS)

total number of trajectories with low ESS (< 100) (out of 100)

```
[1] 28
```

number of trajectories with low ESS (< 100) per parameter (out of 100)

	n_eff < 100
theta[1]	23
theta[2]	6
theta[3]	24
m0	11
sigma	0
scale	16
offset	0
prod_theta2_m0	20
prod_theta2_scale	7
prod_m0_scale	4

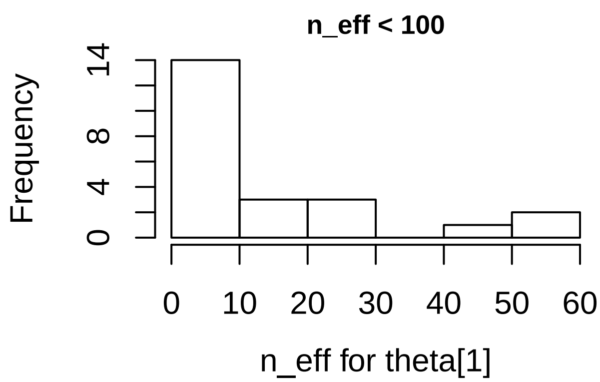
	n_eff < 100
prod_theta2_m0_scale	0
x[180,1]	25
x[180,2]	20

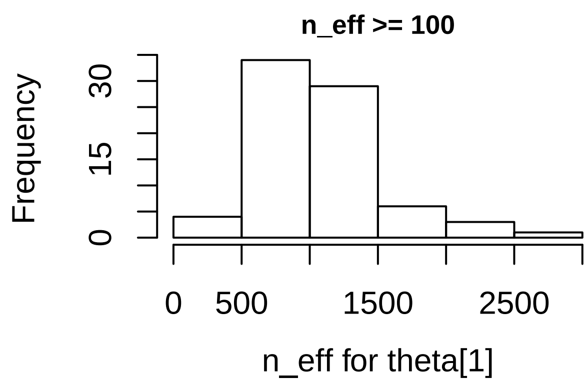
number of parameters with low ESS (< 300) per trajectory (out of 13)

	3	5	10	11	16	17	23	27	29	32	33	37	40	42	46	47	49	50	53	54
n_eff < 100	2	6	8	10	5	8	6	7	3	2	3	6	6	2	2	5	6	3	8	2

theta[1]

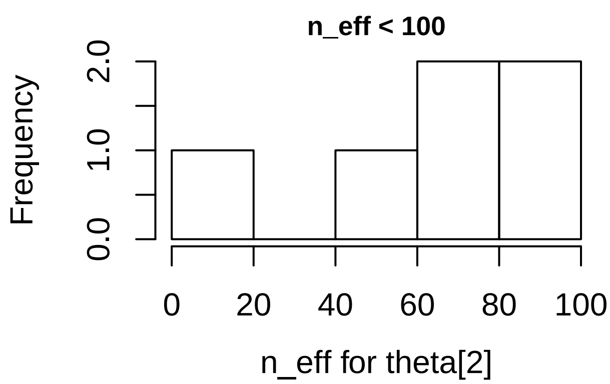
```
number of trajectories with n_eff < 100:    23

indices of trajectories with n_eff < 100:
5 10 11 16 17 23 27 29 33 37 40 47 49 50 53 60 70 78 80 83 91 96 98
```

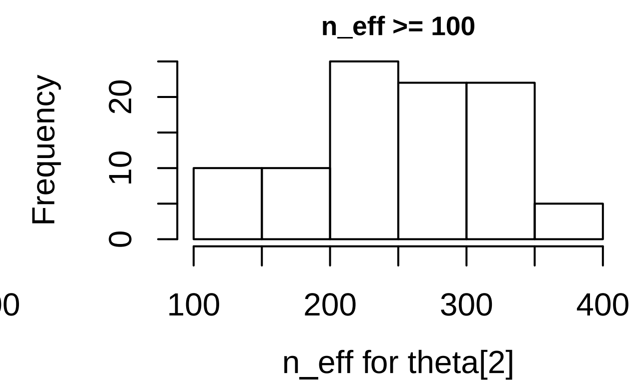




theta[2]

```
number of trajectories with n_eff < 100:    6

indices of trajectories with n_eff < 100:
10 11 32 60 70 98
```

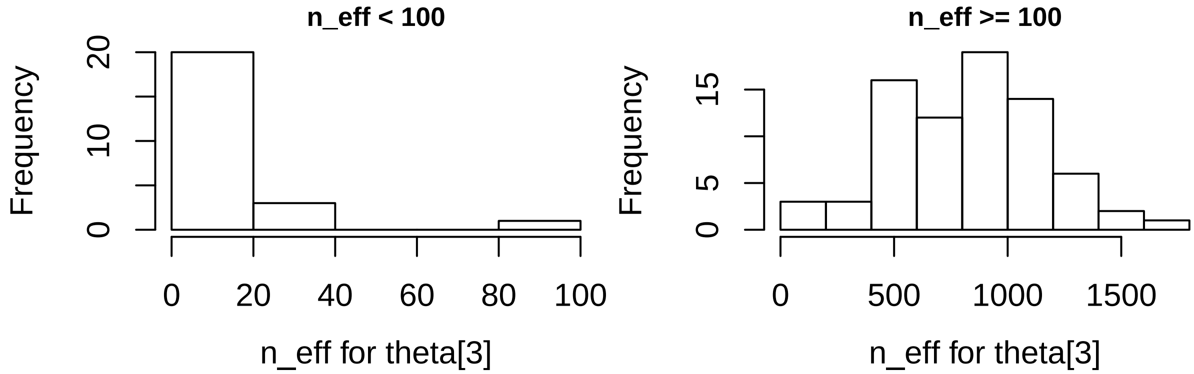




theta[3]

```
number of trajectories with n_eff < 100:    24
```

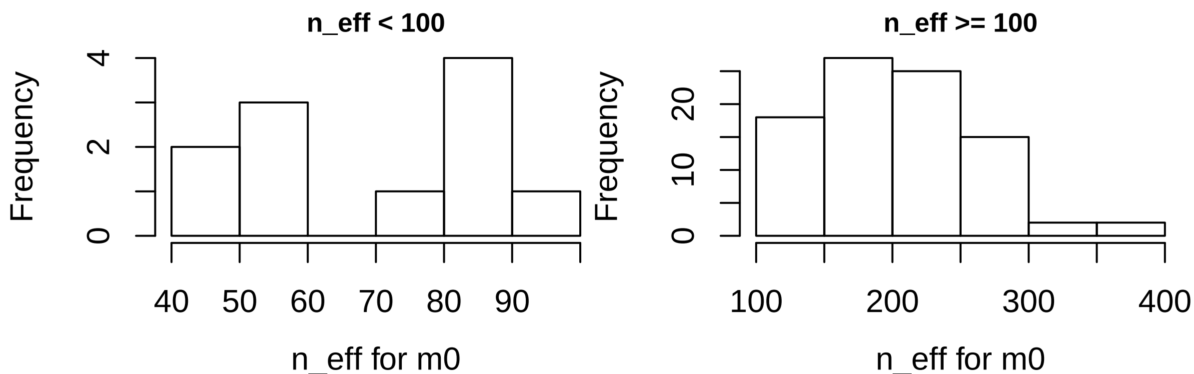
indices of trajectories with n_eff < 100:
5 10 11 16 17 23 27 29 33 37 40 46 47 49 50 53 60 70 78 80 83 91 96 98



m0

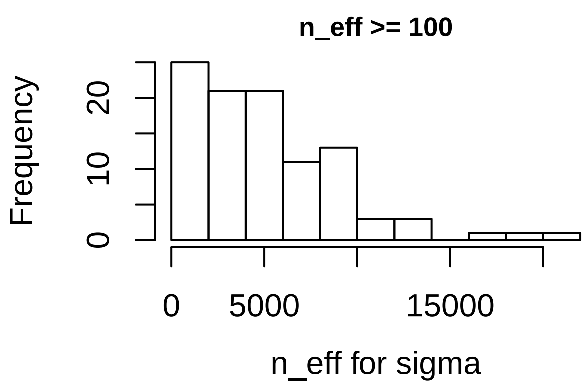
number of trajectories with n_eff < 100: 11

