

Parameter Table

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1 Purpose

This script picks up after model.Rnw to process bootstrap results and make a parameter table. It assumes the current working directory is the script directory containing this file.

1.1 Package

Listing 1:

```
> library(metrumrg)
```

2 inputs

'wikitab' gives us a quick synthesis of 'rlog' and the 'lookup' of wiki notation in 1005.ctl. We do some science on the result first, and then some aesthetics for printing in a \LaTeX table. Table [1](#).

Listing 2:

```
> tab <- wikitab(1005, '../nonmem')
> tab$estimate <- signif(as.numeric(tab$estimate), 3)
> tab$tool <- NULL
> tab$run <- NULL
> tab$se <- NULL
> tab
```

	parameter	description
1	THETA1	apparent oral clearance
2	THETA2	central volume of distribution
3	THETA3	absorption rate constant
4	THETA4	intercompartmental clearance
5	THETA5	peripheral volume of distribution

```

6      THETA6          male effect on clearance
7      THETA7          weight effect on clearance
8      OMEGA1.1        interindividual variability of clearance
9      OMEGA2.1        interindividual clearance-volume covariance
10     OMEGA2.2        interindividual variability of central volume
11     OMEGA3.1        interindividual clearance-Ka covariance
12     OMEGA3.2        interindividual volume-Ka covariance
13     OMEGA3.3        interindividual variability of Ka
14     SIGMA1.1        proportional error
15     SIGMA2.2        additive error

                                model estimate
1  CL/F (L/h) ~ theta_1 *  theta_6 ^MALE * (WT/70)^theta_7 * e^eta_1  9.5100
2                                V_c /F (L) ~ theta_2 * (WT/70)^1 * e^eta_2  22.8000
3                                K_a (h^-1 ) ~ theta_3 * e^eta_3   0.0714
4                                Q/F (L/h) ~ theta_4   3.4700
5                                V_p /F (L) ~ theta_5 113.0000
6                                MALE_CL/F ~ theta_6   1.0200
7                                WT_CL/F ~ theta_7   1.1900
8                                IIV_CL/F ~ Omega_1.1  0.2140
9                                cov_CL,V ~ Omega_2.1  0.1210
10                               IIV_V_c /F ~ Omega_2.2  0.0945
11                               cov_CL,Ka ~ Omega_3.1 -0.0116
12                               cov_V,Ka ~ Omega_3.2 -0.0372
13                               IIV_K_a ~ Omega_3.3  0.0466
14                               err_prop ~ Sigma_1.1  0.0492
15                               err_add ~ Sigma_2.2  0.2020

prse
1  9.84
2  9.56
3  7.35
4  15.4
5   21
6  11.2
7  28.4

```

```
8 22.8
9 26.4
10 33.2
11 173
12 36.1
13 34.7
14 10.9
15 33.5
```

Now we can extract some information from the model statements.

Listing 3:

```
> tab$units <- justUnits(tab$model)
> tab$model <- noUnits(tab$model)
> tab$name <- with(tab, wiki2label(model))
> tab[c('model','units','name')]
```

```

                                model units
1 CL/F ~ theta_1 * theta_6 ^MALE * (WT/70)^theta_7 * e^eta_1 L/h
2                                V_c /F ~ theta_2 * (WT/70)^1 * e^eta_2 L
3                                K_a ~ theta_3 * e^eta_3 h^-1
4                                Q/F ~ theta_4 L/h
5                                V_p /F ~ theta_5 L
6                                MALE_CL/F ~ theta_6
7                                WT_CL/F ~ theta_7
8                                IIV_CL/F ~ Omega_1.1
9                                cov_CL,V ~ Omega_2.1
10                               IIV_V_c /F ~ Omega_2.2
11                               cov_CL,Ka ~ Omega_3.1
12                               cov_V,Ka ~ Omega_3.2
13                               IIV_K_a ~ Omega_3.3
14                               err_prop ~ Sigma_1.1
15                               err_add ~ Sigma_2.2
                                name
```

```

1      CL/F
2      V_c/F
3      K_a
4      Q/F
5      V_p/F
6  MALE_CL/F
7      WT_CL/F
8      IIV_CL/F
9      cov_CL,V
10     IIV_V_c/F
11     cov_CL,Ka
12     cov_V,Ka
13     IIV_K_a
14     err_prop
15     err_add

```

3 variance

The estimates for the matrix diagonals are variances, and their square roots have special meaning. In model 1005, interindividual variability was modelled exponentially, in which case square root of variance gives an approximate CV; alternatively, and exact CV can be calculated. For proportional error terms like ERR1, square root gives an exact CV. For additive error terms like ERR2, square root gives standard deviation.

