Aggregated sampling output

November 20, 2020

Dataset: simulated_data_dataset1_with_error, model type: ODE

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] 1


indices of trajectories without pathologies:
[1] 80
```

no pathologies for a subset of the parameters

```
parameters considered:
[1] "t0"                    "sigma"                 "scale"
[4] "offset"                "prod_theta2_m0_scale"
number of trajectories without pathologies (out of 100):
[1] 87


indices of trajectories without pathologies:
 [1]   1   3   4   5   6   7   8   9  10  12  13  14  15  16  17  18  19  20  21
[20]  23  24  25  27  29  30  31  32  33  35  36  37  38  39  40  41  42  43  44
[39]  46  47  49  50  51  52  53  54  55  56  57  58  60  61  62  63  64  66  67
[58]  68  69  70  71  72  75  76  77  78  79  80  81  82  83  84  86  87  88  89
[77]  90  91  92  93  94  95  96  97  98  99 100
```

Divergent transitions

num..of.div..transitions	Freq
0	100

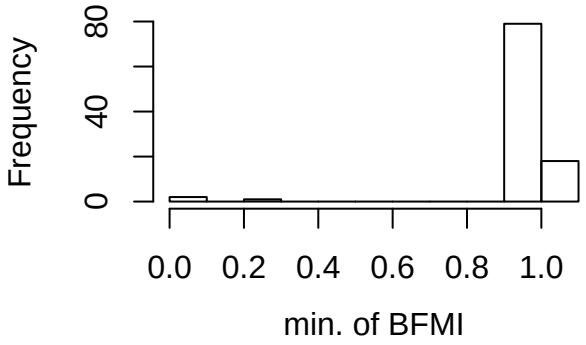
Maximum tree depth exceeded

num..of.max.t.d..exceeded	Freq
0	96
2500	4

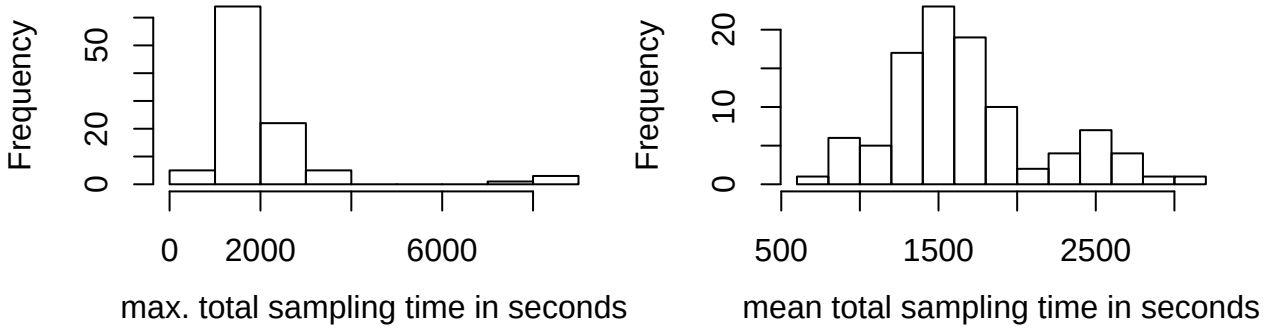
```
total number of trajectories were max. tree depth was exceeded: 4
indices of trajectories were max. tree depth was exceeded:
2 28 45 48
```

Bayesian fraction of missing information (BFMI)

num..of.low.BFMI	Freq
0	98
1	1
4	1



Total sampling time



R-hat

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

```
[1] 99
```

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

	Rhat > 1.02	Rhat > 1.1
theta[1]	100	99
theta[2]	3	0
theta[3]	100	99
m0	3	1
sigma	11	10
scale	4	3
offset	13	13
t0	13	13
prod_theta2_m0	0	0
prod_theta2_scale	0	0
prod_m0_scale	2	1
prod_theta2_m0_scale	13	13
x2_sim[180]	0	0

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	2	10	2	2	2	2	2	2	2	2	6	2	2	2	2	2	2	2	2	2
Rhat > 1.1	2	9	2	2	2	2	2	2	2	2	6	2	2	2	2	2	2	2	2	2

	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
Rhat > 1.02	2	6	2	2	2	6	2	10	2	2	2	2	2	6	2	2	2	2	2	2
Rhat > 1.1	2	6	2	2	2	6	2	7	2	2	2	2	2	6	2	2	2	2	2	2

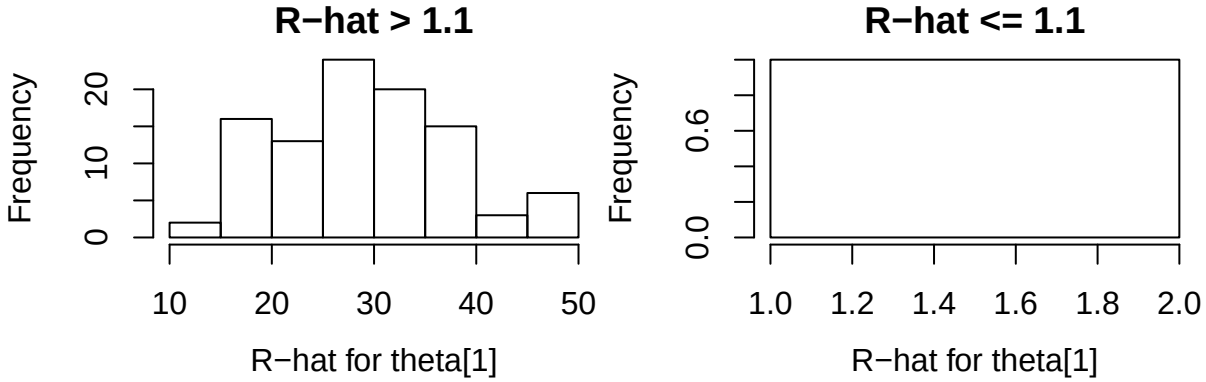
	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
Rhat > 1.02	2	2	2	2	8	2	2	8	2	2	2	2	2	2	2	2	2	2	5	2
Rhat > 1.1	2	2	2	2	6	2	2	7	2	2	2	2	2	2	2	2	2	2	5	2

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

	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100
Rhat > 1.02	2	2	2	2	5	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Rhat > 1.1	2	2	2	2	5	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2

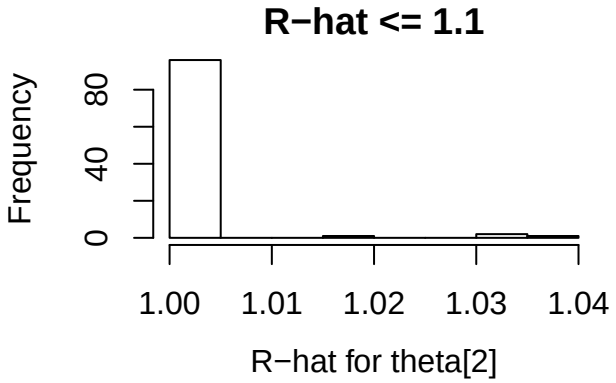
theta[1]

```
number of trajectories with Rhat > 1.02:    100

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 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38

number of trajectories with Rhat > 1.1: 99

indices of trajectories with Rhat > 1.1:
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38
```



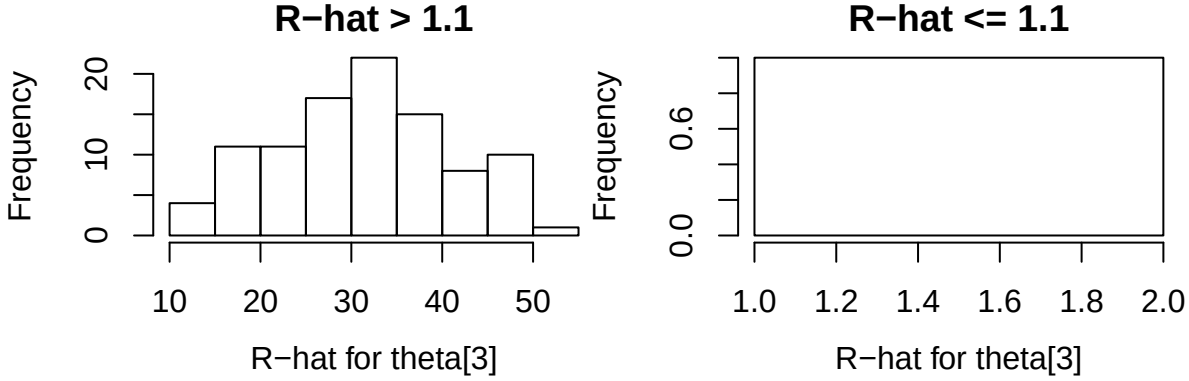
theta[2]

```
number of trajectories with Rhat > 1.02:    3

indizes of trajectories with Rhat > 1.02:
2 28 45
```



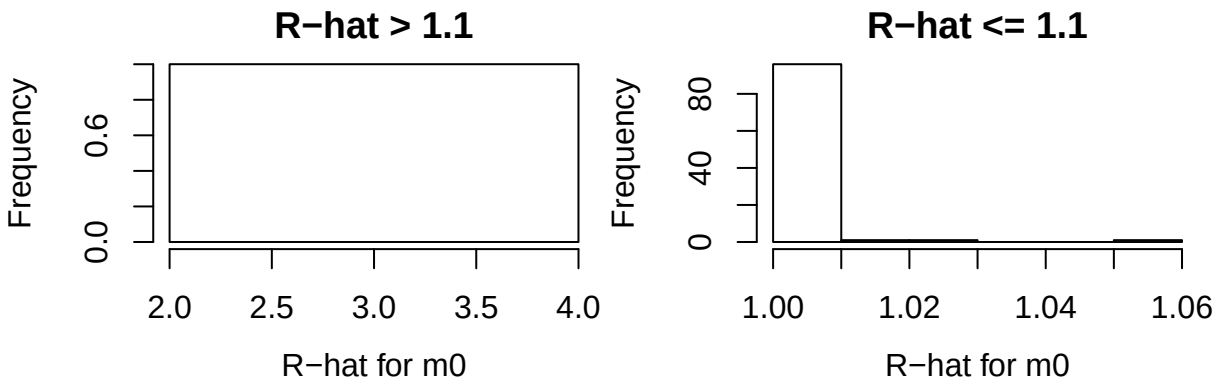
theta[3]