indices of trajectories with n_eff < 100:
3 11 17 27 42 53 60 70 80 83 96



sigma

no n_eff < 100

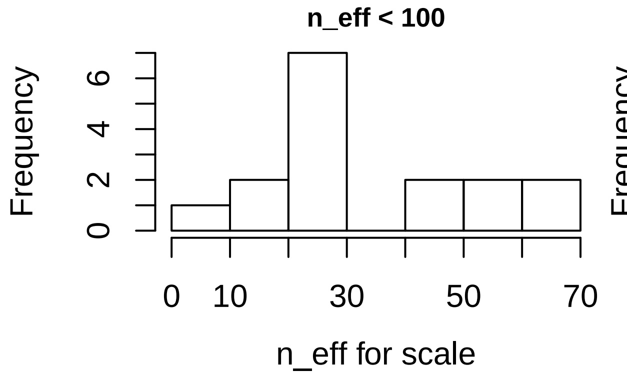


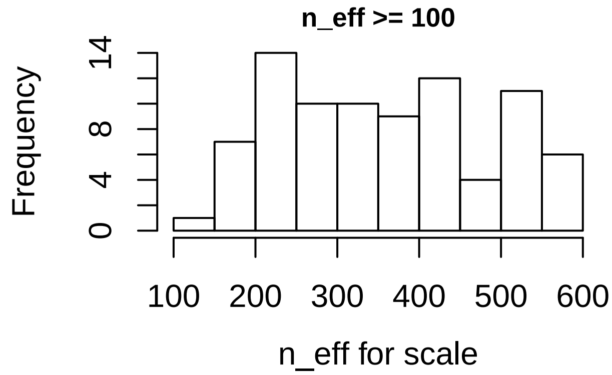
scale

number of trajectories with n_eff < 100: 16

indices of trajectories with n_eff < 100:

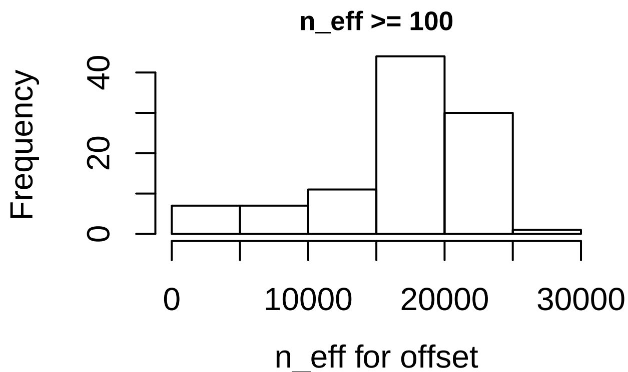
5 10 11 17 23 27 37 40 49 53 60 70 83 91 96 98





offset

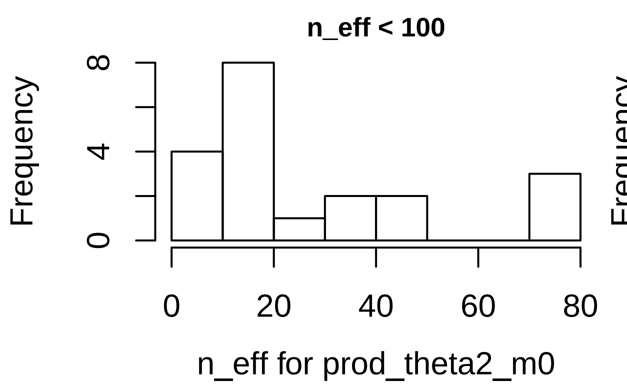
no n_eff < 100

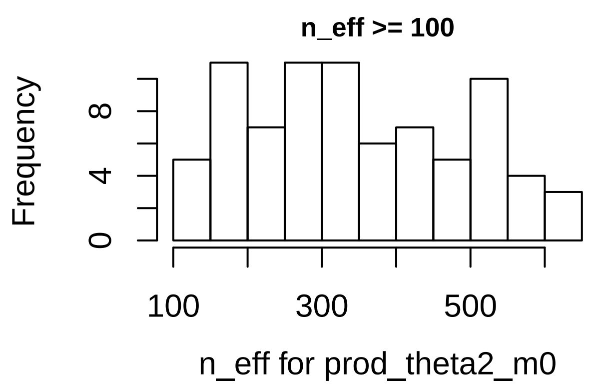


prod_theta2_m0

number of trajectories with n_eff < 100:   20

indices of trajectories with n_eff < 100:
5 10 11 16 17 23 27 37 40 47 49 53 54 60 70 78 83 91 96 98

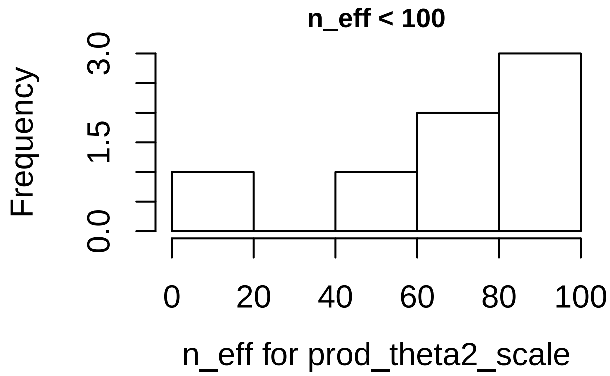


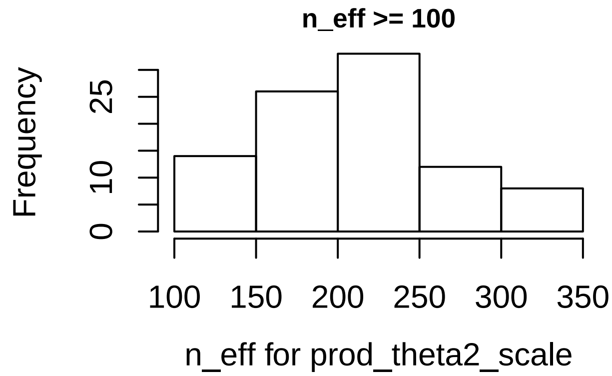


prod_theta2_scale

number of trajectories with n_eff < 100:   7

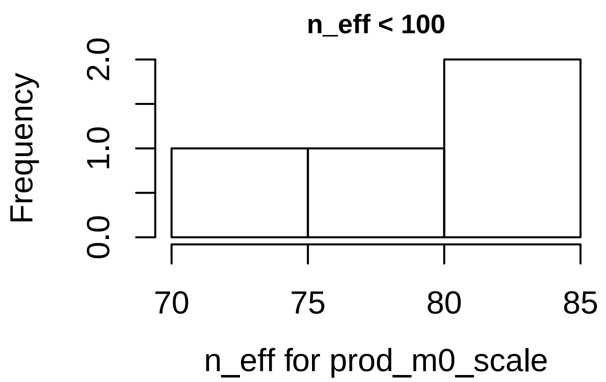
indices of trajectories with n_eff < 100:
11 17 32 42 53 70 96

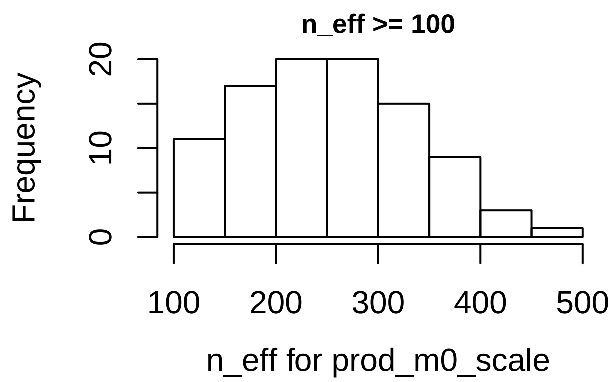




prod_m0_scale

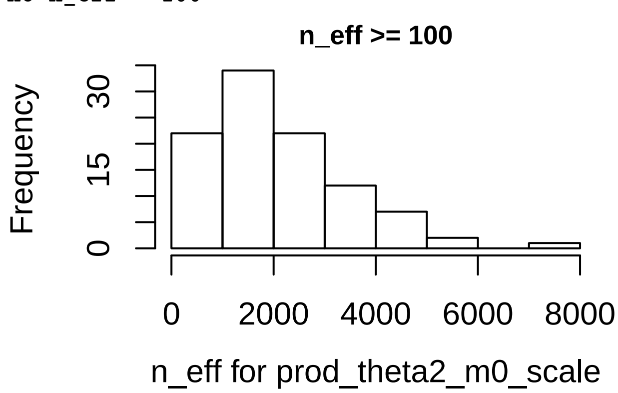
```
number of trajectories with n_eff < 100:    4

indices of trajectories with n_eff < 100:
10 11 60 96
```