We can use functions of 'parameter' to sort out the various error components, as they are used in this model.

3.1 exponential

Listing 4:

```

> expo <- is.iiv(tab$parameter) & is.diagonal(tab$parameter)
> tab$parameter[expo]

```

```
[1] "OMEGA1.1" "OMEGA2.2" "OMEGA3.3"
```

Listing 5:

```
> tab$cv[expo] <- cvLognormal(tab$estimate[expo])
> tab[,c('parameter','name','estimate','cv')]
```

	parameter	name	estimate	cv
1	THETA1	CL/F	9.5100	NA
2	THETA2	V_c/F	22.8000	NA
3	THETA3	K_a	0.0714	NA
4	THETA4	Q/F	3.4700	NA
5	THETA5	V_p/F	113.0000	NA
6	THETA6	MALE_CL/F	1.0200	NA
7	THETA7	WT_CL/F	1.1900	NA
8	OMEGA1.1	IIV_CL/F	0.2140	0.4884902
9	OMEGA2.1	cov_CL,V	0.1210	NA
10	OMEGA2.2	IIV_V_c/F	0.0945	0.3148161
11	OMEGA3.1	cov_CL,Ka	-0.0116	NA
12	OMEGA3.2	cov_V,Ka	-0.0372	NA
13	OMEGA3.3	IIV_K_a	0.0466	0.2184098
14	SIGMA1.1	err_prop	0.0492	NA
15	SIGMA2.2	err_add	0.2020	NA

3.2 proportional

Listing 6:

```
> writeLines(read.nmctl('../nonmem/ctl/1005.ctl')$err)
```

```
Y=F*(1+ERR(1)) + ERR(2)
IPRE=F
;<doc>
```

Listing 7:

```
> prop <- is.random(tab$parameter) & tab$name %contains% 'prop'
> tab$parameter[prop]
```

```
[1] "SIGMA1.1"
```

Listing 8:

```
> tab$cv[prop] <- sqrt(tab$estimate[prop])
> tab[,c('parameter','name','estimate','cv')]
```

	parameter	name	estimate	cv
1	THETA1	CL/F	9.5100	NA
2	THETA2	V_c/F	22.8000	NA
3	THETA3	K_a	0.0714	NA
4	THETA4	Q/F	3.4700	NA
5	THETA5	V_p/F	113.0000	NA
6	THETA6	MALE_CL/F	1.0200	NA
7	THETA7	WT_CL/F	1.1900	NA
8	OMEGA1.1	IIV_CL/F	0.2140	0.4884902
9	OMEGA2.1	cov_CL,V	0.1210	NA
10	OMEGA2.2	IIV_V_c/F	0.0945	0.3148161
11	OMEGA3.1	cov_CL,Ka	-0.0116	NA
12	OMEGA3.2	cov_V,Ka	-0.0372	NA
13	OMEGA3.3	IIV_K_a	0.0466	0.2184098
14	SIGMA1.1	err_prop	0.0492	0.2218107
15	SIGMA2.2	err_add	0.2020	NA

3.3 additive

Listing 9:

```
> add <- is.residual(tab$parameter) & tab$name %contains% 'add'
> tab$parameter[add]
```

```
[1] "SIGMA2.2"
```