```
number of trajectories with Rhat > 1.02:    100

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 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38

number of trajectories with Rhat > 1.1: 99

indices of trajectories with Rhat > 1.1:
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38
```



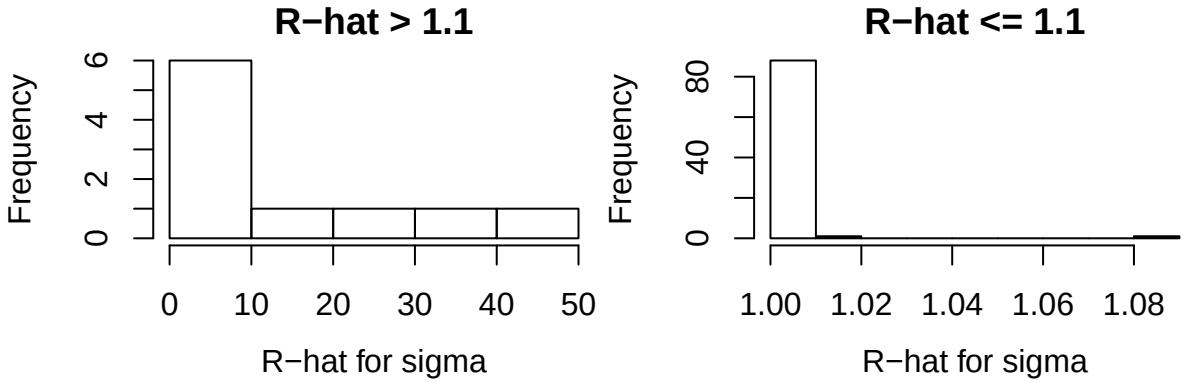
m0

```
number of trajectories with Rhat > 1.02:    3

indizes of trajectories with Rhat > 1.02:
2 28 48

number of trajectories with Rhat > 1.1: 1

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



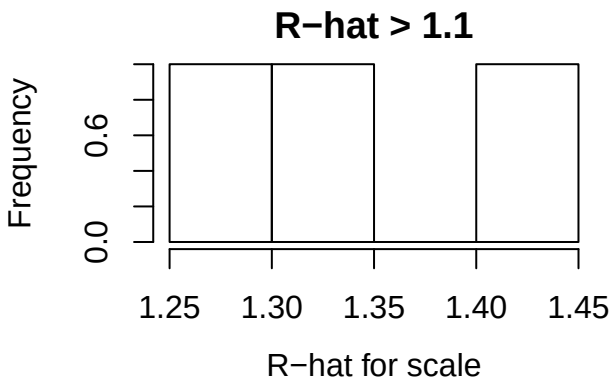
sigma

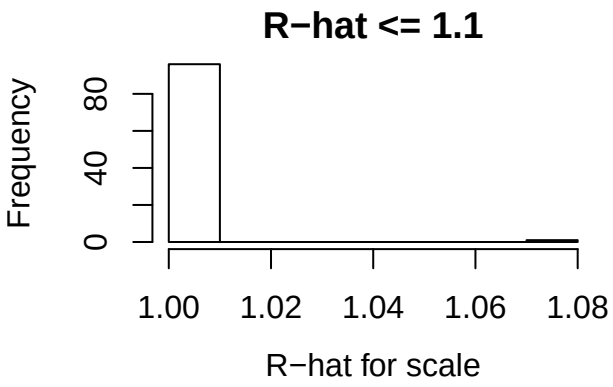
```
number of trajectories with Rhat > 1.02:    11

indizes of trajectories with Rhat > 1.02:
2 11 22 26 28 34 45 48 65 73 74

number of trajectories with Rhat > 1.1: 10

indices of trajectories with Rhat > 1.1:
2 11 22 26 28 34 45 48 65 74
```



scale

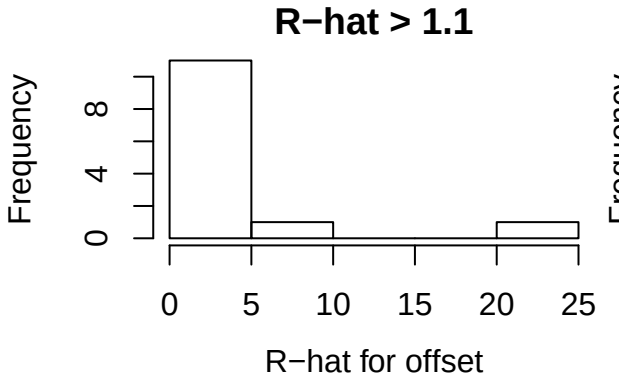
```
number of trajectories with Rhat > 1.02:    4

indizes of trajectories with Rhat > 1.02:
2 28 45 48

number of trajectories with Rhat > 1.1: 3

indices of trajectories with Rhat > 1.1:
2 28 48
```

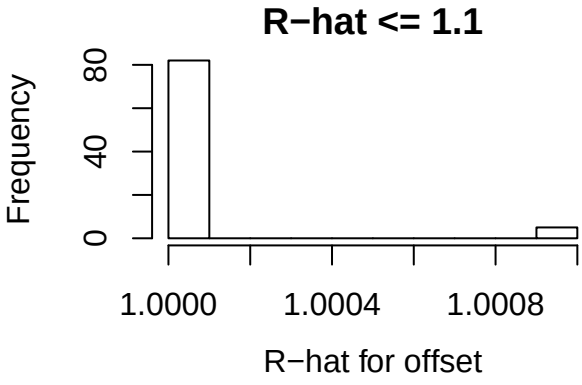




offset

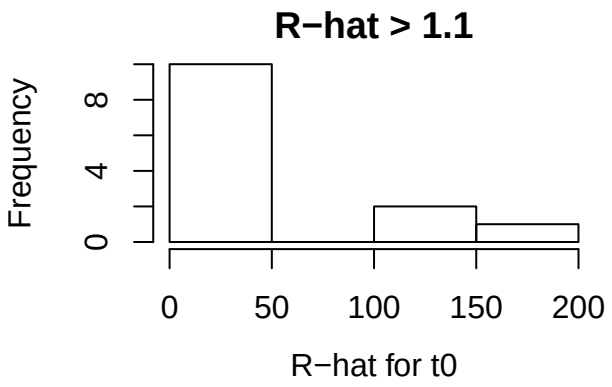
```
number of trajectories with Rhat > 1.02:    13

indizes of trajectories with Rhat > 1.02:
2 11 22 26 28 34 45 48 59 65 73 74 85

number of trajectories with Rhat > 1.1: 13

indices of trajectories with Rhat > 1.1:
2 11 22 26 28 34 45 48 59 65 73 74 85
```

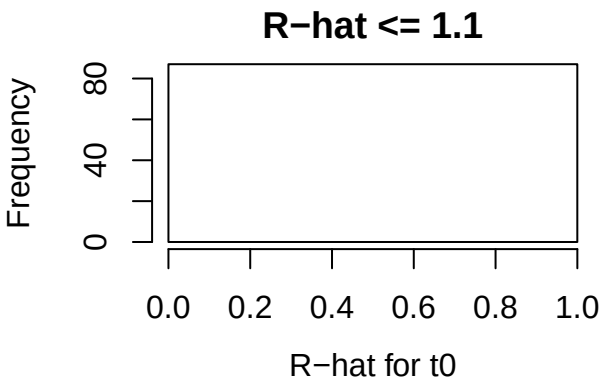




t0

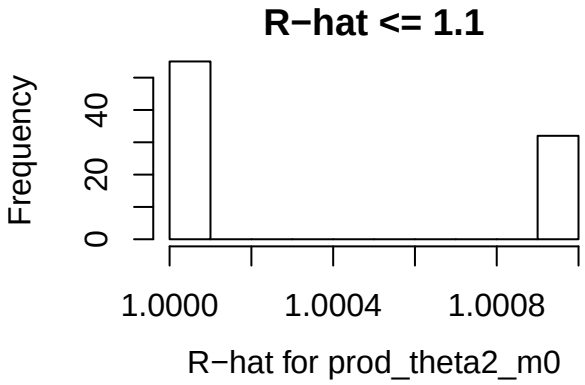
```
number of trajectories with Rhat > 1.02:    13

indizes of trajectories with Rhat > 1.02:
2 11 22 26 28 34 45 48 59 65 73 74 85

number of trajectories with Rhat > 1.1: 13

indices of trajectories with Rhat > 1.1:
2 11 22 26 28 34 45 48 59 65 73 74 85
```





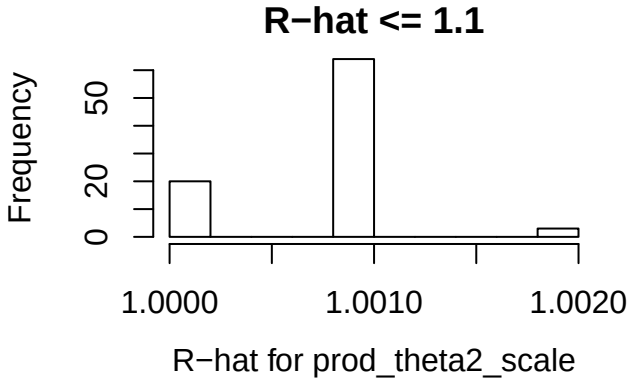
prod_theta2_m0

```
no Rhat > 1.02
```



prod_theta2_scale

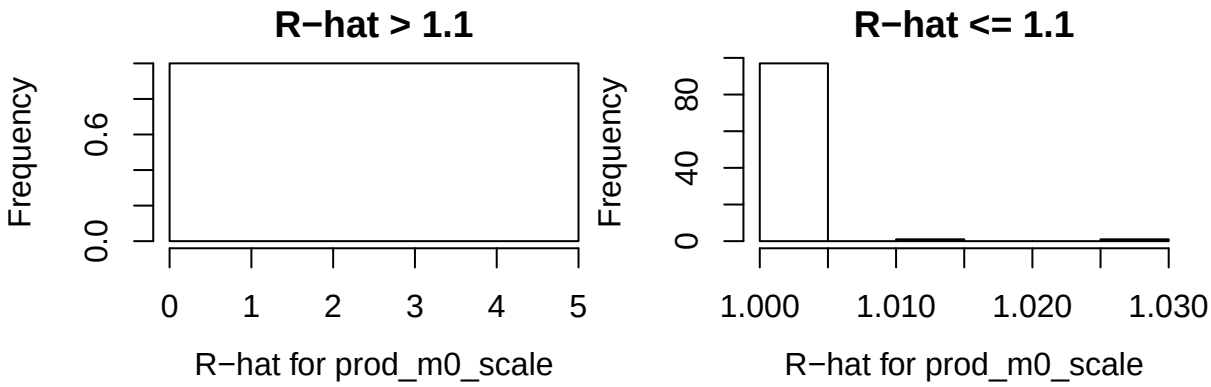
```
no Rhat > 1.02
```



prod_m0_scale

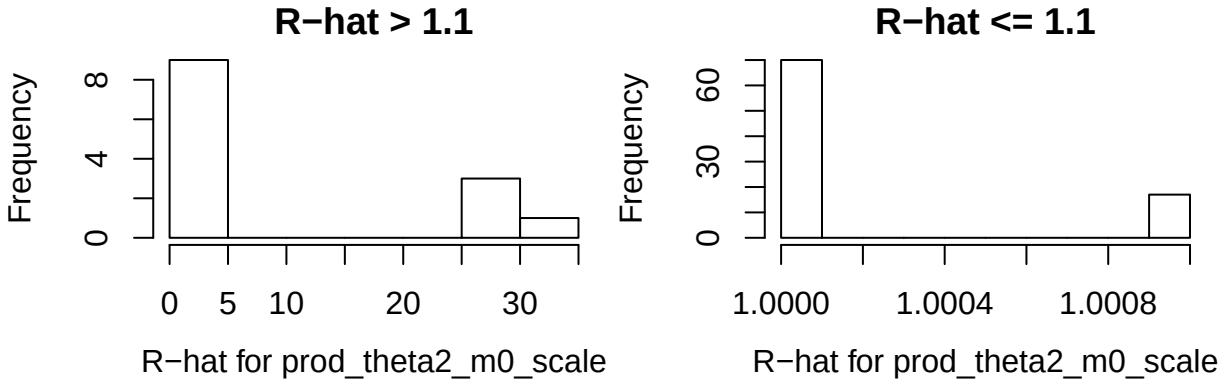
```
number of trajectories with Rhat > 1.02:    2

indizes of trajectories with Rhat > 1.02:
2 28

number of trajectories with Rhat > 1.1: 1

indices of trajectories with Rhat > 1.1:
```