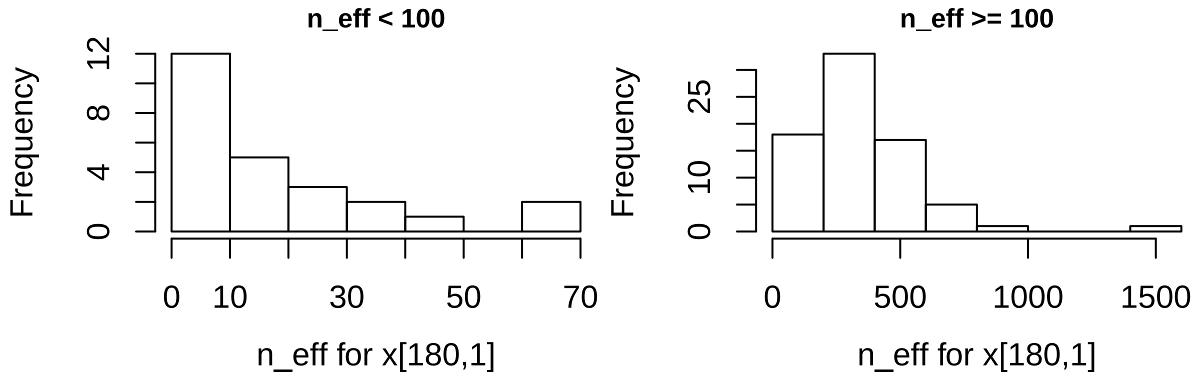
prod_theta2_m0_scale

```
no n_eff < 100
```



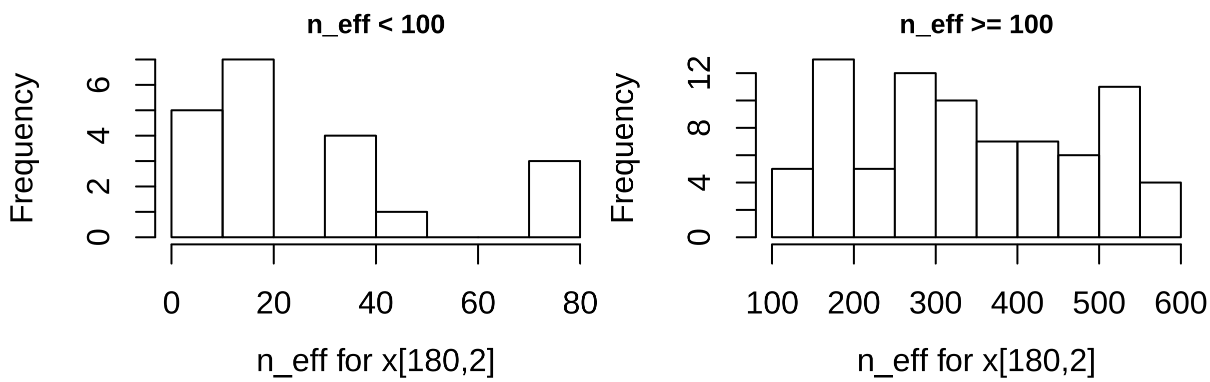
x[180,1]

```
number of trajectories with n_eff < 100:    25

indices of trajectories with n_eff < 100:
3 5 10 11 16 17 23 27 29 33 37 40 46 47 49 50 53 60 70 78 80 83 91 96 98
```



x[180,2]

```
number of trajectories with n_eff < 100:    20

indices of trajectories with n_eff < 100:
5 10 11 16 17 23 27 37 40 47 49 53 54 60 70 78 83 91 96 98
```



Find problematic trajectories and parameters

Are there any trajectories and parameters for which n_eff is below the threshold, but Rhat does not exceed the threshold?

```
## [1] FALSE
```

parameters per trajectories with very high Rhat

```
3:   x[180,1]
5:   theta[1]  theta[3]  scale  prod_theta2_m0  x[180,1]  x[180,2]
10:   theta[1]  theta[2]  theta[3]  scale  prod_theta2_m0  x[180,1]  x[180,2]
11:   theta[1]  theta[2]  theta[3]  m0  scale  prod_theta2_m0  prod_theta2_scale  x[180,1]  x[180,2]
16:   theta[1]  theta[3]  x[180,1]
17:   theta[1]  theta[3]  m0  scale  prod_theta2_m0  prod_theta2_scale  x[180,1]  x[180,2]
23:   theta[1]  theta[3]  scale  prod_theta2_m0  x[180,1]  x[180,2]
27:   theta[1]  theta[3]  scale  prod_theta2_m0  x[180,1]  x[180,2]
29:   theta[1]  theta[3]  x[180,1]
32:   theta[2]  prod_theta2_scale
33:   theta[1]  theta[3]  x[180,1]
37:   theta[1]  theta[3]  scale  prod_theta2_m0  x[180,1]  x[180,2]
40:   theta[1]  theta[3]  scale  prod_theta2_m0  x[180,1]  x[180,2]
46:   x[180,1]
47:   theta[1]  theta[3]  prod_theta2_m0  x[180,1]  x[180,2]
49:   theta[1]  theta[3]  scale  prod_theta2_m0  x[180,1]  x[180,2]
```

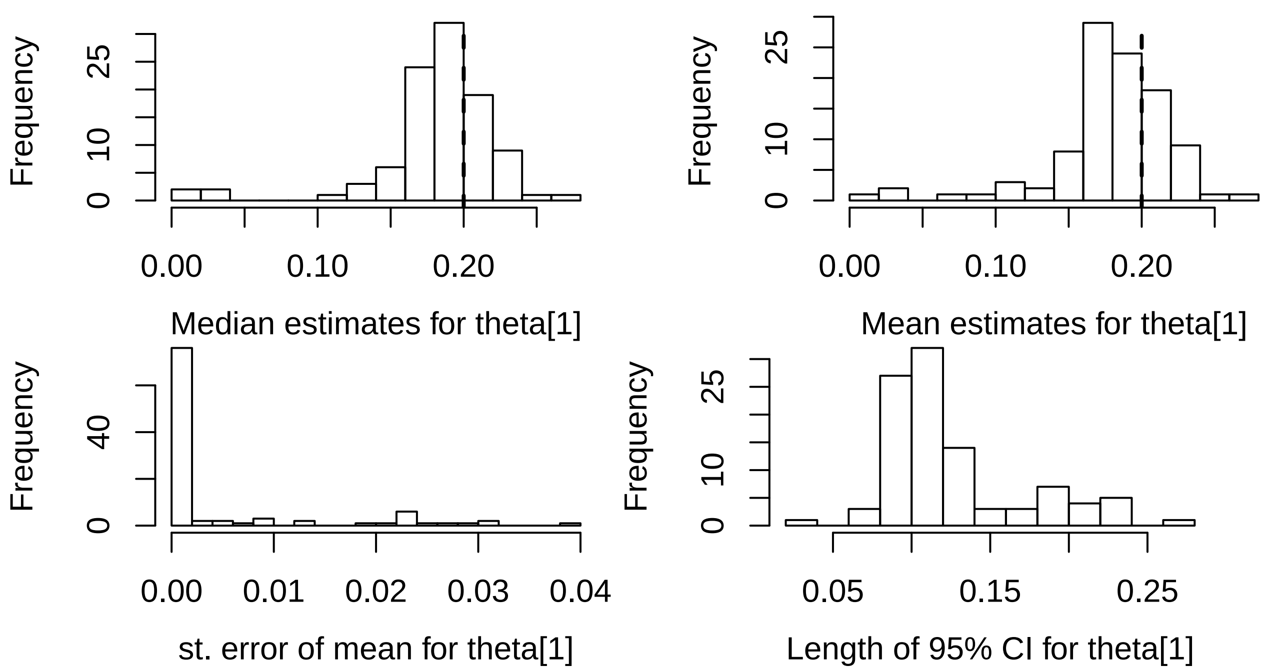
```
50:   theta[1]  theta[3]  x[180,1]
53:   theta[1]  theta[3]  scale  prod_theta2_m0  prod_theta2_scale  x[180,1]  x[180,2]
54:   prod_theta2_m0  x[180,2]
60:   theta[1]  theta[3]  m0  scale  prod_theta2_m0  prod_m0_scale  x[180,1]  x[180,2]
70:   theta[1]  theta[2]  theta[3]  m0  scale  prod_theta2_m0  prod_theta2_scale  x[180,1]  x[180,2]
78:   theta[1]  theta[3]  x[180,1]
80:   theta[1]  theta[3]  x[180,1]
83:   theta[1]  theta[3]  m0  scale  prod_theta2_m0  x[180,1]  x[180,2]
91:   theta[1]  theta[3]  scale  prod_theta2_m0  x[180,1]  x[180,2]
96:   theta[1]  theta[3]  m0  scale  prod_theta2_m0  prod_m0_scale  x[180,1]  x[180,2]
98:   theta[1]  theta[3]  scale  prod_theta2_m0  x[180,1]  x[180,2]
```