Listing 10:

```
> tab$sd[add] <- sqrt(tab$estimate[add])
> tab[,c('parameter','name','estimate','cv','sd')]

  parameter      name estimate      cv      sd
1  THETA1      CL/F    9.5100      NA      NA
2  THETA2     V_c/F   22.8000      NA      NA
3  THETA3      K_a    0.0714      NA      NA
4  THETA4      Q/F    3.4700      NA      NA
5  THETA5     V_p/F  113.0000      NA      NA
6  THETA6 MALE_CL/F    1.0200      NA      NA
7  THETA7  WT_CL/F    1.1900      NA      NA
8  OMEGA1.1 IIV_CL/F    0.2140 0.4884902      NA
9  OMEGA2.1 cov_CL,V    0.1210      NA      NA
10 OMEGA2.2 IIV_V_c/F    0.0945 0.3148161      NA
11 OMEGA3.1 cov_CL,Ka  -0.0116      NA      NA
12 OMEGA3.2 cov_V,Ka  -0.0372      NA      NA
13 OMEGA3.3 IIV_K_a    0.0466 0.2184098      NA
14 SIGMA1.1 err_prop    0.0492 0.2218107      NA
15 SIGMA2.2 err_add    0.2020      NA 0.4494441
```

4 covariance

The estimates of matrix off-diagonals are covariances, and are more useful if transformed to correlations. We could extract the matrices manually, or use package shortcuts.

Listing 11:

```
> cor <- omegacor(run=1005,project='../nonmem')
> cor
```



```
      [,1]      [,2]      [,3]
[1,] 1.0000000 0.8492811 -0.1163229
[2,] 0.8492811 1.0000000 -0.5607054
[3,] -0.1163229 -0.5607054 1.0000000
```

Listing 12:

```
> half(cor)

      1.1      2.1      2.2      3.1      3.2      3.3
1.0000000 0.8492811 1.0000000 -0.1163229 -0.5607054 1.0000000
```

Listing 13:

```
> offdiag(half(cor))

      2.1      3.1      3.2
0.8492811 -0.1163229 -0.5607054
```

Listing 14:

```
> off <- is.iiv(tab$parameter) & is.offdiagonal(tab$parameter)
> tab$parameter[off]

[1] "OMEGA2.1" "OMEGA3.1" "OMEGA3.2"
```

Listing 15:

```
> tab$cor[off] <- offdiag(half(cor))
> tab[,c('parameter','name','estimate','cv','sd','cor')]

  parameter      name estimate      cv      sd      cor
1  THETA1      CL/F    9.5100      NA      NA      NA
2  THETA2      V_c/F    22.8000      NA      NA      NA
3  THETA3      K_a     0.0714      NA      NA      NA
```

4	THETA4	Q/F	3.4700	NA	NA	NA
5	THETA5	V_p/F	113.0000	NA	NA	NA
6	THETA6	MALE_CL/F	1.0200	NA	NA	NA
7	THETA7	WT_CL/F	1.1900	NA	NA	NA
8	OMEGA1.1	IIV_CL/F	0.2140	0.4884902	NA	NA
9	OMEGA2.1	cov_CL,V	0.1210	NA	NA	0.8492811
10	OMEGA2.2	IIV_V_c/F	0.0945	0.3148161	NA	NA
11	OMEGA3.1	cov_CL,Ka	-0.0116	NA	NA	-0.1163229
12	OMEGA3.2	cov_V,Ka	-0.0372	NA	NA	-0.5607054
13	OMEGA3.3	IIV_K_a	0.0466	0.2184098	NA	NA
14	SIGMA1.1	err_prop	0.0492	0.2218107	NA	NA
15	SIGMA2.2	err_add	0.2020	NA	0.4494441	NA

5 confidence interval

We wish to include 95 percentiles in our table as confidence intervals.