2



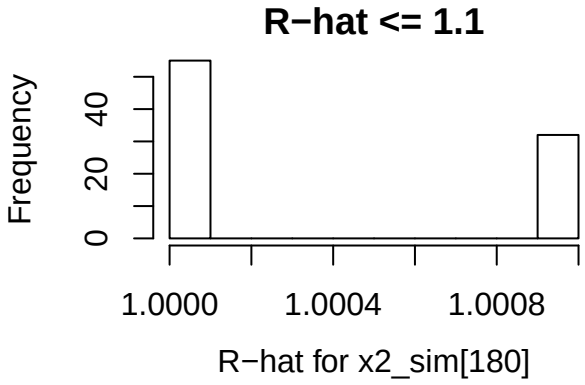
prod_theta2_m0_scale

```
number of trajectories with Rhat > 1.02:    13

indizes of trajectories with Rhat > 1.02:
2 11 22 26 28 34 45 48 59 65 73 74 85

number of trajectories with Rhat > 1.1: 13

indices of trajectories with Rhat > 1.1:
2 11 22 26 28 34 45 48 59 65 73 74 85
```



x2_sim[180]

```
no Rhat > 1.02
```



Effective sample size (ESS)

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

```
[1] NA
```

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

	n_eff < 100
theta[1]	99
theta[2]	2
theta[3]	99
m0	2
sigma	11
scale	4
offset	13
t0	NA
prod_theta2_m0	0
prod_theta2_scale	0
prod_m0_scale	1
prod_theta2_m0_scale	13
x2_sim[180]	0

number of parameters with low ESS (< 300) 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
n_eff < 100	2	10	2	2	2	2	2	2	2	2	6	2	2	2	2	2	2	2	2	2

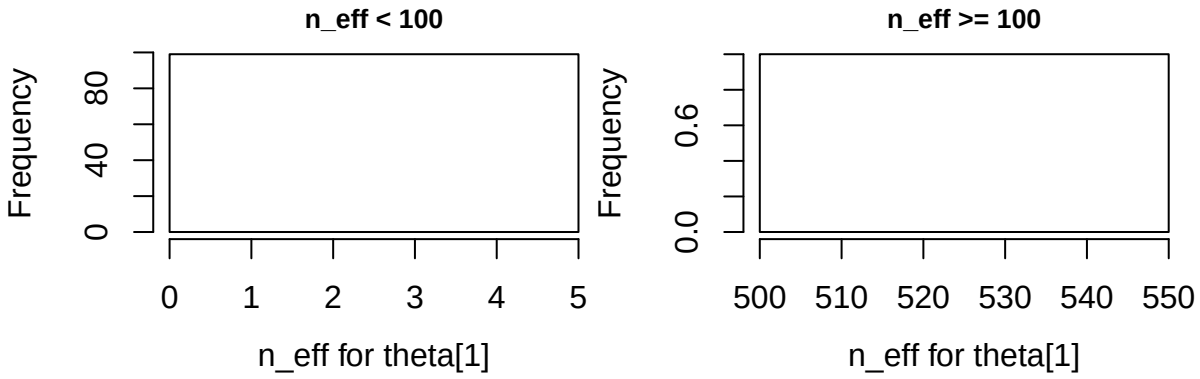
	21	22	23	24	25	26	27	29	30	31	32	33	34	35	36	37	38	39	40	41
n_eff < 100	2	6	2	2	2	6	2	2	2	2	2	2	6	2	2	2	2	2	2	2

	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61
n_eff < 100	2	2	2	8	2	2	8	2	2	2	2	2	2	2	2	2	2	5	2	2

	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	81	82
n_eff < 100	2	2	2	6	2	2	2	2	2	2	2	6	6	2	2	2	2	2	2	2

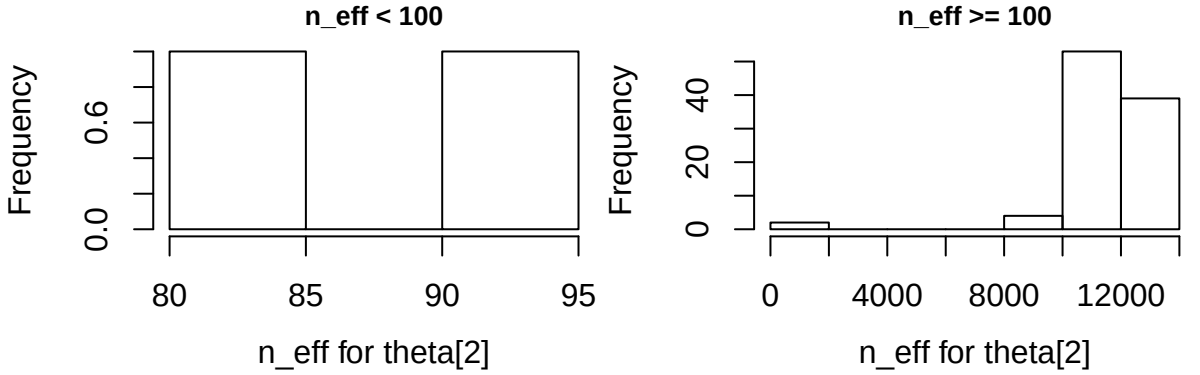
theta[1]

```
number of trajectories with n_eff < 100:    99

indices of trajectories with n_eff < 100:
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38
```



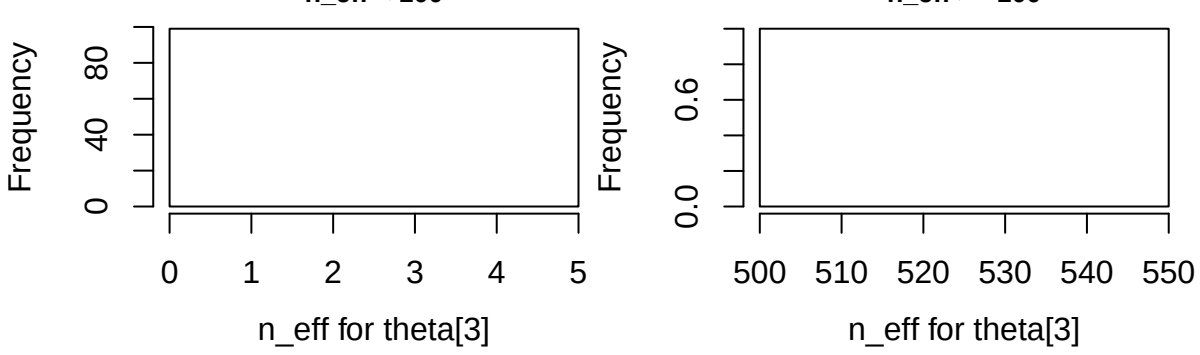
theta[2]

```
number of trajectories with n_eff < 100:    2

indices of trajectories with n_eff < 100:
2 45
```



theta[3]

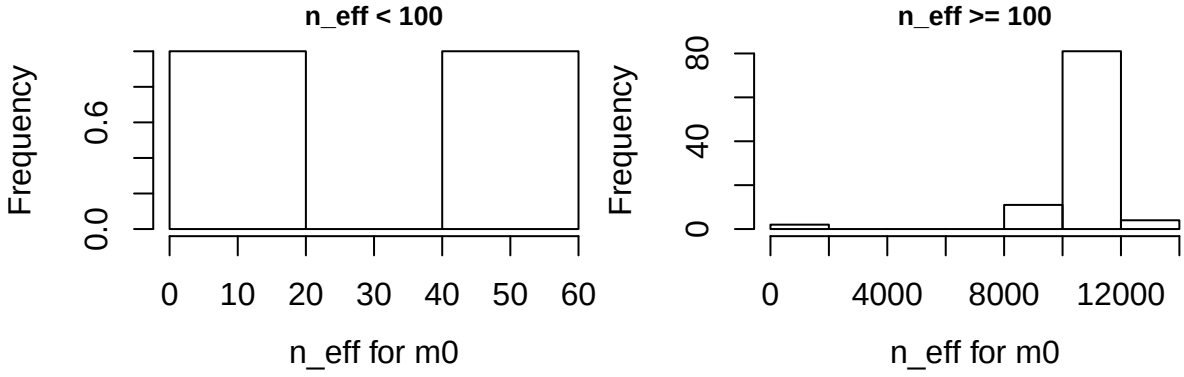
```
number of trajectories with n_eff < 100:    99

indices of trajectories with n_eff < 100:
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38
```



m0

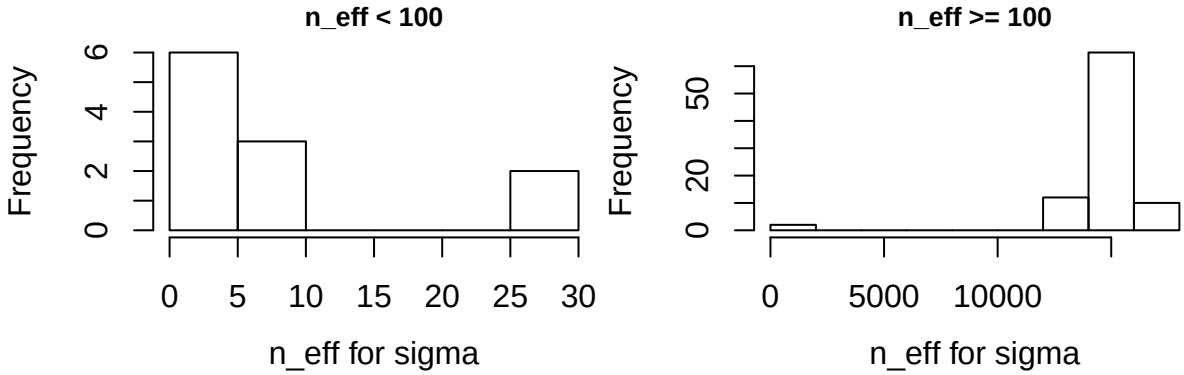
```
number of trajectories with n_eff < 100:    2
```

```
indices of trajectories with n_eff < 100:
2 48
```