unique combinations:

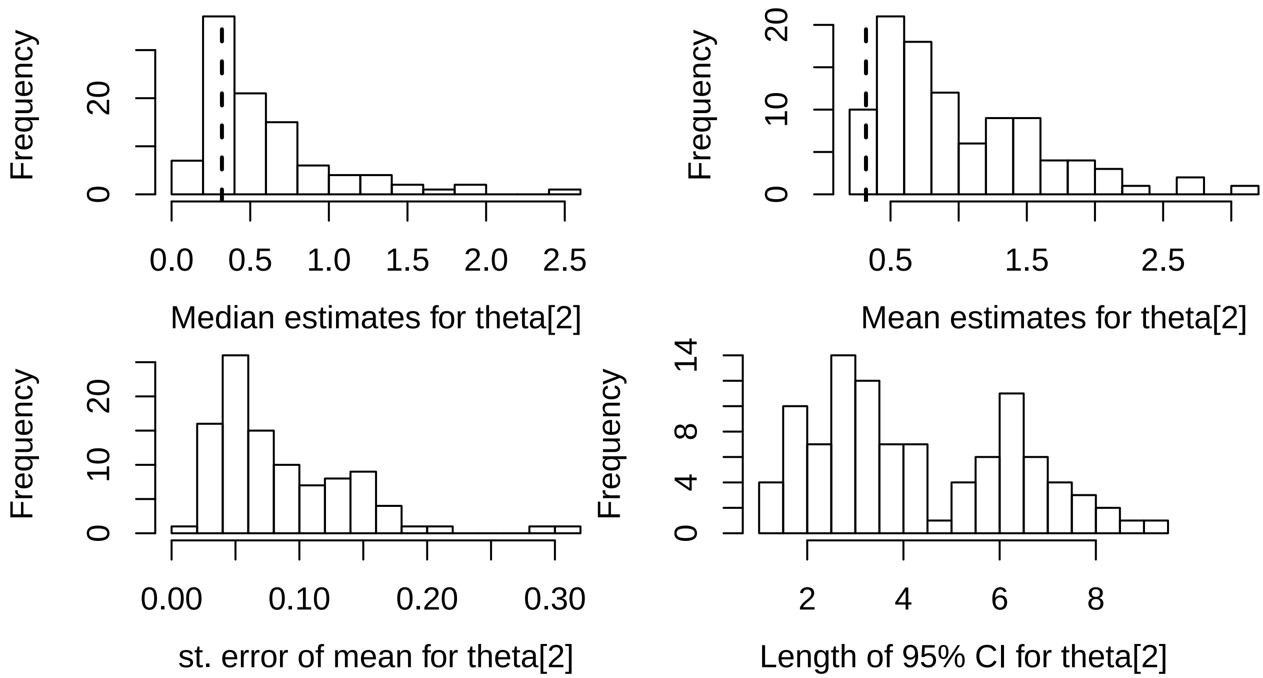
```
number of unique combinations:  12

combinations and number of their occruence:

2  :  x[180,1]
8  :  theta[1]  theta[3]  scale  prod_theta2_m0  x[180,1]  x[180,2]
1  :  theta[1]  theta[2]  theta[3]  scale  prod_theta2_m0  x[180,1]  x[180,2]
2  :  theta[1]  theta[2]  theta[3]  m0  scale  prod_theta2_m0  prod_theta2_scale  x[180,1]  x[180,2]
6  :  theta[1]  theta[3]  x[180,1]
1  :  theta[1]  theta[3]  m0  scale  prod_theta2_m0  prod_theta2_scale  x[180,1]  x[180,2]
1  :  theta[2]  prod_theta2_scale
1  :  theta[1]  theta[3]  prod_theta2_m0  x[180,1]  x[180,2]
1  :  theta[1]  theta[3]  scale  prod_theta2_m0  prod_theta2_scale  x[180,1]  x[180,2]
1  :  prod_theta2_m0  x[180,2]
2  :  theta[1]  theta[3]  m0  scale  prod_theta2_m0  prod_m0_scale  x[180,1]  x[180,2]
1  :  theta[1]  theta[3]  m0  scale  prod_theta2_m0  x[180,1]  x[180,2]
```

Overview of estimates

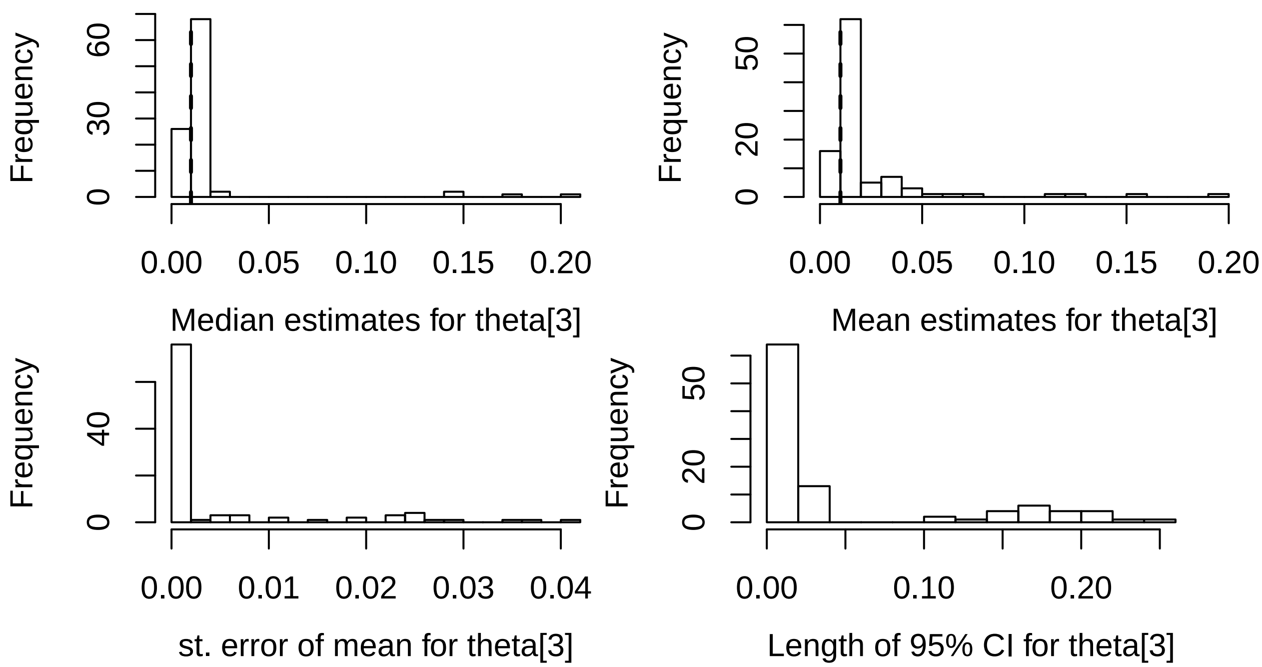
theta[1]