Listing 16:

```
> boot <- read.csv('../nonmem/1005bootlog.csv',as.is=TRUE)
> head(boot)
```

	X	tool	run	parameter	moment	value
1	1	nm7	1	ofv	minimum	2459.17577365853
2	2	nm7	1	THETA1	estimate	9.90635
3	3	nm7	1	THETA1	prse	<NA>
4	4	nm7	1	THETA1	se	<NA>
5	5	nm7	1	THETA2	estimate	21.8851
6	6	nm7	1	THETA2	prse	<NA>

Listing 17:

```
> boot <- boot[boot$moment=='estimate',]
```

```
> boot <- data.frame(cast(boot,... ~ moment))
> head(boot)
```

	X	tool	run	parameter	estimate
1	2	nm7	1	THETA1	9.90635
2	5	nm7	1	THETA2	21.8851
3	8	nm7	1	THETA3	0.0708169
4	11	nm7	1	THETA4	3.36905
5	14	nm7	1	THETA5	94.6453
6	17	nm7	1	THETA6	0.972457

Listing 18:

```
> boot <- boot[,c('run','parameter','estimate')]
> sapply(boot,class)
```

run	parameter	estimate
"integer"	"character"	"factor"

Listing 19:

```
> boot$estimate <- as.numeric(as.character(boot$estimate))
> unique(boot$parameter)
```

```
[1] "THETA1" "THETA2" "THETA3" "THETA4" "THETA5" "THETA6"
[7] "THETA7" "OMEGA1.1" "OMEGA2.1" "OMEGA2.2" "OMEGA3.1" "OMEGA3.2"
[13] "OMEGA3.3" "SIGMA1.1" "SIGMA2.1" "SIGMA2.2"
```

Listing 20:

```
> quan <- function(x,probs)as.character(signif(quantile(x,probs=probs,na.rm=TRUE),3))
> boot$lo <- with(boot, reapply(estimate,parameter,quan,probs=.05))
> boot$hi <- with(boot, reapply(estimate,parameter,quan,probs=.95))
> head(boot)
```

	run	parameter	estimate	lo	hi
1	1	THETA1	9.9063500	7.31	11.1
2	1	THETA2	21.8851000	19.2	27.9
3	1	THETA3	0.0708169	0.0625	0.0838
4	1	THETA4	3.3690500	2.78	4.91
5	1	THETA5	94.6453000	85.6	559
6	1	THETA6	0.9724570	0.847	1.25

Listing 21:

```
> boot <- unique(boot[,c('parameter','lo','hi')])
> boot
```

	parameter	lo	hi
1	THETA1	7.31	11.1
2	THETA2	19.2	27.9
3	THETA3	0.0625	0.0838
4	THETA4	2.78	4.91
5	THETA5	85.6	559
6	THETA6	0.847	1.25
7	THETA7	0.61	1.91
8	OMEGA1.1	0.128	0.321
9	OMEGA2.1	0.0606	0.183
10	OMEGA2.2	0.047	0.158
11	OMEGA3.1	-0.0448	0.0261
12	OMEGA3.2	-0.0577	-0.0049
13	OMEGA3.3	0.0236	0.0811
14	SIGMA1.1	0.0399	0.0587
15	SIGMA2.1	0	0
16	SIGMA2.2	0.0836	0.329

Listing 22:

```
> boot$ci <- with(boot, parens(glue(lo,',',hi)))
> boot
```

	parameter	lo	hi	ci
1	THETA1	7.31	11.1	(7.31,11.1)
2	THETA2	19.2	27.9	(19.2,27.9)
3	THETA3	0.0625	0.0838	(0.0625,0.0838)
4	THETA4	2.78	4.91	(2.78,4.91)
5	THETA5	85.6	559	(85.6,559)
6	THETA6	0.847	1.25	(0.847,1.25)
7	THETA7	0.61	1.91	(0.61,1.91)
8	OMEGA1.1	0.128	0.321	(0.128,0.321)
9	OMEGA2.1	0.0606	0.183	(0.0606,0.183)
10	OMEGA2.2	0.047	0.158	(0.047,0.158)
11	OMEGA3.1	-0.0448	0.0261	(-0.0448,0.0261)
12	OMEGA3.2	-0.0577	-0.0049	(-0.0577,-0.0049)
13	OMEGA3.3	0.0236	0.0811	(0.0236,0.0811)
14	SIGMA1.1	0.0399	0.0587	(0.0399,0.0587)
15	SIGMA2.1	0	0	(0,0)
16	SIGMA2.2	0.0836	0.329	(0.0836,0.329)