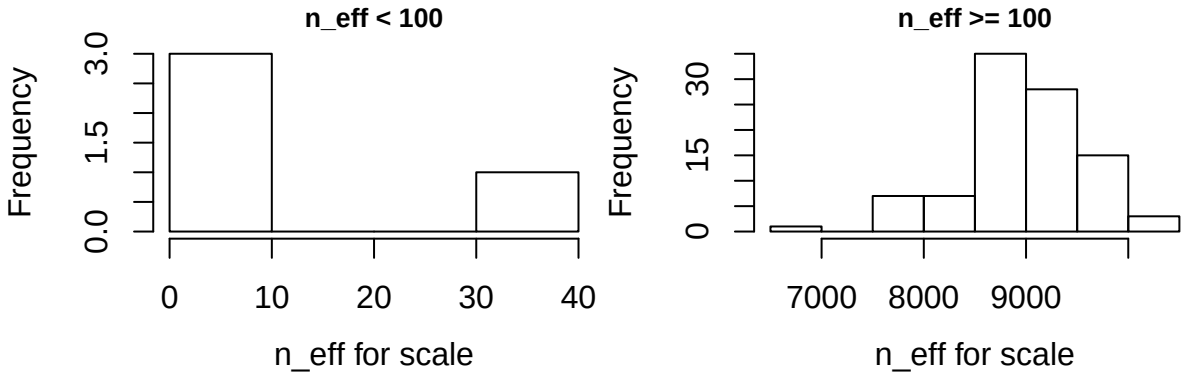
sigma

```
number of trajectories with n_eff < 100:    11

indices of trajectories with n_eff < 100:
2 11 22 26 28 34 45 48 65 73 74
```



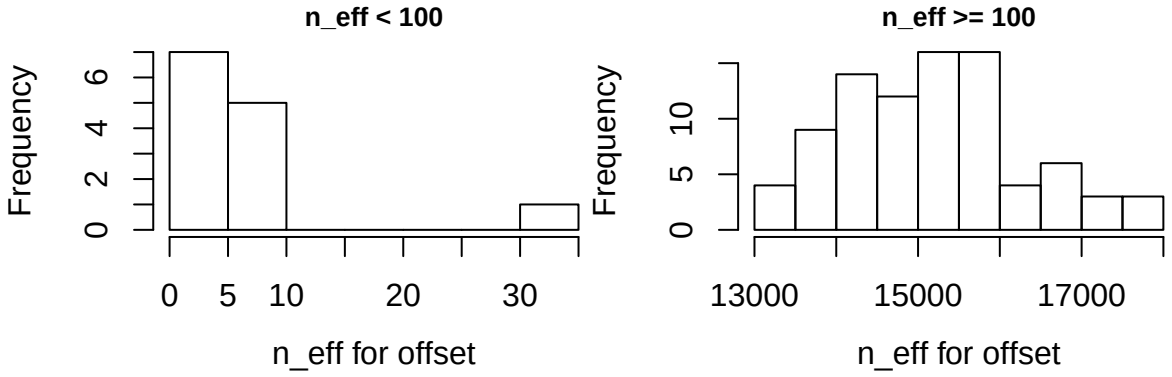
scale

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

indices of trajectories with n_eff < 100:
2 28 45 48
```



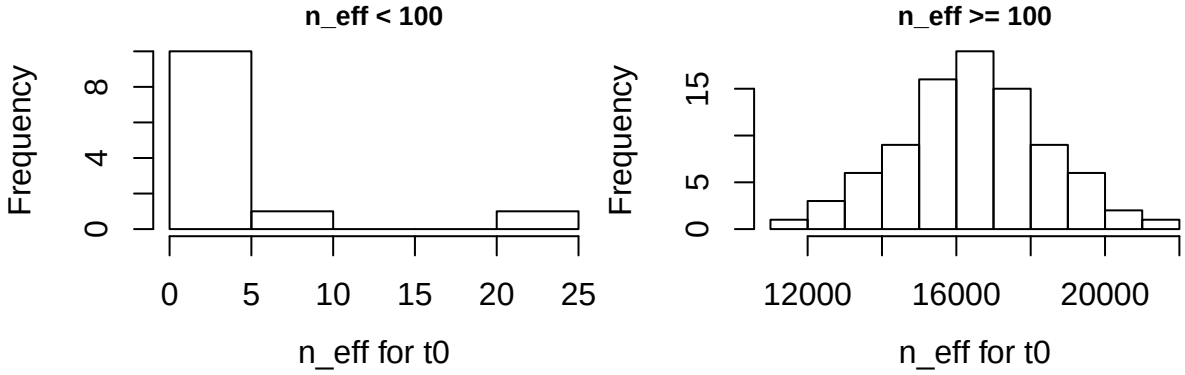
offset

```
number of trajectories with n_eff < 100:    13

indices of trajectories with n_eff < 100:
2 11 22 26 28 34 45 48 59 65 73 74 85
```



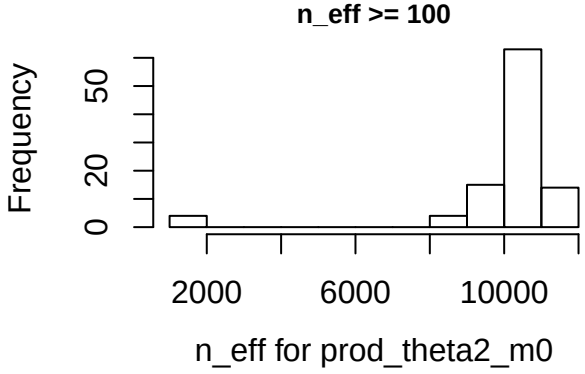
t0

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

indices of trajectories with n_eff < 100:
2 11 22 26 34 45 48 59 65 73 74 85
```



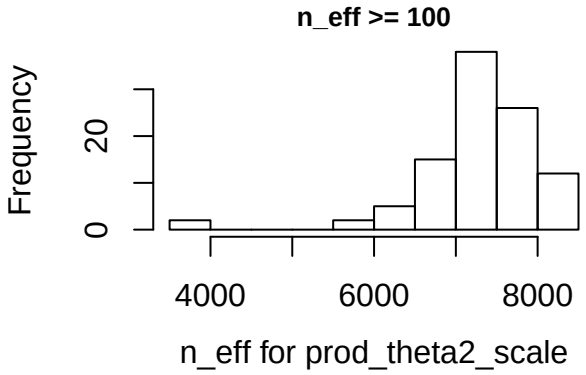
prod_theta2_m0

```
no n_eff < 100
```



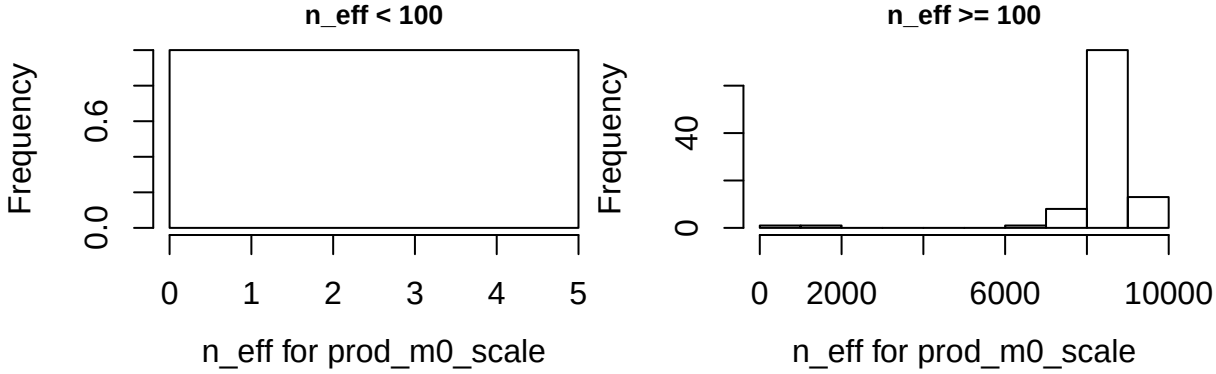
prod_theta2_scale

```
no n_eff < 100
```



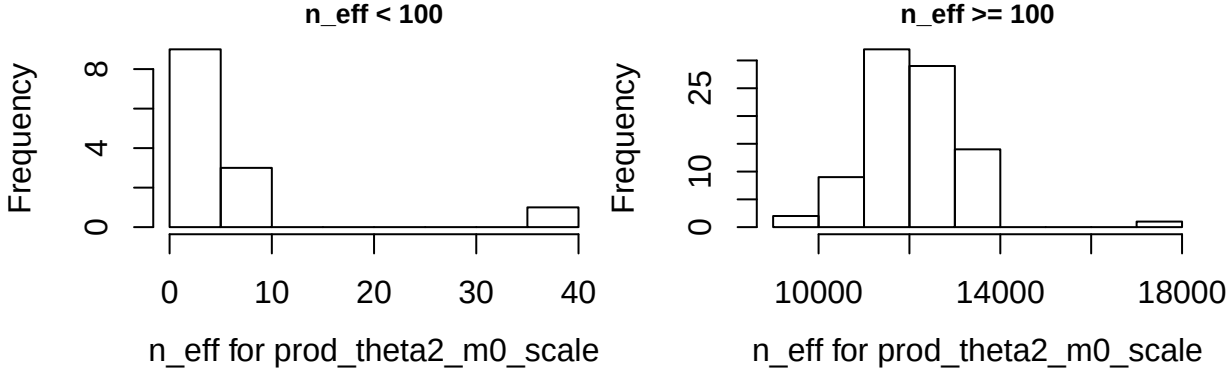
prod_m0_scale

```
number of trajectories with n_eff < 100:    1

indices of trajectories with n_eff < 100:
2
```



