

fitDTVARMx: Internal Tests

Ivan Jacob Agaloos Pesigan

Tests

```
#> test-fitDTVARMx-fit-dt-var-id-mx-psi-diag
#> Running DTVAR with 12 parameters
#>
#> Beginning initial fit attempt
#> Running DTVAR with 12 parameters
#>
#> Lowest minimum so far: 741.858019666399
#>
#> Solution found
```

```
#>
#> Solution found! Final fit=741.85802 (started at 3195.3436) (1 attempt(s): 1
valid, 0 errors)
#> Start values from best fit:
#> 0.744102359401248,0.471983549669145,-0.123485840970363,-0.00232191598171461,0.652661527232958,0.42
#> Running DTVAR with 12 parameters
#>
#> Beginning initial fit attempt
#> Running DTVAR with 12 parameters
#>
#> Lowest minimum so far: 823.404995013856
#>
#> Solution found
```

```
#>
#> Solution found! Final fit=823.405 (started at 2764.6005) (1 attempt(s): 1 valid,
0 errors)
#> Start values from best fit:
#> 0.654633086676883,0.509278984394305,-0.134962902847776,0.0271964367580654,0.606323423068992,0.42
#>
#> Means of the estimated paramaters per individual.
#>      beta_11      beta_21      beta_31      beta_12      beta_22      beta_32
#> 0.699367723 0.490631267 -0.129224372 0.012437260 0.629492475 0.439116493
```

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#>      beta_13      beta_23      beta_33      psi_11      psi_22      psi_33
#> 0.008699698 -0.020536672 0.487354890 0.095762197 0.103896589 0.095903969
#>
#> Estimated paramaters per individual.
#>      beta_11      beta_21      beta_31      beta_12      beta_22      beta_32
#> [1,] 0.7441024 0.4719835 -0.1234858 -0.002321916 0.6526615 0.4504739
#> [2,] 0.6546331 0.5092790 -0.1349629 0.027196437 0.6063234 0.4277591
#>      beta_13      beta_23      beta_33      psi_11      psi_22      psi_33
#> [1,] 0.013953886 0.00239793 0.4659242 0.08813525 0.1052980 0.09439619
#> [2,] 0.003445509 -0.04347127 0.5087856 0.10338914 0.1024952 0.09741175
#> Test passed

#> Running DTVAR with 12 parameters
#>
#> Beginning initial fit attempt
#> Running DTVAR with 12 parameters
#>
#> Lowest minimum so far: 741.858019666378
#>
#> Solution found

```

```

#>
#> Solution found! Final fit=741.85802 (started at 757.28572) (1 attempt(s): 1
valid, 0 errors)
#> Start values from best fit:
#> 0.744102418583201,0.471983559006466,-0.12348585991363,-0.00232201282800975,0.652661556937646,0.4504739
#> Running DTVAR with 12 parameters
#>
#> Beginning initial fit attempt
#> Running DTVAR with 12 parameters
#>
#> Lowest minimum so far: 823.404995013852
#>
#> Solution found

```

```

#>
#> Solution found! Final fit=823.405 (started at 830.00116) (1 attempt(s): 1 valid,
0 errors)
#> Start values from best fit:
#> 0.654633081123348,0.509278968155817,-0.134962904254715,0.027196439106069,0.606323418161673,0.4277591
#>
#> Means of the estimated paramaters per individual.
#>      beta_11      beta_21      beta_31      beta_12      beta_22      beta_32
#> 0.699367750 0.490631264 -0.129224382 0.012437213 0.629492488 0.439116498
#>      beta_13      beta_23      beta_33      psi_11      psi_22      psi_33

```

```

#> 0.008699747 -0.020536680 0.487354900 0.095762199 0.103896585 0.095903966
#>
#> Estimated paramaters per individual.
#>      beta_11  beta_21  beta_31  beta_12  beta_22  beta_32
#> [1,] 0.7441024 0.4719836 -0.1234859 -0.002322013 0.6526616 0.4504739
#> [2,] 0.6546331 0.5092790 -0.1349629 0.027196439 0.6063234 0.4277591
#>      beta_13  beta_23  beta_33  psi_11  psi_22  psi_33
#> [1,] 0.013953981 0.002397895 0.4659242 0.08813525 0.1052980 0.09439619
#> [2,] 0.003445514 -0.043471254 0.5087856 0.10338915 0.1024952 0.09741174
#> Test passed