Listing 23:

```
> tab <- stableMerge(tab,boot[,c('parameter','ci')])
> tab
```

	parameter	description
1	THETA1	apparent oral clearance
2	THETA2	central volume of distribution
3	THETA3	absorption rate constant
4	THETA4	intercompartmental clearance
5	THETA5	peripheral volume of distribution
6	THETA6	male effect on clearance
7	THETA7	weight effect on clearance
8	OMEGA1.1	interindividual variability of clearance
9	OMEGA2.1	interindividual clearance-volume covariance
10	OMEGA2.2	interindividual variability of central volume
11	OMEGA3.1	interindividual clearance-Ka covariance

```

12 OMEGA3.2      interindividual volume-Ka covariance
13 OMEGA3.3      interindividual variability of Ka
14 SIGMA1.1      proportional error
15 SIGMA2.2      additive error

                                model estimate prse
1 CL/F ~ theta_1 * theta_6 ^MALE * (WT/70)^theta_7 * e^eta_1  9.5100 9.84
2 V_c /F ~ theta_2 * (WT/70)^1 * e^eta_2  22.8000 9.56
3 K_a ~ theta_3 * e^eta_3  0.0714 7.35
4 Q/F ~ theta_4  3.4700 15.4
5 V_p /F ~ theta_5 113.0000 21
6 MALE_CL/F ~ theta_6  1.0200 11.2
7 WT_CL/F ~ theta_7  1.1900 28.4
8 IIV_CL/F ~ Omega_1.1  0.2140 22.8
9 cov_CL,V ~ Omega_2.1  0.1210 26.4
10 IIV_V_c /F ~ Omega_2.2  0.0945 33.2
11 cov_CL,Ka ~ Omega_3.1 -0.0116 173
12 cov_V,Ka ~ Omega_3.2 -0.0372 36.1
13 IIV_K_a ~ Omega_3.3  0.0466 34.7
14 err_prop ~ Sigma_1.1  0.0492 10.9
15 err_add ~ Sigma_2.2  0.2020 33.5

units      name      cv      sd      cor      ci
1 L/h      CL/F      NA      NA      NA      (7.31,11.1)
2 L        V_c/F      NA      NA      NA      (19.2,27.9)
3 h^-1     K_a      NA      NA      NA      (0.0625,0.0838)
4 L/h      Q/F      NA      NA      NA      (2.78,4.91)
5 L        V_p/F      NA      NA      NA      (85.6,559)
6 MALE_CL/F      NA      NA      NA      (0.847,1.25)
7 WT_CL/F      NA      NA      NA      (0.61,1.91)
8 IIV_CL/F 0.4884902  NA      NA      (0.128,0.321)
9 cov_CL,V  NA      NA      0.8492811 (0.0606,0.183)
10 IIV_V_c/F 0.3148161  NA      NA      (0.047,0.158)
11 cov_CL,Ka  NA      NA -0.1163229 (-0.0448,0.0261)
12 cov_V,Ka  NA      NA -0.5607054 (-0.0577,-0.0049)
13 IIV_K_a 0.2184098  NA      NA      (0.0236,0.0811)

```

```
14      err_prop 0.2218107      NA      NA      (0.0399,0.0587)
15      err_add      NA 0.4494441      NA      (0.0836,0.329)
```

6 aesthetics

Here we format the table for printing.

Listing 24:

```
> tab$name <- NULL
> tab$parameter <- NULL
> tab$model <- wiki2latex(tab$model)
> tab$estimate <- as.character(tab$estimate)
> tab$estimate <- paste(tab$estimate, '$', tab$units, '$')
> tab$units <- NULL
```

Note that no parameter defines more than one of CV, SD, and COR. We could collapse these into a single column, and add a descriptive flag.