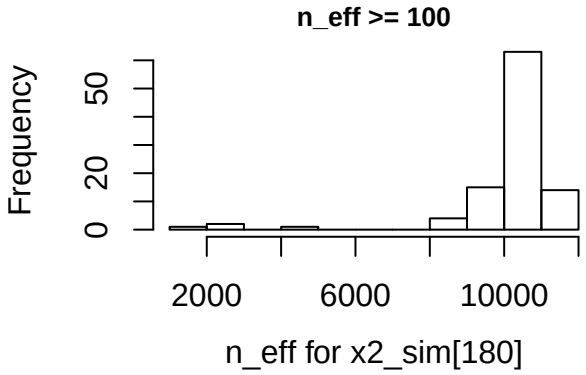
prod_theta2_m0_scale

```
number of trajectories with n_eff < 100:    13

indices of trajectories with n_eff < 100:
2 11 22 26 28 34 45 48 59 65 73 74 85
```



x2_sim[180]

```
no n_eff < 100
```



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] NA
```

parameters per trajectories with very high Rhat

```
1:   theta[1]  theta[3]
2:   theta[1]  theta[3]  m0  sigma  scale  offset  t0  prod_m0_scale  prod_theta2_m0_scale
3:   theta[1]  theta[3]
4:   theta[1]  theta[3]
5:   theta[1]  theta[3]
6:   theta[1]  theta[3]
7:   theta[1]  theta[3]
8:   theta[1]  theta[3]
9:   theta[1]  theta[3]
10:   theta[1]  theta[3]
11:   theta[1]  theta[3]  sigma  offset  t0  prod_theta2_m0_scale
12:   theta[1]  theta[3]
13:   theta[1]  theta[3]
14:   theta[1]  theta[3]
15:   theta[1]  theta[3]
16:   theta[1]  theta[3]
17:   theta[1]  theta[3]
18:   theta[1]  theta[3]
19:   theta[1]  theta[3]
20:   theta[1]  theta[3]
21:   theta[1]  theta[3]
22:   theta[1]  theta[3]  sigma  offset  t0  prod_theta2_m0_scale
23:   theta[1]  theta[3]
24:   theta[1]  theta[3]
25:   theta[1]  theta[3]
26:   theta[1]  theta[3]  sigma  offset  t0  prod_theta2_m0_scale
27:   theta[1]  theta[3]
28:   theta[1]  theta[3]  sigma  scale  offset  t0  prod_theta2_m0_scale
29:   theta[1]  theta[3]
30:   theta[1]  theta[3]
31:   theta[1]  theta[3]
32:   theta[1]  theta[3]
33:   theta[1]  theta[3]
```

```
34:   theta[1]  theta[3]  sigma  offset  t0  prod_theta2_m0_scale
35:   theta[1]  theta[3]
36:   theta[1]  theta[3]
37:   theta[1]  theta[3]
38:   theta[1]  theta[3]
39:   theta[1]  theta[3]
40:   theta[1]  theta[3]
41:   theta[1]  theta[3]
42:   theta[1]  theta[3]
43:   theta[1]  theta[3]
44:   theta[1]  theta[3]
45:   theta[1]  theta[3]  sigma  offset  t0  prod_theta2_m0_scale
46:   theta[1]  theta[3]
47:   theta[1]  theta[3]
48:   theta[1]  theta[3]  sigma  scale  offset  t0  prod_theta2_m0_scale
49:   theta[1]  theta[3]
50:   theta[1]  theta[3]
51:   theta[1]  theta[3]
52:   theta[1]  theta[3]
53:   theta[1]  theta[3]
54:   theta[1]  theta[3]
55:   theta[1]  theta[3]
56:   theta[1]  theta[3]
57:   theta[1]  theta[3]
58:   theta[1]  theta[3]
59:   theta[1]  theta[3]  offset  t0  prod_theta2_m0_scale
60:   theta[1]  theta[3]
61:   theta[1]  theta[3]
62:   theta[1]  theta[3]
63:   theta[1]  theta[3]
64:   theta[1]  theta[3]
65:   theta[1]  theta[3]  sigma  offset  t0  prod_theta2_m0_scale
66:   theta[1]  theta[3]
67:   theta[1]  theta[3]
68:   theta[1]  theta[3]
69:   theta[1]  theta[3]
70:   theta[1]  theta[3]
71:   theta[1]  theta[3]
72:   theta[1]  theta[3]
73:   theta[1]  theta[3]  offset  t0  prod_theta2_m0_scale
74:   theta[1]  theta[3]  sigma  offset  t0  prod_theta2_m0_scale
75:   theta[1]  theta[3]
76:   theta[1]  theta[3]
77:   theta[1]  theta[3]
78:   theta[1]  theta[3]
79:   theta[1]  theta[3]
81:   theta[1]  theta[3]
82:   theta[1]  theta[3]
83:   theta[1]  theta[3]
84:   theta[1]  theta[3]
85:   theta[1]  theta[3]  offset  t0  prod_theta2_m0_scale
86:   theta[1]  theta[3]
87:   theta[1]  theta[3]
88:   theta[1]  theta[3]
89:   theta[1]  theta[3]
90:   theta[1]  theta[3]
```

```
91:   theta[1]  theta[3]
92:   theta[1]  theta[3]
93:   theta[1]  theta[3]
94:   theta[1]  theta[3]
95:   theta[1]  theta[3]
96:   theta[1]  theta[3]
97:   theta[1]  theta[3]
98:   theta[1]  theta[3]
99:   theta[1]  theta[3]
100:   theta[1]  theta[3]
```

unique combinations:

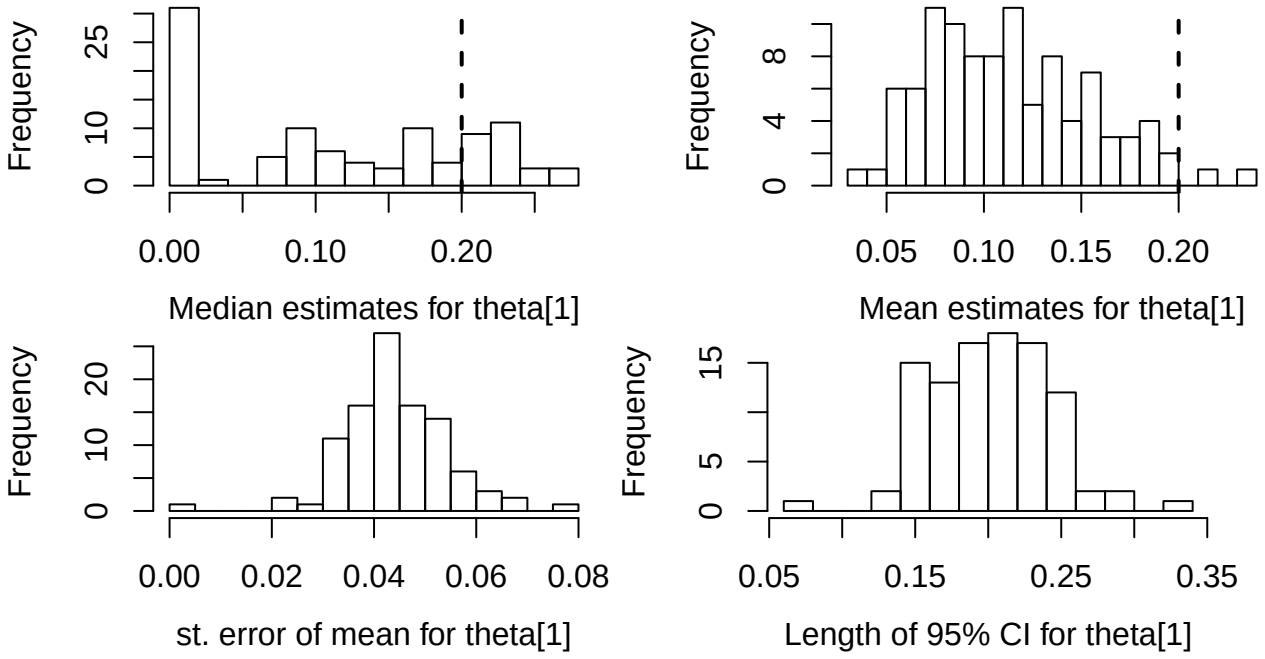
```
number of unique combinations:  5
```