#> test-fitDTVARm-fit-dt-var-id-mx-psi-full-alpha
#> Running DTVAR with 21 parameters
#>
#> Beginning initial fit attempt
#> Running DTVAR with 21 parameters
#>
#> Lowest minimum so far: 733.408957116007
#>
#> Solution found

```

```

#>
#> Solution found! Final fit=733.40896 (started at 2437.3594) (1 attempt(s): 1
valid, 0 errors)
#> Start values from best fit:
#> 0.739871411523927,0.470115592482495,-0.120054358558432,-0.00611126637533839,0.650753374340416,0.
#> Running DTVAR with 21 parameters
#>
#> Beginning initial fit attempt
#> Running DTVAR with 21 parameters
#>
#> Lowest minimum so far: 818.567376586158
#>
#> Solution found

```

```

#>
#> Solution found! Final fit=818.56738 (started at 2195.461) (1 attempt(s): 1
valid, 0 errors)
#> Start values from best fit:
#> 0.652074095901659,0.489740843878582,-0.145635446505624,0.0307222228730336,0.642747337688428,0.45
#>
#> Means of the estimated paramaters per individual.
#>      beta_11  beta_21  beta_31  beta_12  beta_22
#> 6.959728e-01 4.799282e-01 -1.328449e-01 1.230548e-02 6.467504e-01
#>      beta_32  beta_13  beta_23  beta_33  alpha_1

```

```

#> 4.521646e-01 8.064762e-03 -3.016166e-02 4.818910e-01 -1.178617e-02
#>      alpha_2      alpha_3      psi_11      psi_21      psi_22
#> 2.363822e-03 1.364088e-02 9.557389e-02 -3.292093e-03 9.587218e-02
#>      psi_31      psi_32      psi_33      theta_11      theta_22
#> -8.369571e-04 -4.464475e-03 9.459958e-02 8.248521e-19 5.681747e-03
#>      theta_33
#> 4.659938e-18
#>
#> Estimated paramaters per individual.
#>      beta_11  beta_21  beta_31      beta_12  beta_22  beta_32
#> [1,] 0.7398714 0.4701156 -0.1200544 -0.006111266 0.6507534 0.4533482
#> [2,] 0.6520741 0.4897408 -0.1456354 0.030722223 0.6427473 0.4509810
#>      beta_13  beta_23  beta_33      alpha_1      alpha_2      alpha_3
#> [1,] 0.013500229 0.002305463 0.4663572 -0.018761637 -0.009005463 0.01496199
#> [2,] 0.002629296 -0.062628778 0.4974248 -0.004810708 0.013733106 0.01231977
#>      psi_11      psi_21      psi_22      psi_31      psi_32      psi_33
#> [1,] 0.08781343 -0.003778116 0.10520578 -0.0002521965 -0.0091462552 0.09417727
#> [2,] 0.10333435 -0.002806069 0.08653858 -0.0014217176 0.0002173043 0.09502190
#>      theta_11      theta_22      theta_33
#> [1,] 1.649704e-18 1.189026e-17 9.319876e-18
#> [2,] 2.225074e-308 1.136349e-02 2.225074e-308
#> Test passed

#> Running DTVAR with 21 parameters
#>
#> Beginning initial fit attempt
#> Running DTVAR with 21 parameters
#>
#> Lowest minimum so far: 733.408957115968
#>
#> Solution found

```

```

#>
#> Solution found! Final fit=733.40896 (started at 1274.7112) (1 attempt(s): 1
valid, 0 errors)
#> Start values from best fit:
#> 0.739871435693285,0.47011557704911,-0.120054300900438,-0.00611126737586362,0.650753336909686,0.4
#> Running DTVAR with 21 parameters
#>
#> Beginning initial fit attempt
#> Running DTVAR with 21 parameters
#>
#> Lowest minimum so far: 818.567376586132
#>
#> Solution found

```