Listing 25:

```
> m <- as.matrix(tab[,c('cv','sd','cor')])
> tab$variability <- suppressWarnings(apply(m,1,max,na.rm=TRUE))
> tab$variability[is.infinite(tab$variability)] <- NA
> i <- !is.na(m)
> i[!i] <- NA
> tab$statistic <- apply(i,1,function(x){
+   p <- colnames(i)[x]
+   ifelse(all(is.na(p)),NA,p[!is.na(p)])
+ })
> toPercent <- with(tab, !is.na(statistic) & statistic=='cv')
> tab$variability[toPercent] <- percent(tab$variability[toPercent])
> tab$variability <- as.character(signif(tab$variability,3))
> tab$statistic <- map(tab$statistic,from=c(NA,'cv','cor','sd'),to=c(NA,'\\%CV','CORR','SD'))
```

```
> tab$variability <- paste(tab$statistic,tab$variability,sep=' = ')
> tab$variability[is.na(tab$statistic)] <- NA
> tab$statistic <- NULL
> tab$cv <- NULL
> tab$sd <- NULL
> tab$cor <- NULL
```

Table 1: Parameter Estimates from Population Pharmacokinetic Model Run 1005

description	model	estimate	prse	ci	variability
apparent oral clearance	$CL/F \sim \theta_1 \cdot \theta_6^{MALE} \cdot (WT/70)^{\theta_7} \cdot e^{\eta_1}$	9.51 L/h	9.84	(7.31,11.1)	
central volume of distribution	$V_c/F \sim \theta_2 \cdot (WT/70)^1 \cdot e^{\eta_2}$	22.8 L	9.56	(19.2,27.9)	
absorption rate constant	$K_a \sim \theta_3 \cdot e^{\eta_3}$	0.0714 h ⁻¹	7.35	(0.0625,0.0838)	
intercompartmental clearance	$Q/F \sim \theta_4$	3.47 L/h	15.4	(2.78,4.91)	
peripheral volume of distribution	$V_p/F \sim \theta_5$	113 L	21	(85.6,559)	
male effect on clearance	$MALE_{CL/F} \sim \theta_6$	1.02	11.2	(0.847,1.25)	
weight effect on clearance	$WT_{CL/F} \sim \theta_7$	1.19	28.4	(0.61,1.91)	
interindividual variability of clearance	$IIV_{CL/F} \sim \Omega_{1.1}$	0.214	22.8	(0.128,0.321)	%CV = 48.8
interindividual clearance-volume covariance	$COV_{CL,V} \sim \Omega_{2.1}$	0.121	26.4	(0.0606,0.183)	CORR = 0.849
interindividual variability of central volume	$IIV_{V_c/F} \sim \Omega_{2.2}$	0.0945	33.2	(0.047,0.158)	%CV = 31.5
interindividual clearance-Ka covariance	$COV_{CL,Ka} \sim \Omega_{3.1}$	-0.0116	173	(-0.0448,0.0261)	CORR = -0.116
interindividual volume-Ka covariance	$COV_{V,Ka} \sim \Omega_{3.2}$	-0.0372	36.1	(-0.0577,-0.0049)	CORR = -0.561
interindividual variability of Ka	$IIV_{K_a} \sim \Omega_{3.3}$	0.0466	34.7	(0.0236,0.0811)	%CV = 21.8
proportional error	$err_{prop} \sim \Sigma_{1.1}$	0.0492	10.9	(0.0399,0.0587)	%CV = 22.2
additive error	$err_{add} \sim \Sigma_{2.2}$	0.202	33.5	(0.0836,0.329)	SD = 0.449

7 simple parameter table

We can make a quick parameter table that does not use wikipar markup. Table 2.

Listing 26:

```
> tab <- rlog(1005, '../nonmem', tool='nm7', file=NULL)
> head(tab)
```

	tool	run	parameter	moment	value
1	nm7	1005	ofv	minimum	2405.91625845151
2	nm7	1005	THETA1	estimate	9.50754
3	nm7	1005	THETA1	prse	9.84
4	nm7	1005	THETA1	se	0.935942
5	nm7	1005	THETA2	estimate	22.7907
6	nm7	1005	THETA2	prse	9.56