```
combinations and number of their occruence:
```

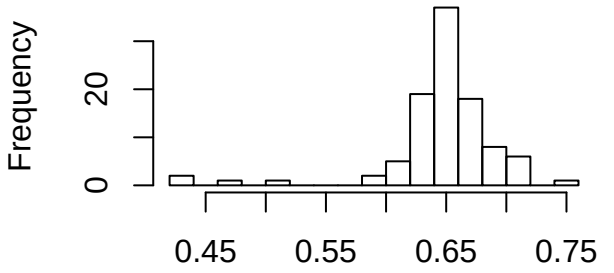
```
86  :  theta[1]  theta[3]
1  :  theta[1]  theta[3]  m0  sigma  scale  offset  t0  prod_m0_scale  prod_theta2_m0_scale
7  :  theta[1]  theta[3]  sigma  offset  t0  prod_theta2_m0_scale
2  :  theta[1]  theta[3]  sigma  scale  offset  t0  prod_theta2_m0_scale
3  :  theta[1]  theta[3]  offset  t0  prod_theta2_m0_scale
```

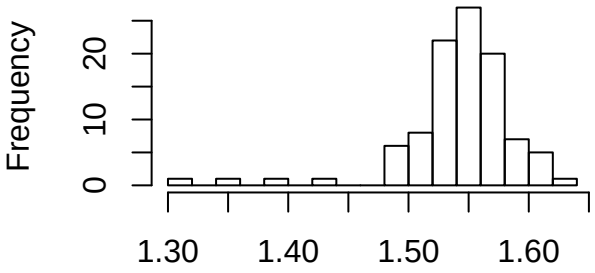
Overview of estimates

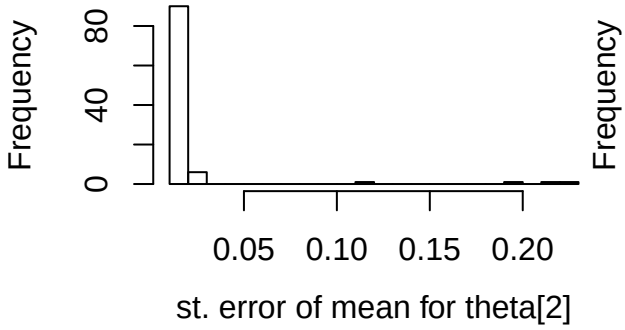
theta[1]

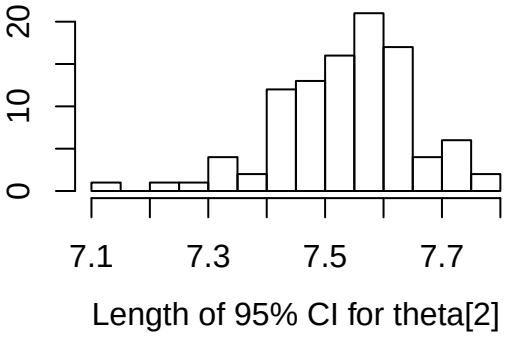


theta[2]

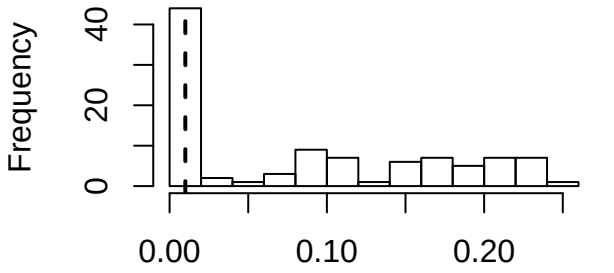


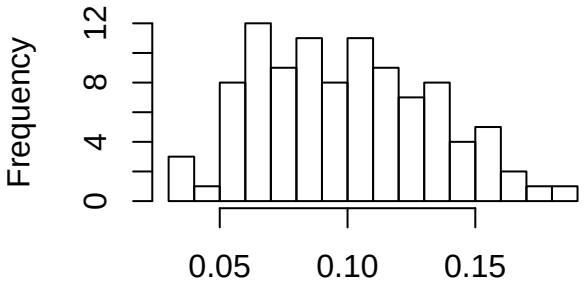


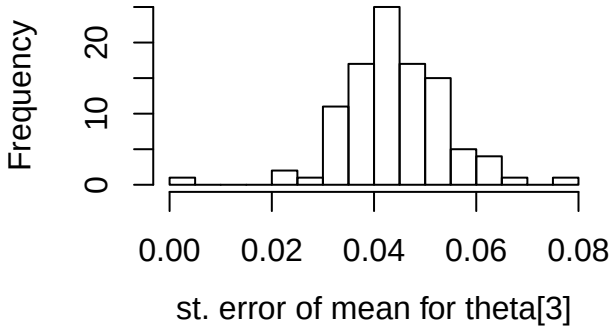


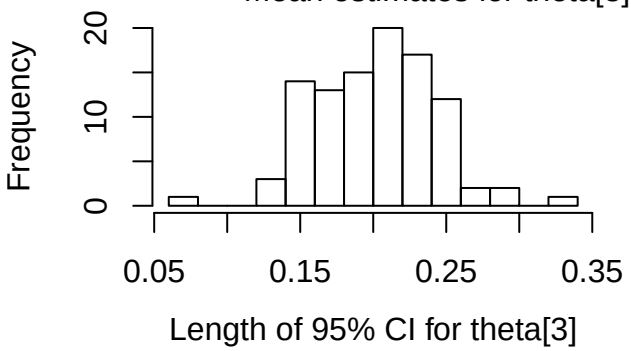


theta[3]

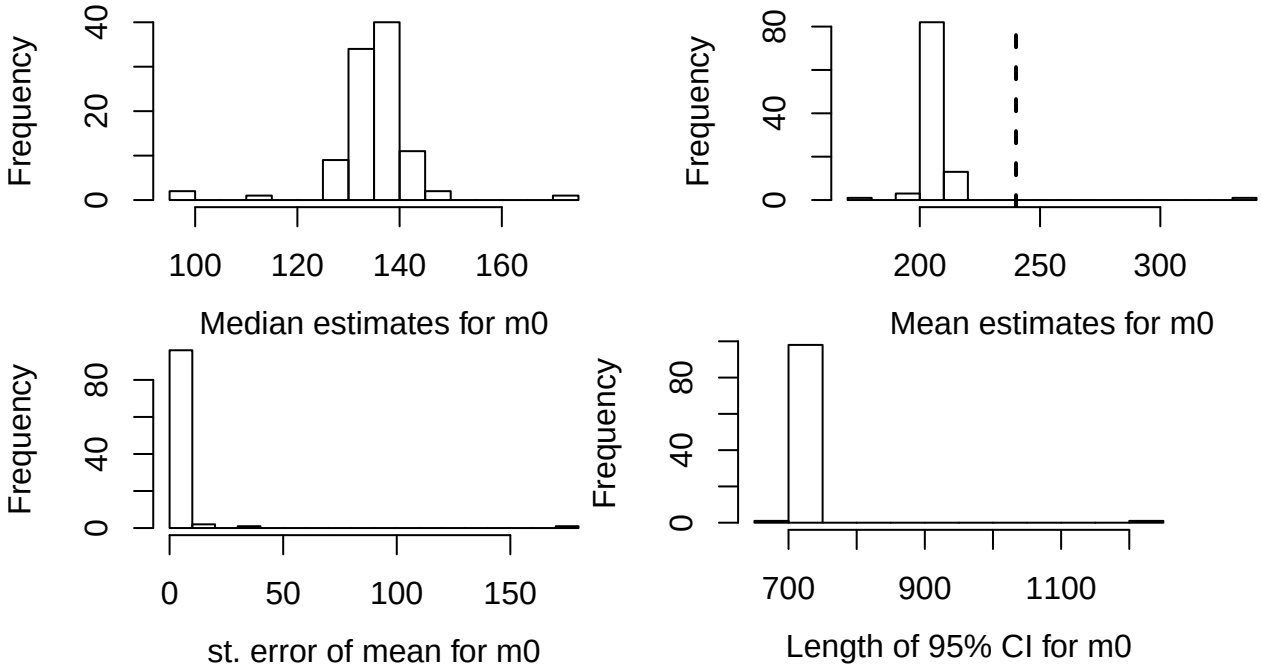




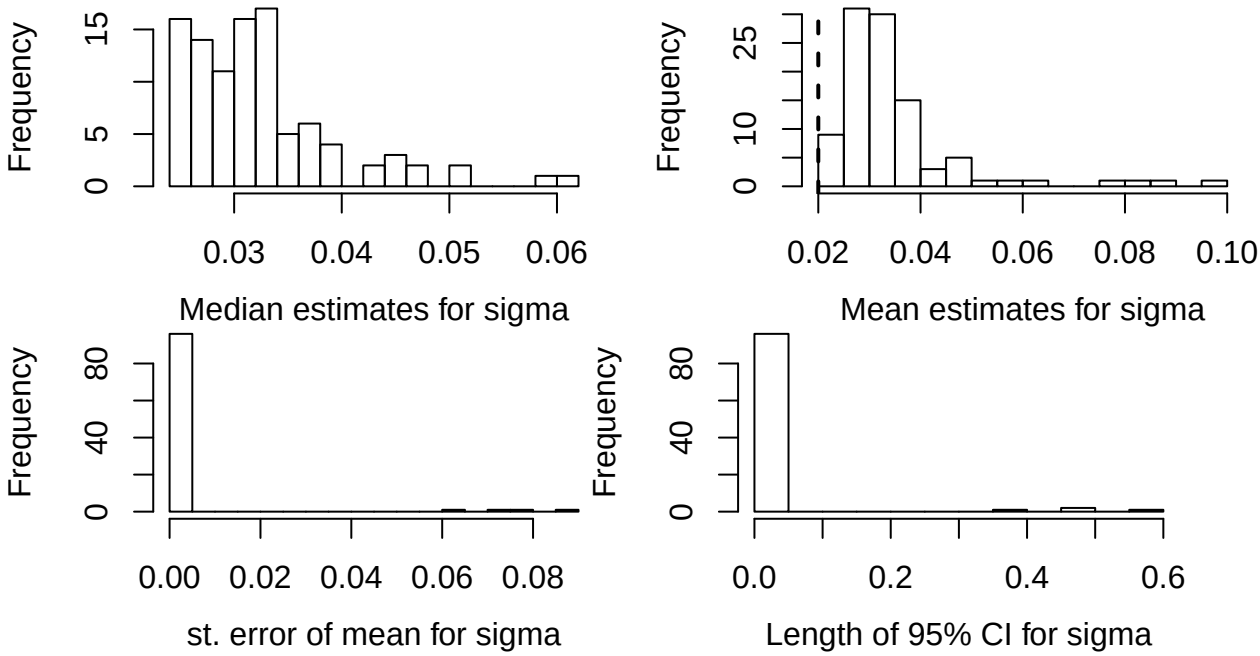




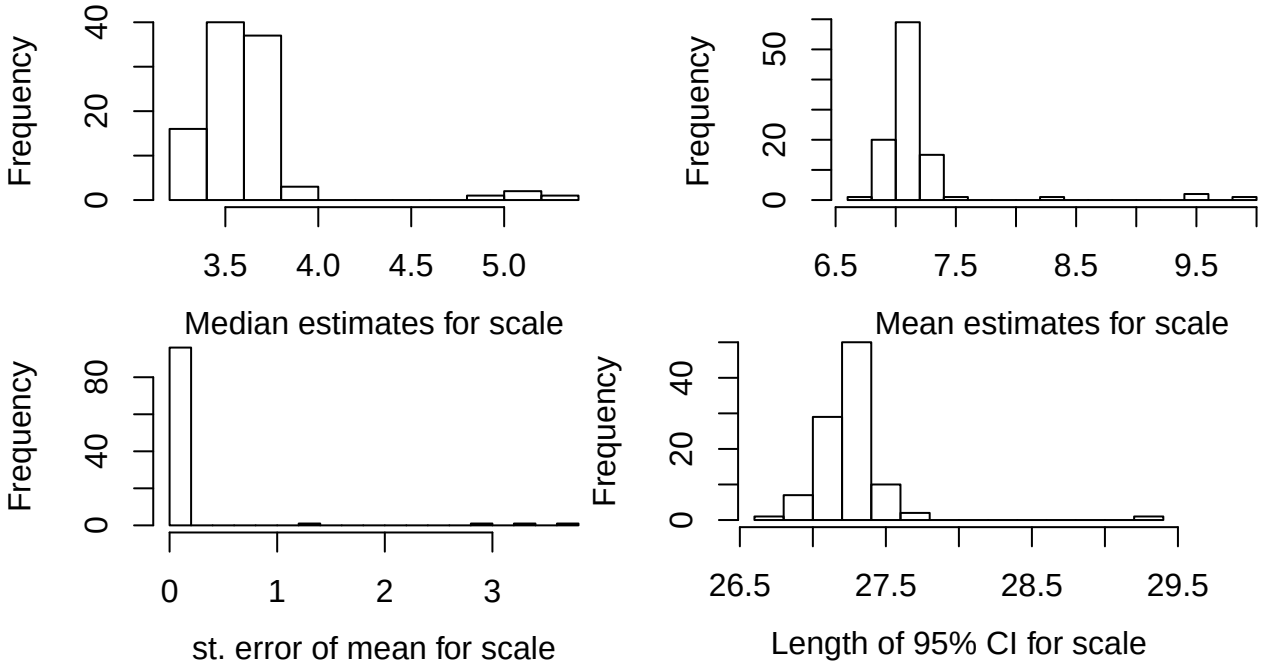
m0


Frequency
0
20
40
100
120
140
160
Median estimates for m0
Frequency
0
40
80
200
250
300
Mean estimates for m0
Frequency
0
40
80
0
50
100
150
st. error of mean for m0
Frequency
0
40
80
700
900
1100
Length of 95% CI for m0

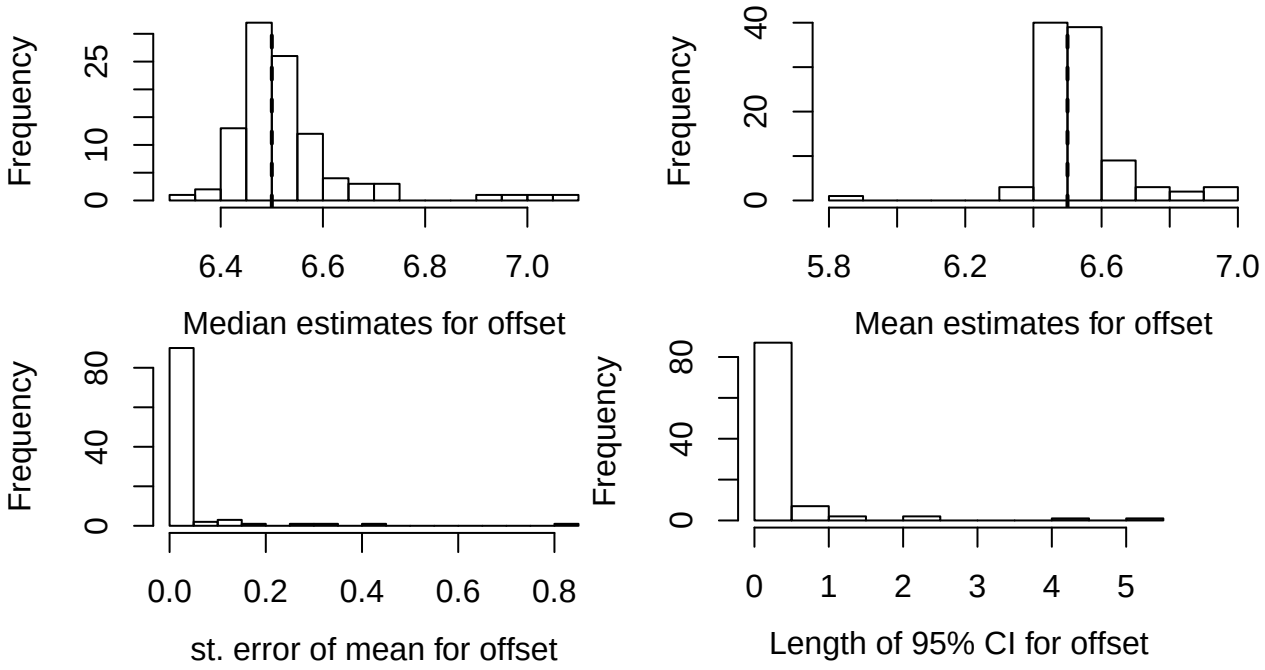
sigma


Frequency
0
5
15
0.03
0.04
0.05
0.06
Median estimates for sigma
Frequency
0
10
25
0.02
0.04
0.06
0.08
0.10
Mean estimates for sigma
Frequency