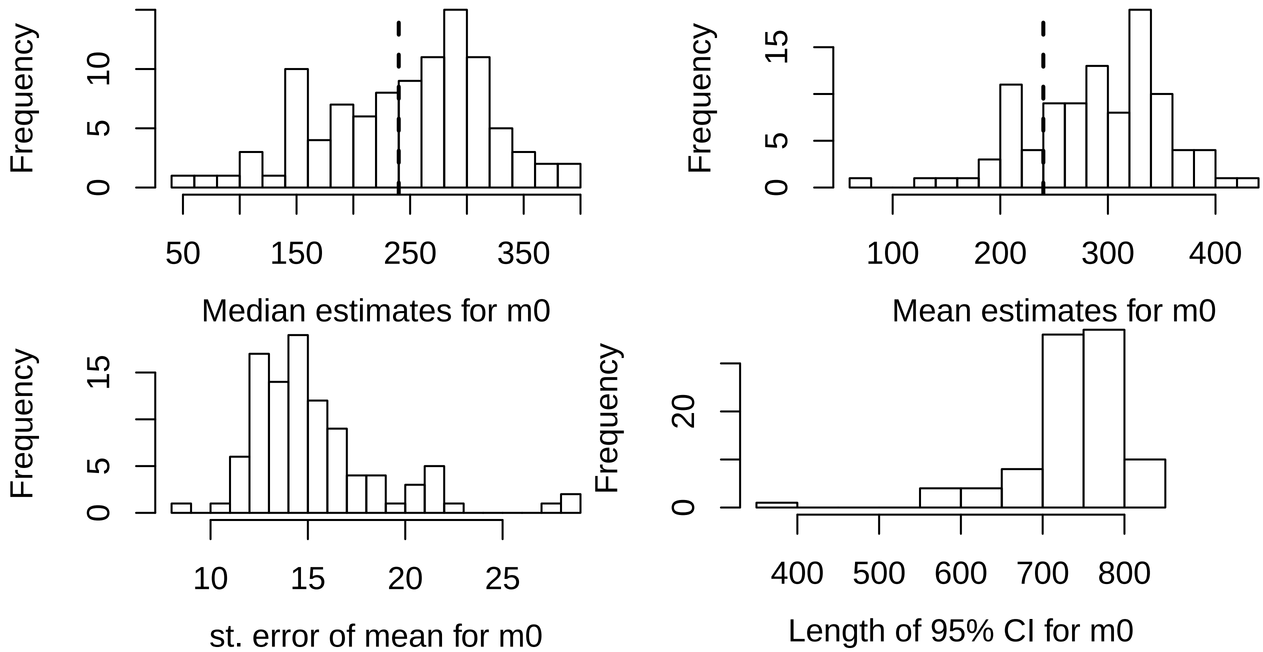
theta[2]



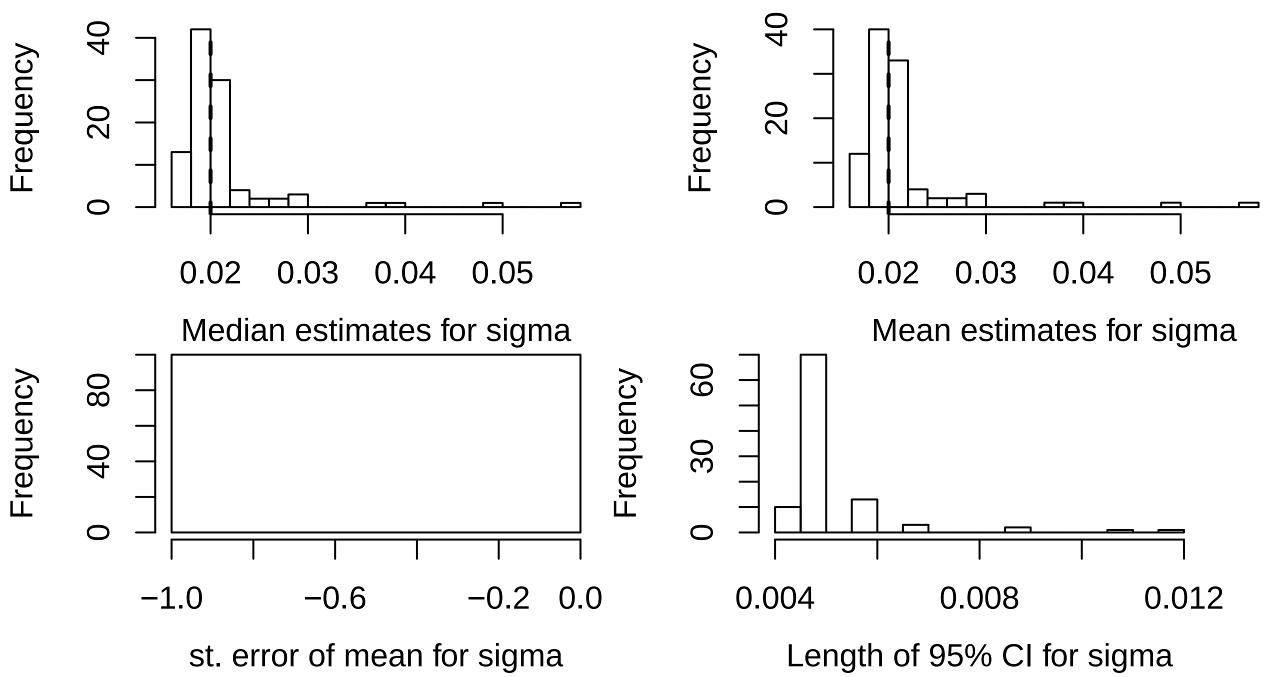
theta[3]



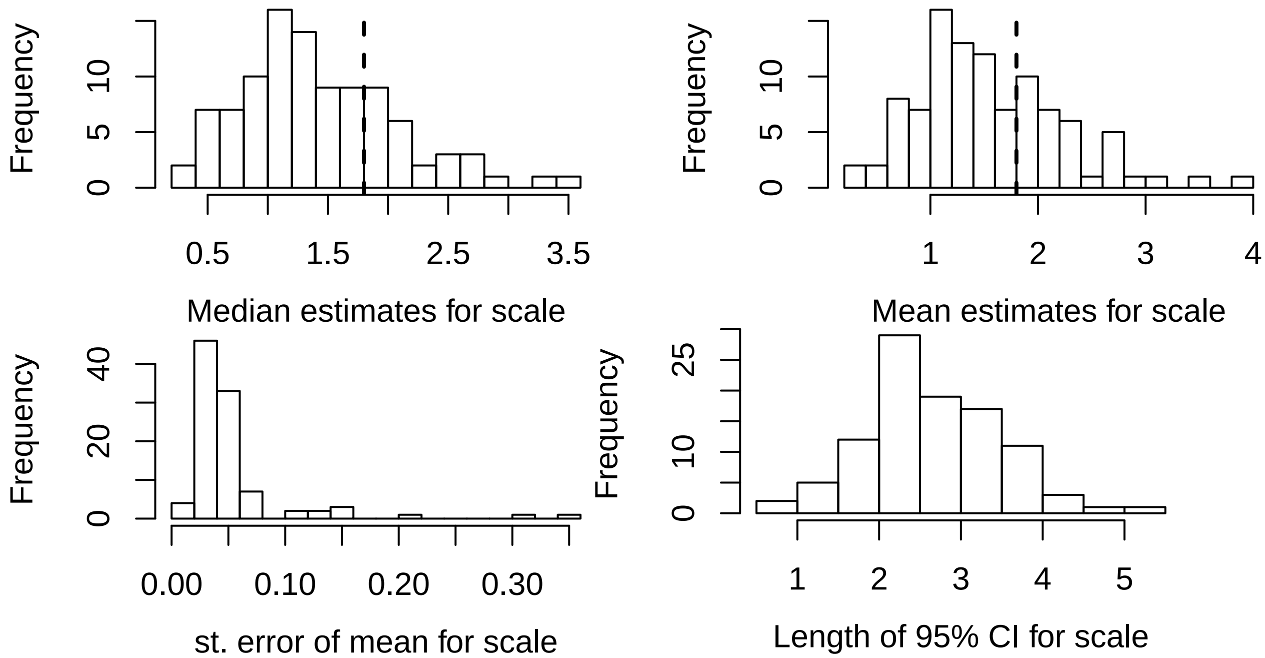
m0


Frequency
Median estimates for m0
Mean estimates for m0
st. error of mean for m0
Length of 95% CI for m0