```

#>
#> Solution found! Final fit=818.56738 (started at 1276.6239) (1 attempt(s): 1
valid, 0 errors)
#> Start values from best fit:
#> 0.652074102142338,0.489740891047252,-0.145635408891411,0.0307221937793098,0.642747385879721,0.450
#>
#> Means of the estimated paramaters per individual.
#>      beta_11      beta_21      beta_31      beta_12      beta_22
#> 6.959728e-01 4.799282e-01 -1.328449e-01 1.230546e-02 6.467504e-01
#>      beta_32      beta_13      beta_23      beta_33      alpha_1
#> 4.521647e-01 8.064768e-03 -3.016164e-02 4.818910e-01 -1.178615e-02
#>      alpha_2      alpha_3      psi_11      psi_21      psi_22
#> 2.363809e-03 1.364089e-02 9.557389e-02 -3.292096e-03 9.587220e-02
#>      psi_31      psi_32      psi_33      theta_11      theta_22
#> -8.369446e-04 -4.464481e-03 9.459960e-02 1.614229e-18 5.681742e-03
#>      theta_33
#> 2.516782e-17
#>
#> Estimated paramaters per individual.
#>      beta_11      beta_21      beta_31      beta_12      beta_22      beta_32
#> [1,] 0.7398714 0.4701156 -0.1200543 -0.006111267 0.6507533 0.4533482
#> [2,] 0.6520741 0.4897409 -0.1456354 0.030722194 0.6427474 0.4509811
#>      beta_13      beta_23      beta_33      alpha_1      alpha_2      alpha_3
#> [1,] 0.013500209 0.002305514 0.4663572 -0.01876164 -0.009005483 0.01496199
#> [2,] 0.002629327 -0.062628792 0.4974248 -0.00481066 0.013733100 0.01231979
#>      psi_11      psi_21      psi_22      psi_31      psi_32      psi_33
#> [1,] 0.08781343 -0.003778125 0.10520579 -0.0002521791 -0.0091462743 0.09417730
#> [2,] 0.10333435 -0.002806068 0.08653861 -0.0014217102 0.0002173113 0.09502191
#>      theta_11      theta_22      theta_33
#> [1,] 3.228458e-18 1.497703e-17 5.033564e-17
#> [2,] 2.225074e-308 1.136348e-02 2.225074e-308
#> Test passed

#> test-fitDTVARm-fit-dt-var-id-mx-psi-full
#> Running DTVAR with 15 parameters
#>
#> Beginning initial fit attempt
#> Running DTVAR with 15 parameters
#>
#> Lowest minimum so far: 736.768311313362
#>
#> Solution found

```

```

#>
#> Solution found! Final fit=736.76831 (started at 3195.3436) (1 attempt(s): 1

```

```

valid, 0 errors)
#> Start values from best fit:
#> 0.744111828443433,0.472027289781822,-0.123384441991236,-0.00232614070645446,0.652594561411527,0.
#> Running DTVAR with 15 parameters
#>
#> Beginning initial fit attempt
#> Running DTVAR with 15 parameters
#>
#> Lowest minimum so far: 822.432007525035
#>
#> Solution found

#>
#> Solution found! Final fit=822.43201 (started at 2764.6005) (1 attempt(s): 1
valid, 0 errors)
#> Start values from best fit:
#> 0.654616074304076,0.509265077043905,-0.134913420573332,0.0272177376211155,0.606319427287526,0.42
#>
#> Means of the estimated paramaters per individual.
#>
#>      beta_11      beta_21      beta_31      beta_12      beta_22
#> 0.6993639514 0.4906461834 -0.1291489313 0.0124457985 0.6294569943
#>      beta_32      beta_13      beta_23      beta_33      psi_11
#> 0.4390182948 0.0086865121 -0.0204440908 0.4874007382 0.0957622670
#>      psi_21      psi_22      psi_31      psi_32      psi_33
#> -0.0031446795 0.1038929361 -0.0008354084 -0.0029423646 0.0959030699
#>
#> Estimated paramaters per individual.
#>
#>      beta_11      beta_21      beta_31      beta_12      beta_22      beta_32
#> [1,] 0.7441118 0.4720273 -0.1233844 -0.002326141 0.6525946 0.4503418
#> [2,] 0.6546161 0.5092651 -0.1349134 0.027217738 0.6063194 0.4276948
#>      beta_13      beta_23      beta_33      psi_11      psi_21      psi_22
#> [1,] 0.013928278 0.002553338 0.4659789 0.0881366 -0.003608184 0.1052932
#> [2,] 0.003444746 -0.043441519 0.5088226 0.1033879 -0.002681175 0.1024927
#>      psi_31      psi_32      psi_33
#> [1,] -0.0005183741 -0.009283966 0.09439469
#> [2,] -0.0011524427 0.003399236 0.09741145
#> Test passed