0
40
80
0.00
0.02
0.04
0.06
0.08
st. error of mean for sigma
Frequency
0
40
80
0.0
0.2
0.4
0.6
Length of 95% CI for sigma

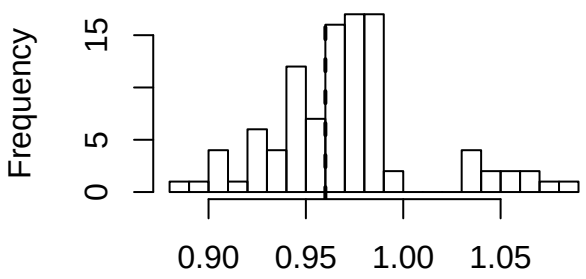
scale

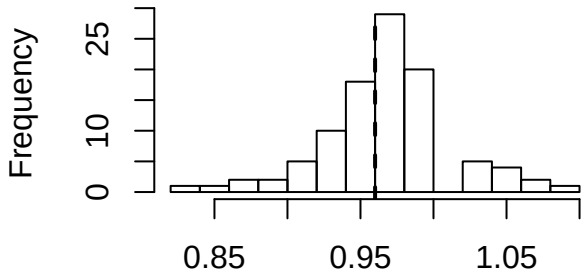


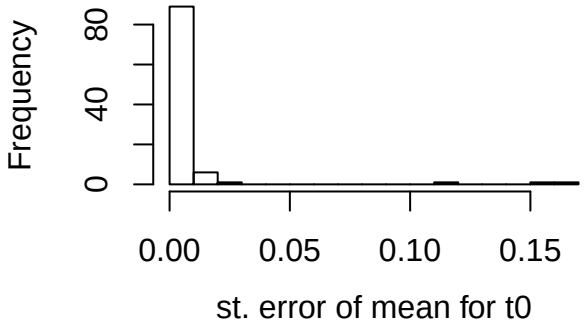
offset

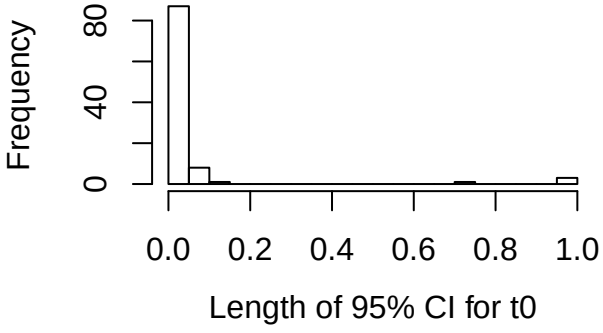


t0

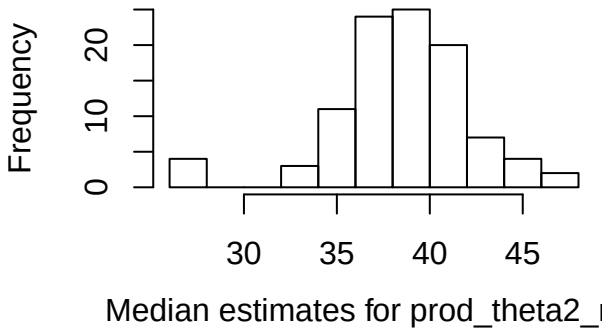


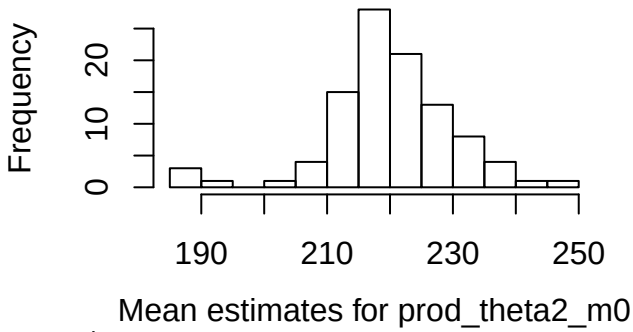


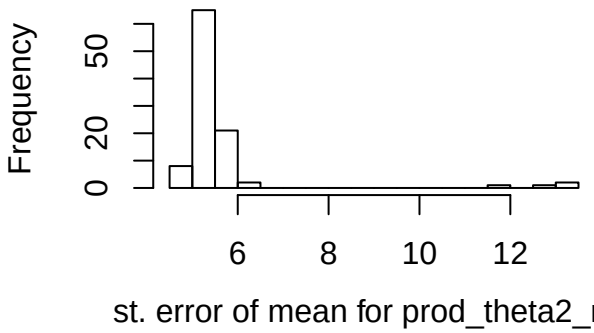


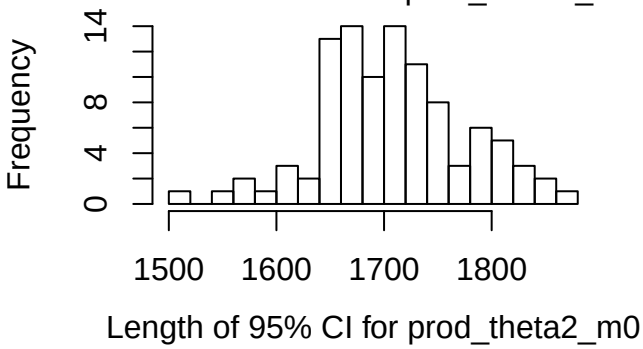


prod_theta2_m0

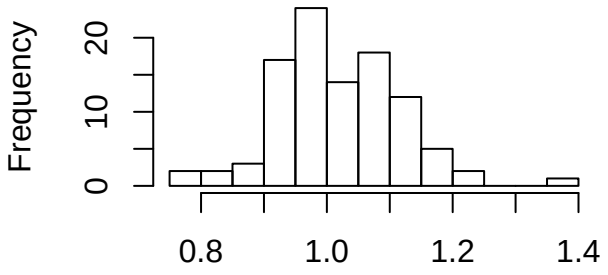




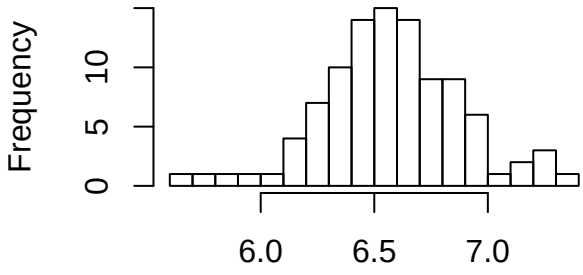




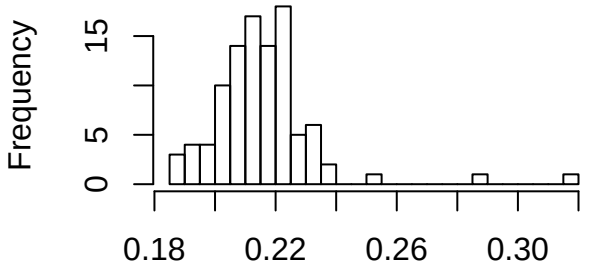
prod_theta2_scale



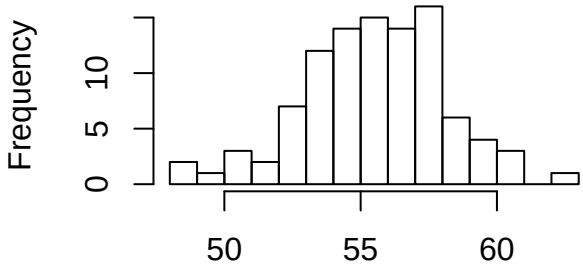
Median estimates for prod_theta2_scale



Mean estimates for prod_theta2_scale

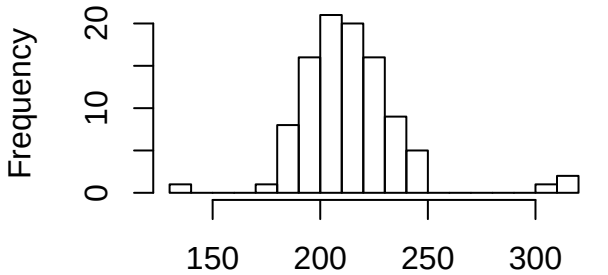


st. error of mean for prod_theta2_scale

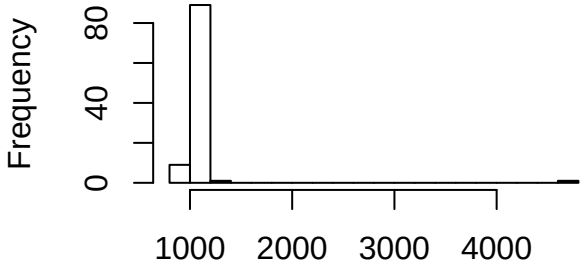


Length of 95% CI for prod_theta2_scale

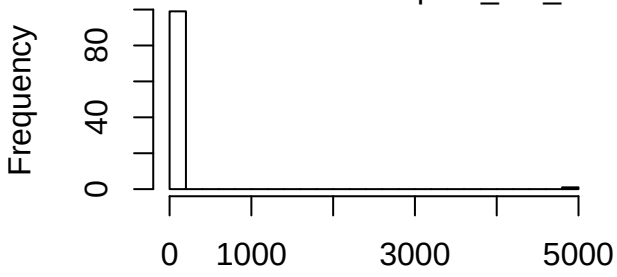
prod_m0_scale



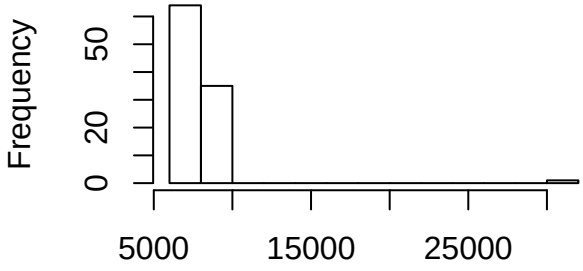
Median estimates for prod_m0_scale



Mean estimates for prod_m0_scale

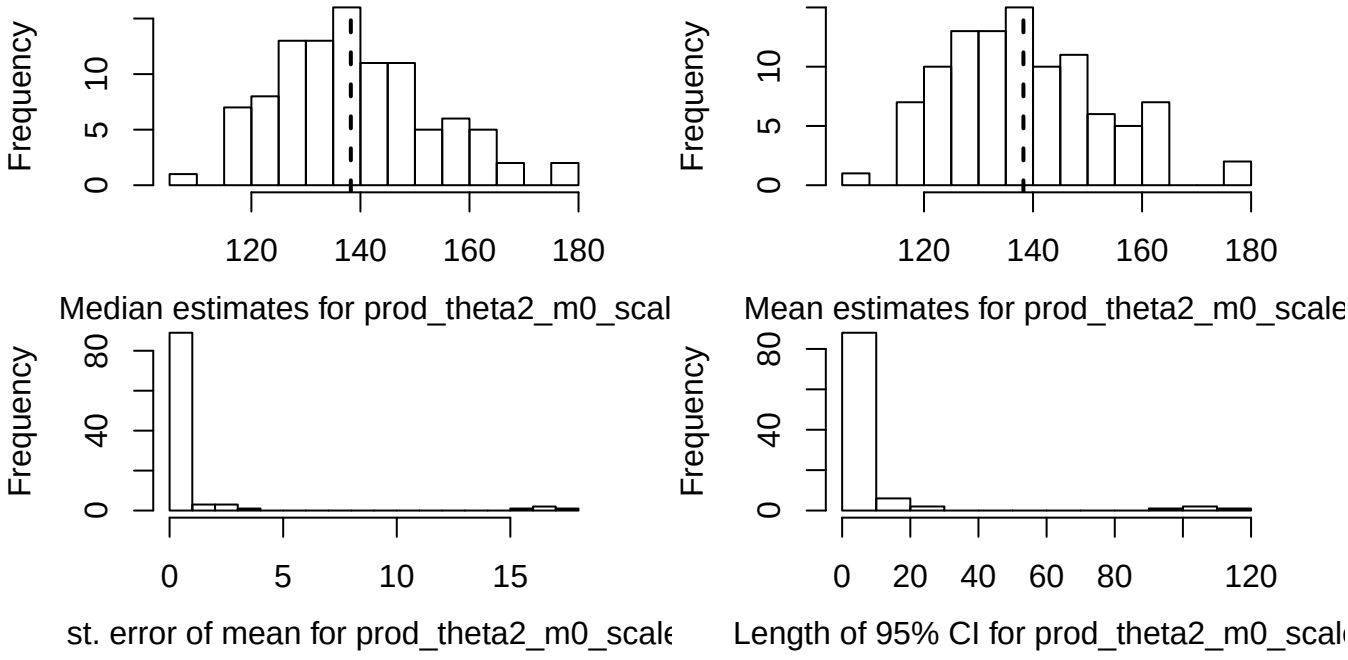


st. error of mean for prod_m0_scale

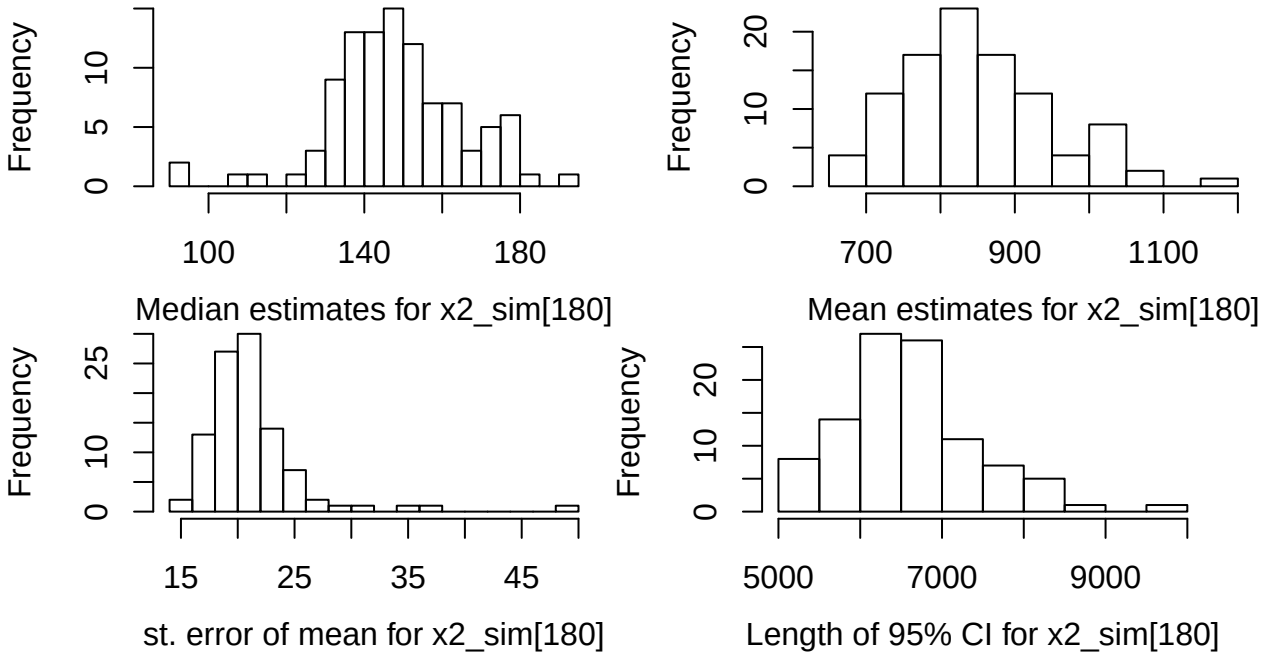


Length of 95% CI for prod_m0_scale

prod_theta2_m0_scale



x2_sim[180]