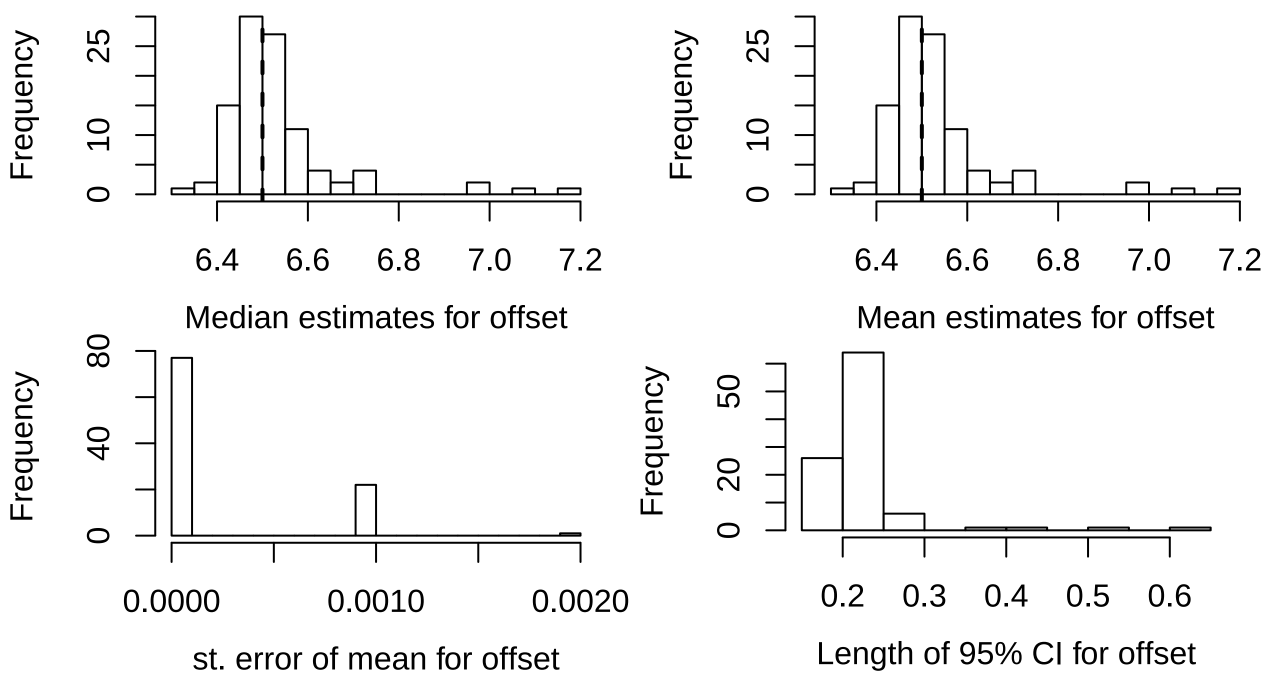
sigma


Frequency
Median estimates for sigma
Mean estimates for sigma
st. error of mean for sigma
Length of 95% CI for sigma