#> Running DTVAR with 15 parameters
#>
#> Beginning initial fit attempt
#> Running DTVAR with 15 parameters
#>
#> Lowest minimum so far: 736.768311313353
#>
#> Solution found

```

```

#>
#> Solution found! Final fit=736.76831 (started at 757.28572) (1 attempt(s): 1
valid, 0 errors)
#> Start values from best fit:
#> 0.744111835025889,0.472027251107065,-0.123384408156667,-0.00232615532898741,0.652594563875736,0.
#> Running DTVAR with 15 parameters
#>
#> Beginning initial fit attempt
#> Running DTVAR with 15 parameters
#>
#> Lowest minimum so far: 822.432007525033
#>
#> Solution found

```

```

#>
#> Solution found! Final fit=822.43201 (started at 830.00116) (1 attempt(s): 1
valid, 0 errors)
#> Start values from best fit:
#> 0.654616093273062,0.509265068677969,-0.134913406408658,0.0272177372674195,0.606319423848777,0.42
#>
#> Means of the estimated paramaters per individual.
#>      beta_11      beta_21      beta_31      beta_12      beta_22
#> 0.6993639641 0.4906461599 -0.1291489073 0.0124457910 0.6294569939
#>      beta_32      beta_13      beta_23      beta_33      psi_11
#> 0.4390182812 0.0086865135 -0.0204440876 0.4874007381 0.0957622648
#>      psi_21      psi_22      psi_31      psi_32      psi_33
#> -0.0031446765 0.1038929353 -0.0008354051 -0.0029423614 0.0959030684
#>
#> Estimated paramaters per individual.
#>      beta_11      beta_21      beta_31      beta_12      beta_22      beta_32
#> [1,] 0.7441118 0.4720273 -0.1233844 -0.002326155 0.6525946 0.4503417
#> [2,] 0.6546161 0.5092651 -0.1349134 0.027217737 0.6063194 0.4276948
#>      beta_13      beta_23      beta_33      psi_11      psi_21      psi_22
#> [1,] 0.013928284 0.002553342 0.4659789 0.08813659 -0.003608181 0.1052932
#> [2,] 0.003444743 -0.043441517 0.5088226 0.10338794 -0.002681172 0.1024927
#>      psi_31      psi_32      psi_33
#> [1,] -0.0005183717 -0.009283960 0.09439468
#> [2,] -0.0011524386 0.003399237 0.09741145
#> Test passed

#> test-fitDTVARMx-fit-dt-var-id-mx-theta-diag
#> Running DTVAR with 15 parameters
#>
#> Beginning initial fit attempt
#> Running DTVAR with 15 parameters

```

```
#>
#> Lowest minimum so far: 741.858019666395
#>
#> Solution found
```

```
#>
#> Solution found! Final fit=741.85802 (started at 2437.3594) (1 attempt(s): 1
valid, 0 errors)
#> Start values from best fit:
#> 0.744102312732812,0.471983595508954,-0.123485819979284,-0.00232199465694653,0.652661570082528,0.4504739
#> Running DTVAR with 15 parameters
#>
#> Beginning initial fit attempt
#> Running DTVAR with 15 parameters
#>
#> Lowest minimum so far: 821.002435268409
#>
#> Solution found
```