Listing 27:

```
> tab$tool <- NULL
> tab$run <- NULL
> tab <- tab[tab$moment %in% c('estimate','prse'),]
> unique(tab$parameter)
```

```
[1] "THETA1" "THETA2" "THETA3" "THETA4" "THETA5" "THETA6"
[7] "THETA7" "OMEGA1.1" "OMEGA2.1" "OMEGA2.2" "OMEGA3.1" "OMEGA3.2"
[13] "OMEGA3.3" "SIGMA1.1" "SIGMA2.1" "SIGMA2.2"
```

Listing 28:

```
> tab$value <- signif(as.numeric(tab$value),3)
> tab$parameter <- factor(tab$parameter, levels=unique(tab$parameter)) #to preserve row order during cast
> tab <- cast(tab, parameter ~ moment)
> tab
```

	parameter	estimate	prse
1	THETA1	9.5100	9.84
2	THETA2	22.8000	9.56
3	THETA3	0.0714	7.35
4	THETA4	3.4700	15.40
5	THETA5	113.0000	21.00
6	THETA6	1.0200	11.20
7	THETA7	1.1900	28.40
8	OMEGA1.1	0.2140	22.80
9	OMEGA2.1	0.1210	26.40
10	OMEGA2.2	0.0945	33.20
11	OMEGA3.1	-0.0116	173.00
12	OMEGA3.2	-0.0372	36.10
13	OMEGA3.3	0.0466	34.70
14	SIGMA1.1	0.0492	10.90
15	SIGMA2.1	0.0000	Inf
16	SIGMA2.2	0.2020	33.50

Listing 29:

```
> tab$parameter <- parameter2wiki(tab$parameter)
> tab
```

	parameter	estimate	prse
1	theta_1	9.5100	9.84
2	theta_2	22.8000	9.56
3	theta_3	0.0714	7.35
4	theta_4	3.4700	15.40
5	theta_5	113.0000	21.00
6	theta_6	1.0200	11.20
7	theta_7	1.1900	28.40
8	Omega_1.1	0.2140	22.80
9	Omega_2.1	0.1210	26.40
10	Omega_2.2	0.0945	33.20
11	Omega_3.1	-0.0116	173.00

```
12 Omega_3.2    -0.0372  36.10
13 Omega_3.3     0.0466  34.70
14 Sigma_1.1     0.0492  10.90
15 Sigma_2.1     0.0000   Inf
16 Sigma_2.2     0.2020  33.50
```

Listing 30:

```
> tab$parameter <- wiki2latex(tab$parameter)
> tab
```

	parameter	estimate	prse
1	θ_1	9.5100	9.84
2	θ_2	22.8000	9.56
3	θ_3	0.0714	7.35
4	θ_4	3.4700	15.40
5	θ_5	113.0000	21.00
6	θ_6	1.0200	11.20
7	θ_7	1.1900	28.40
8	$\Omega_{1.1}$	0.2140	22.80
9	$\Omega_{2.1}$	0.1210	26.40
10	$\Omega_{2.2}$	0.0945	33.20
11	$\Omega_{3.1}$	-0.0116	173.00
12	$\Omega_{3.2}$	-0.0372	36.10
13	$\Omega_{3.3}$	0.0466	34.70
14	$\Sigma_{1.1}$	0.0492	10.90
15	$\Sigma_{2.1}$	0.0000	Inf
16	$\Sigma_{2.2}$	0.2020	33.50

Table 2: Simple Parameter Table

parameter	estimate	prse
θ_1	9.5100	9.84
θ_2	22.8000	9.56
θ_3	0.0714	7.35
θ_4	3.4700	15.40
θ_5	113.0000	21.00
θ_6	1.0200	11.20
θ_7	1.1900	28.40
$\Omega_{1.1}$	0.2140	22.80
$\Omega_{2.1}$	0.1210	26.40
$\Omega_{2.2}$	0.0945	33.20
$\Omega_{3.1}$	-0.0116	173.00
$\Omega_{3.2}$	-0.0372	36.10
$\Omega_{3.3}$	0.0466	34.70
$\Sigma_{1.1}$	0.0492	10.90
$\Sigma_{2.1}$	0.0000	Inf
$\Sigma_{2.2}$	0.2020	33.50