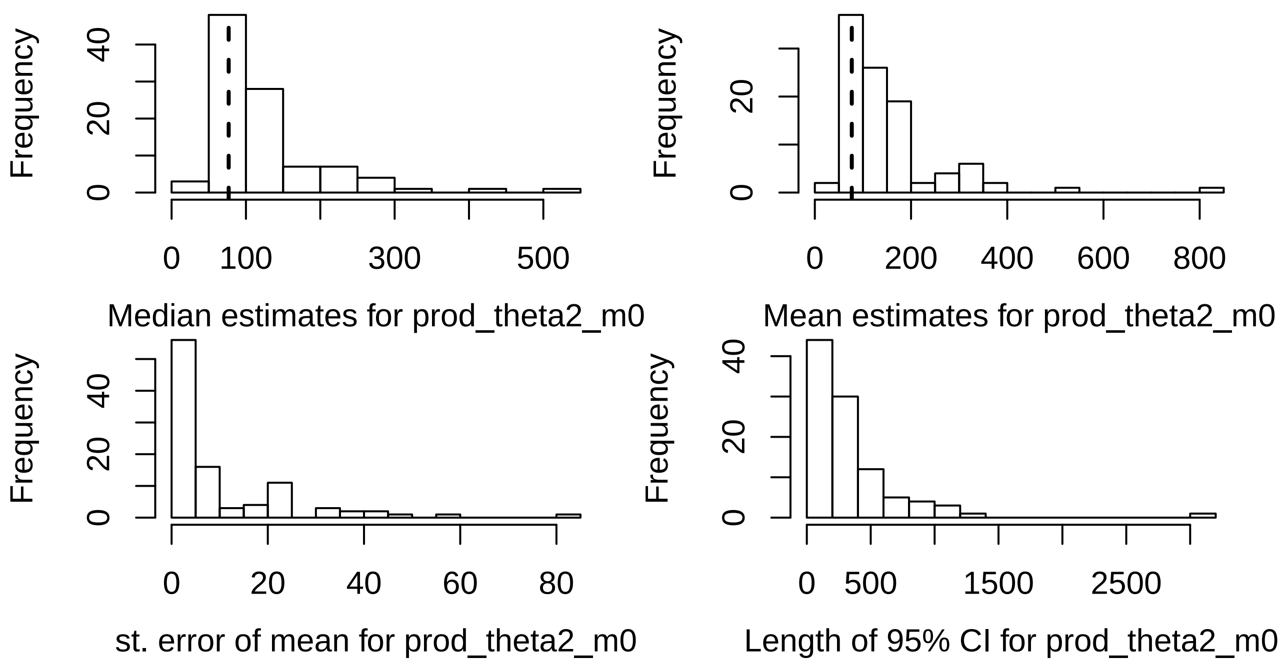
scale



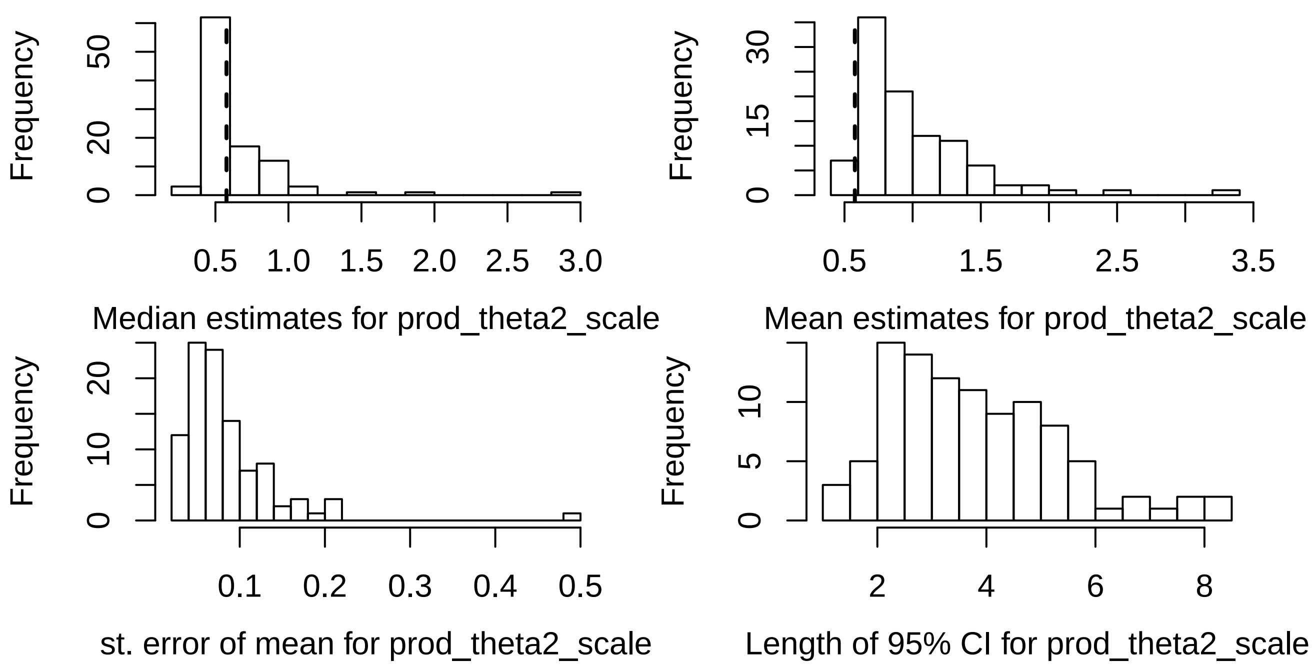
offset



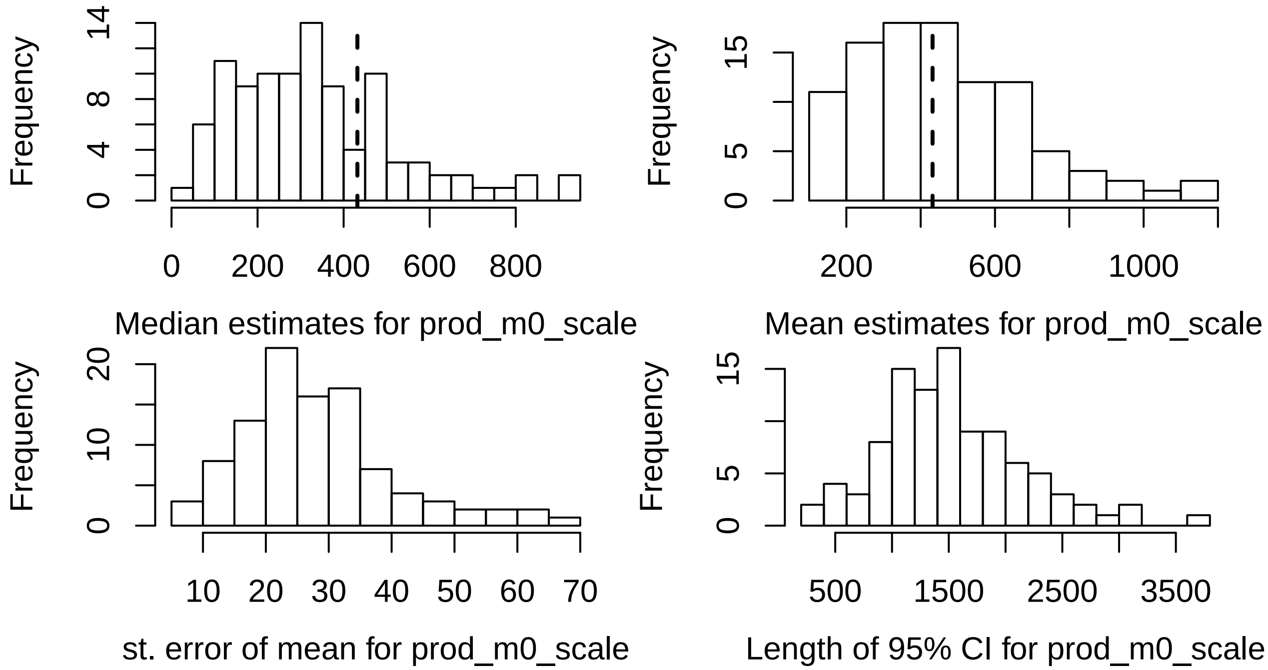
prod_theta2_m0



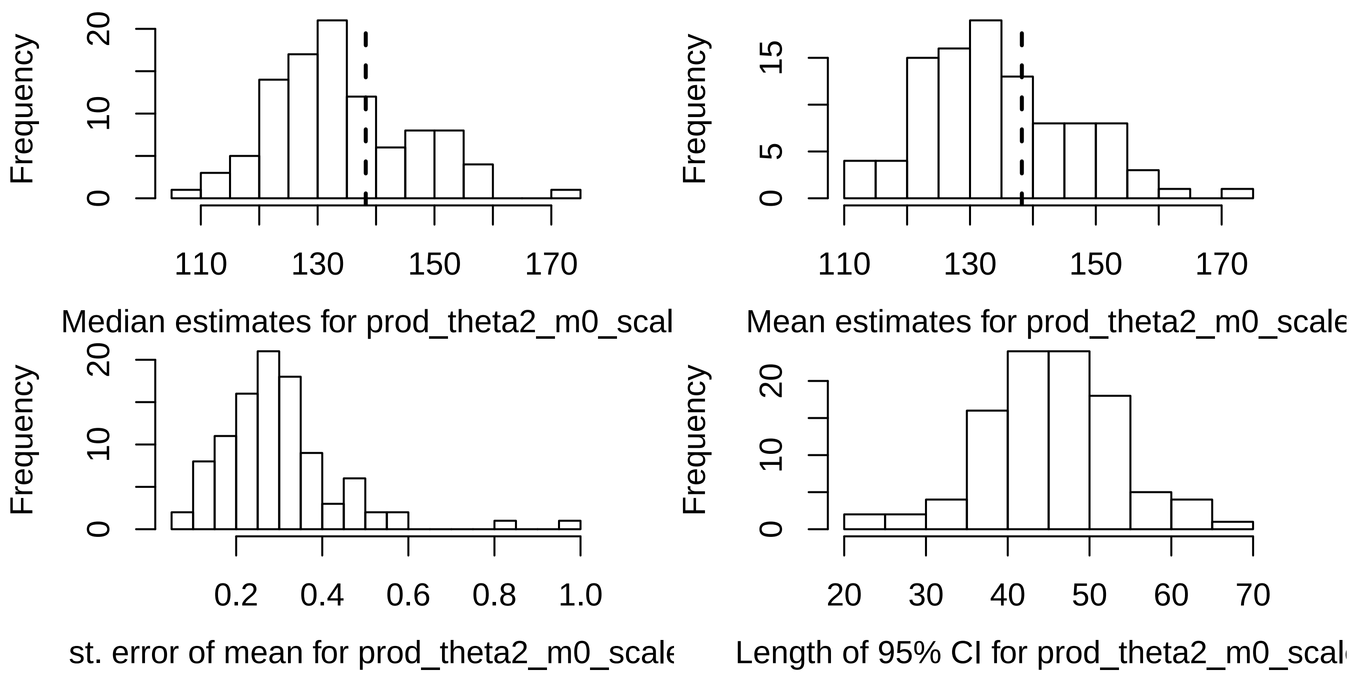
prod_theta2_scale



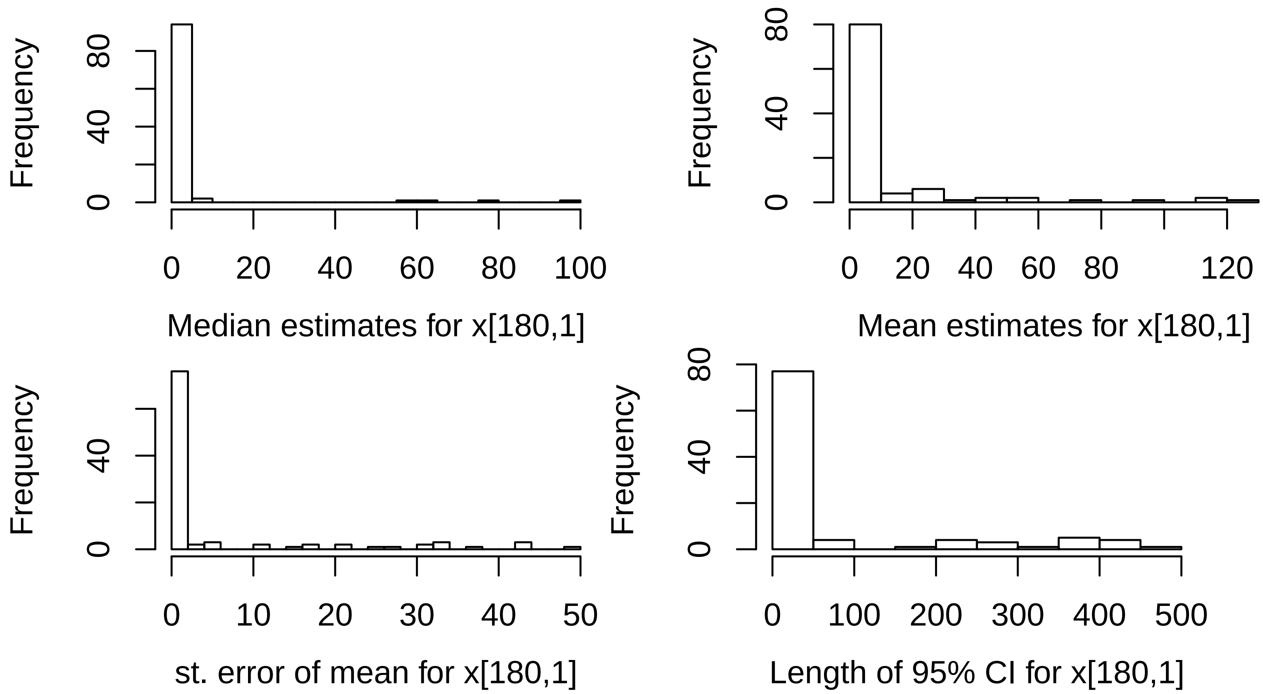
prod_m0_scale



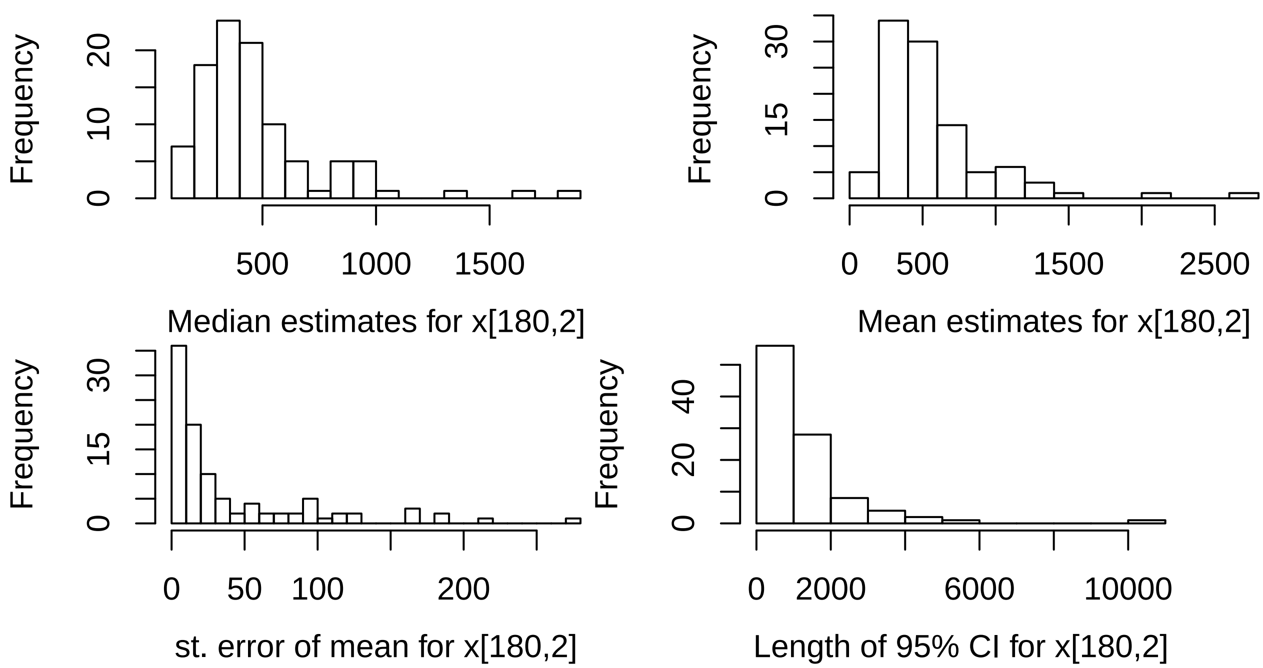
prod_theta2_m0_scale



x[180,1]


Frequency
0
40
80
0
20
40
60
80
100
Median estimates for x[180,1]
Frequency
0
40
80
0
20
40
60
80
120
Mean estimates for x[180,1]
Frequency
0
40
0
10
20
30
40
50
st. error of mean for x[180,1]
Frequency
0
40
80
0
100
200
300
400
500
Length of 95% CI for x[180,1]

x[180,2]


Frequency
0
10
20
500
1000
1500
Median estimates for x[180,2]
Frequency
0
15
30
0
500
1500
2500
Mean estimates for x[180,2]
Frequency
0
15
30
0
50
100
200
st. error of mean for x[180,2]
Frequency
0
20
40
0
2000
6000
10000
Length of 95% CI for x[180,2]

Summary of length of 95% credible intervals (CIs)

Here we give the median, standard deviation (sd), and coefficient of variation (cv) of the length of the 95% CIs.

For simulated data (where the true parameter values are known), we also give the number of times that the CI covers the true value and median, sd, and cv of the length of those 95% CIs that cover the true value.

	median	sd	cv	num_cover	median_cover	sd_cover	cv_cover
theta[1]	0.111	0.046	0.359	90	0.110	0.045	0.359
theta[2]	3.686	2.063	0.483	99	3.671	2.046	0.483
theta[3]	0.016	0.070	1.339	89	0.016	0.067	1.457
m0	746.741	65.983	0.090	100	746.741	65.983	0.090
sigma	0.005	0.001	0.227	87	0.005	0.000	0.094
scale	2.542	0.822	0.311	91	2.589	0.670	0.247
offset	0.212	0.060	0.267	84	0.210	0.014	0.069