```
#>
#> Solution found! Final fit=821.00244 (started at 2195.461) (1 attempt(s): 1
valid, 0 errors)
#> Start values from best fit:
#> 0.653299531827981,0.48753892395409,-0.147719001881108,0.0294606879907606,0.641755710002061,0.4504739
#>
#> Means of the estimated paramaters per individual.
#>
#>      beta_11      beta_21      beta_31      beta_12      beta_22
#> 6.987009e-01  4.797613e-01 -1.356024e-01  1.356935e-02  6.472086e-01
#>      beta_32      beta_13      beta_23      beta_33      psi_11
#> 4.505207e-01  8.252568e-03 -2.882770e-02  4.826202e-01  9.575435e-02
#>      psi_22      psi_33      theta_11      theta_22      theta_33
#> 9.629485e-02  9.481189e-02  2.225074e-308  5.481672e-03  2.225074e-308
#>
#> Estimated paramaters per individual.
#>
#>      beta_11      beta_21      beta_31      beta_12      beta_22      beta_32
#> [1,] 0.7441023 0.4719836 -0.1234858 -0.002321995 0.6526616 0.4504739
#> [2,] 0.6532995 0.4875389 -0.1477190 0.029460688 0.6417557 0.4505675
#>      beta_13      beta_23      beta_33      psi_11      psi_22      psi_33
#> [1,] 0.013954012 0.002397879 0.4659241 0.08813525 0.10529798 0.09439619
#> [2,] 0.002551124 -0.060053276 0.4993163 0.10337345 0.08729171 0.09522759
#>      theta_11      theta_22      theta_33
#> [1,] 2.225074e-308 2.225074e-308 2.225074e-308
#> [2,] 2.225074e-308 1.096334e-02 2.225074e-308
#> Test passed
```



```
#> Running DTVAR with 15 parameters
```

```
#>
```

```
#> Beginning initial fit attempt
```

```
#> Running DTVAR with 15 parameters
```

```
#>
```

```
#> Lowest minimum so far: 741.858019666377
```

```
#>
```

```
#> Solution found
```

```
#>
```

```
#> Solution found! Final fit=741.85802 (started at 1274.7112) (1 attempt(s): 1  
valid, 0 errors)
```

```
#> Start values from best fit:
```

```
#> 0.744102418959596,0.471983551826989,-0.123485864222315,-0.00232201566053201,0.652661564425077,0.4505677
```

```
#> Running DTVAR with 15 parameters
```

```
#>
```

```
#> Beginning initial fit attempt
```

```
#> Running DTVAR with 15 parameters
```

```
#>
```

```
#> Lowest minimum so far: 821.002435268711
```

```
#>
```

```
#> Solution found
```

```
#>
```

```
#> Solution found! Final fit=821.00244 (started at 1276.6239) (1 attempt(s): 1  
valid, 0 errors)
```

```
#> Start values from best fit:
```

```
#> 0.653299502877738,0.487538691185285,-0.147719056218907,0.0294606364759032,0.641755876109492,0.4505677
```

```
#>
```

```
#> Means of the estimated paramaters per individual.
```

```
#>      beta_11      beta_21      beta_31      beta_12      beta_22
```

```
#> 6.987010e-01 4.797611e-01 -1.356025e-01 1.356931e-02 6.472087e-01
```

```
#>      beta_32      beta_13      beta_23      beta_33      psi_11
```

```
#> 4.505208e-01 8.252606e-03 -2.882773e-02 4.826202e-01 9.575435e-02
```

```
#>      psi_22      psi_33      theta_11      theta_22      theta_33
```

```
#> 9.629478e-02 9.481186e-02 3.709507e-18 5.481699e-03 2.789189e-17
```

```
#>
```

```
#> Estimated paramaters per individual.
```

```
#>      beta_11      beta_21      beta_31      beta_12      beta_22      beta_32
```

```
#> [1,] 0.7441024 0.4719836 -0.1234859 -0.002322016 0.6526616 0.4504739
```

```
#> [2,] 0.6532995 0.4875387 -0.1477191 0.029460636 0.6417559 0.4505677
```

```
#>      beta_13      beta_23      beta_33      psi_11      psi_22      psi_33
```

```
#> [1,] 0.013953985 0.002397887 0.4659242 0.08813525 0.10529799 0.09439619
```

```
#> [2,] 0.002551228 -0.060053354 0.4993162 0.10337345 0.08729157 0.09522754
```

```
#>      theta_11      theta_22      theta_33
```

```
#> [1,] 7.419014e-18 8.003968e-17 5.578379e-17
#> [2,] 2.225074e-308 1.096340e-02 2.225074e-308
#> Test passed
```

```
#> test-fitDTVARm-fit-dt-var-id-mx-theta-null
#> Running DTVAR with 12 parameters
#>
#> Beginning initial fit attempt
#> Running DTVAR with 12 parameters
#>
#> Lowest minimum so far: 741.858019666399
#>
#> Solution found
```