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]	0.203	0.041	0.202	60	0.223	0.028	0.122
theta[2]	7.548	0.119	0.016	100	7.548	0.119	0.016
theta[3]	0.204	0.040	0.200	63	0.222	0.032	0.145
m0	733.851	51.420	0.070	100	733.851	51.420	0.070
sigma	0.007	0.092	3.531	0	NA	NA	NA
scale	27.250	0.259	0.010	100	27.250	0.259	0.010
offset	0.335	0.708	1.394	96	0.335	0.722	1.401
t0	0.012	0.178	3.283	16	0.015	0.355	1.891
prod_theta2_m0	1702.366	68.089	0.040	100	1702.366	68.089	0.040
prod_theta2_scale	55.700	2.637	0.048	100	55.700	2.637	0.048
prod_m0_scale	7896.070	2328.458	0.287	100	7896.070	2328.458	0.287
prod_theta2_m0_scale	4.958	19.581	1.943	15	5.115	35.542	1.840
x2_sim[180]	6543.534	821.874	0.125	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]	1.94	1.79	1.85	1.01	60	1.91	1.63
theta[2]	11.58	4.88	11.55	23.59	100	11.58	11.55
theta[3]	2.11	1.97	2.53	20.35	63	14.31	18.50
m0	5.40	3.56	5.41	3.06	100	5.40	5.41
sigma	0.21	0.21	0.22	0.35	0	NA	NA
scale	7.64	3.83	7.62	15.14	100	7.64	7.62
offset	0.05	0.05	0.05	0.05	96	0.05	0.05
t0	0.01	0.01	0.01	0.01	16	0.02	0.02
prod_theta2_m0	44.50	7.73	44.10	22.17	100	44.50	44.10
prod_theta2_scale	54.72	8.46	55.28	96.70	100	54.72	55.28
prod_m0_scale	37.38	7.49	37.38	18.28	100	37.38	37.38
prod_theta2_m0_scale	0.04	0.04	0.04	0.04	15	0.04	0.04
x2_sim[180]	44.42	7.72	44.70	NA	NA	NA	NA