prod_theta2_m0	223.218	383.297	1.118	92	211.231	219.420	0.764
prod_theta2_scale	3.548	1.561	0.410	100	3.548	1.561	0.410
prod_m0_scale	1479.128	623.487	0.407	98	1480.376	606.740	0.390
prod_theta2_m0_scale	45.555	8.219	0.182	92	45.823	7.951	0.173
x[180,1]	6.836	133.959	1.883	NA	NA	NA	NA
x[180,2]	838.137	1383.082	1.065	NA	NA	NA	NA

The following table shows the values of the median of *the length of the CIs divided by the median of each sample*

$$m_1 = \text{median}\left(\frac{q_i(0.975) - q_i(0.025)}{q_i(0.5)}\right),$$

the median of *the length of the CIs divided by the mean of each sample*

$$m_1 = \text{median}\left(\frac{q_i(0.975) - q_i(0.025)}{sample\_mean}\right),$$

as well as the median of the length of the CIs divided by *the median of the medians of the sample*

$$m_3 = \frac{\text{median}(q_i(0.975) - q_i(0.025))}{\text{median}(q_i(0.5))}.$$

and (if applicable) the median of *the length of the CIs divided by the true value*

$$m_4 = \frac{\text{median}(q_i(0.975) - q_i(0.025))}{\text{true value}}.$$

	m_1	m_2	m_3	m_4	num_cover	m_1_cover	m_3_cover
theta[1]	0.59	0.60	0.59	0.55	90	0.57	0.57
theta[2]	8.04	4.49	8.31	11.52	99	8.05	8.31
theta[3]	1.37	1.31	1.38	1.65	89	1.38	1.45
m0	2.88	2.50	2.94	3.11	100	2.88	2.94
sigma	0.25	0.24	0.25	0.25	87	0.25	0.25
scale	1.89	1.76	1.98	1.41	91	1.85	1.92
offset	0.03	0.03	0.03	0.03	84	0.03	0.03
prod_theta2_m0	2.12	1.92	2.26	2.91	92	2.08	2.18
prod_theta2_scale	6.18	3.82	6.76	6.16	100	6.18	6.76
prod_m0_scale	4.46	3.31	4.70	3.42	98	4.46	4.63
prod_theta2_m0_scale	0.35	0.35	0.34	0.33	92	0.35	0.34
x[180,1]	6.24	4.00	7.18	NA	NA	NA	NA
x[180,2]	2.09	1.90	2.08	NA	NA	NA	NA