```
#>
#> Solution found! Final fit=741.85802 (started at 3195.3436) (1 attempt(s): 1
valid, 0 errors)
#> Start values from best fit:
#> 0.744102359401248,0.471983549669145,-0.123485840970363,-0.00232191598171461,0.652661527232958,0.4277591
#> Running DTVAR with 12 parameters
#>
#> Beginning initial fit attempt
#> Running DTVAR with 12 parameters
#>
#> Lowest minimum so far: 823.404995013856
#>
#> Solution found
```

```
#>
#> Solution found! Final fit=823.405 (started at 2764.6005) (1 attempt(s): 1 valid,
0 errors)
#> Start values from best fit:
#> 0.654633086676883,0.509278984394305,-0.134962902847776,0.0271964367580654,0.606323423068992,0.4277591
#>
#> Means of the estimated paramaters per individual.
#>      beta_11      beta_21      beta_31      beta_12      beta_22      beta_32
#> 0.699367723 0.490631267 -0.129224372 0.012437260 0.629492475 0.439116493
#>      beta_13      beta_23      beta_33      psi_11      psi_22      psi_33
#> 0.008699698 -0.020536672 0.487354890 0.095762197 0.103896589 0.095903969
#>
#> Estimated paramaters per individual.
#>      beta_11      beta_21      beta_31      beta_12      beta_22      beta_32
#> [1,] 0.7441024 0.4719835 -0.1234858 -0.002321916 0.6526615 0.4504739
#> [2,] 0.6546331 0.5092790 -0.1349629 0.027196437 0.6063234 0.4277591
#>      beta_13      beta_23      beta_33      psi_11      psi_22      psi_33
```

```
#> [1,] 0.013953886 0.00239793 0.4659242 0.08813525 0.1052980 0.09439619
#> [2,] 0.003445509 -0.04347127 0.5087856 0.10338914 0.1024952 0.09741175
#> Test passed
```

```
#> Running DTVAR with 12 parameters
#>
#> Beginning initial fit attempt
#> Running DTVAR with 12 parameters
#>
#> Lowest minimum so far: 741.858019666378
#>
#> Solution found
```

```
#>
#> Solution found! Final fit=741.85802 (started at 757.28572) (1 attempt(s): 1
valid, 0 errors)
#> Start values from best fit:
#> 0.744102418583201,0.471983559006466,-0.12348585991363,-0.00232201282800975,0.652661556937646,0.4277591
#> Running DTVAR with 12 parameters
#>
#> Beginning initial fit attempt
#> Running DTVAR with 12 parameters
#>
#> Lowest minimum so far: 823.404995013852
#>
#> Solution found
```

```
#>
#> Solution found! Final fit=823.405 (started at 830.00116) (1 attempt(s): 1 valid,
0 errors)
#> Start values from best fit:
#> 0.654633081123348,0.509278968155817,-0.134962904254715,0.027196439106069,0.606323418161673,0.4277591
#>
#> Means of the estimated paramaters per individual.
#>      beta_11      beta_21      beta_31      beta_12      beta_22      beta_32
#> 0.699367750 0.490631264 -0.129224382 0.012437213 0.629492488 0.439116498
#>      beta_13      beta_23      beta_33      psi_11      psi_22      psi_33
#> 0.008699747 -0.020536680 0.487354900 0.095762199 0.103896585 0.095903966
#>
#> Estimated paramaters per individual.
#>      beta_11      beta_21      beta_31      beta_12      beta_22      beta_32
#> [1,] 0.7441024 0.4719836 -0.1234859 -0.002322013 0.6526616 0.4504739
#> [2,] 0.6546331 0.5092790 -0.1349629 0.027196439 0.6063234 0.4277591
#>      beta_13      beta_23      beta_33      psi_11      psi_22      psi_33
#> [1,] 0.013953981 0.002397895 0.4659242 0.08813525 0.1052980 0.09439619
```

```
#> [2,] 0.003445514 -0.043471254 0.5087856 0.10338915 0.1024952 0.09741174
#> Test passed

#> test-fitDTVARmx-fit-dt-var-mx-theta-null
#> Error in mxFitFunctionMultigroup(paste0("DTVAR", "_", ids)): could not find function
"mxFitFunctionMultigroup"
```

Environment

```
ls()  
#> [1] "root"
```

Class

```
#> [[1]]  
#> [1] "root_criterion"
```

References

R Core Team. (2024). *R: A language and environment for statistical computing*. R Foundation for Statistical Computing. Vienna, Austria. <https://www.R-project.org/>