1 Julia Output 2021-01-04

To check the covariance matrix generator function, I printed out the "Latexified" symbolic matrix generated in Julia using $N = 2, T = 3$.

LEFT HALF OF COVARIANCE MATRIX

$$\begin{bmatrix}
\sigma_u^2 \left(1.0 + \frac{\rho^2}{2-2\rho}\right) + \frac{\sigma_a^2}{1-\rho^2} & \frac{\sigma_a^2}{1-\rho^2} + \frac{\sigma_u^2\rho^2}{2-2\rho} & \frac{\sigma_a^2\rho}{1-\rho^2} + \sigma_u^2 \left(\frac{1}{2}\rho + \frac{\rho^3}{2-2\rho}\right) \\
\frac{\sigma_a^2}{1-\rho^2} + \frac{\sigma_u^2\rho^2}{2-2\rho} & \sigma_u^2 \left(1.0 + \frac{\rho^2}{2-2\rho}\right) + \frac{\sigma_a^2}{1-\rho^2} & \frac{\sigma_a^2\rho}{1-\rho^2} + \sigma_u^2 \left(\frac{1}{2}\rho + \frac{\rho^3}{2-2\rho}\right) \\
\frac{\sigma_a^2\rho}{1-\rho^2} + \sigma_u^2 \left(\frac{1}{2}\rho + \frac{\rho^3}{2-2\rho}\right) & \frac{\sigma_a^2\rho}{1-\rho^2} + \sigma_u^2 \left(\frac{1}{2}\rho + \frac{\rho^3}{2-2\rho}\right) & \sigma_u^2 \left(1.0 + \frac{\rho^2}{2-2\rho}\right) + \frac{\sigma_a^2}{1-\rho^2} \\
\frac{\sigma_a^2\rho}{1-\rho^2} + \sigma_u^2 \left(\frac{1}{2}\rho + \frac{\rho^3}{2-2\rho}\right) & \frac{\sigma_a^2\rho}{1-\rho^2} + \sigma_u^2 \left(\frac{1}{2}\rho + \frac{\rho^3}{2-2\rho}\right) & \frac{\sigma_a^2}{1-\rho^2} + \frac{\sigma_u^2\rho^2}{2-2\rho} \\
\sigma_u^2 \left(\frac{1}{2}\rho^2 + \frac{\rho^4}{2-2\rho}\right) + \frac{\sigma_a^2\rho^2}{1-\rho^2} & \sigma_u^2 \left(\frac{1}{2}\rho^2 + \frac{\rho^4}{2-2\rho}\right) + \frac{\sigma_a^2\rho^2}{1-\rho^2} & \frac{\sigma_a^2\rho}{1-\rho^2} + \sigma_u^2 \left(\frac{1}{2}\rho + \frac{\rho^3}{2-2\rho}\right) \\
\sigma_u^2 \left(\frac{1}{2}\rho^2 + \frac{\rho^4}{2-2\rho}\right) + \frac{\sigma_a^2\rho^2}{1-\rho^2} & \sigma_u^2 \left(\frac{1}{2}\rho^2 + \frac{\rho^4}{2-2\rho}\right) + \frac{\sigma_a^2\rho^2}{1-\rho^2} & \frac{\sigma_a^2\rho}{1-\rho^2} + \sigma_u^2 \left(\frac{1}{2}\rho + \frac{\rho^3}{2-2\rho}\right)
\end{bmatrix} \tag{1}$$

RIGHT HALF OF COVARIANCE MATRIX

$$\begin{bmatrix}
\frac{\sigma_a^2\rho}{1-\rho^2} + \sigma_u^2 \left(\frac{1}{2}\rho + \frac{\rho^3}{2-2\rho}\right) & \sigma_u^2 \left(\frac{1}{2}\rho^2 + \frac{\rho^4}{2-2\rho}\right) + \frac{\sigma_a^2\rho^2}{1-\rho^2} & \sigma_u^2 \left(\frac{1}{2}\rho^2 + \frac{\rho^4}{2-2\rho}\right) + \frac{\sigma_a^2\rho^2}{1-\rho^2} \\
\frac{\sigma_a^2\rho}{1-\rho^2} + \sigma_u^2 \left(\frac{1}{2}\rho + \frac{\rho^3}{2-2\rho}\right) & \sigma_u^2 \left(\frac{1}{2}\rho^2 + \frac{\rho^4}{2-2\rho}\right) + \frac{\sigma_a^2\rho^2}{1-\rho^2} & \sigma_u^2 \left(\frac{1}{2}\rho^2 + \frac{\rho^4}{2-2\rho}\right) + \frac{\sigma_a^2\rho^2}{1-\rho^2} \\
\frac{\sigma_a^2}{1-\rho^2} + \frac{\sigma_u^2\rho^2}{2-2\rho} & \frac{\sigma_a^2\rho}{1-\rho^2} + \sigma_u^2 \left(\frac{1}{2}\rho + \frac{\rho^3}{2-2\rho}\right) & \frac{\sigma_a^2\rho}{1-\rho^2} + \sigma_u^2 \left(\frac{1}{2}\rho + \frac{\rho^3}{2-2\rho}\right) \\
\sigma_u^2 \left(1.0 + \frac{\rho^2}{2-2\rho}\right) + \frac{\sigma_a^2}{1-\rho^2} & \frac{\sigma_a^2\rho}{1-\rho^2} + \sigma_u^2 \left(\frac{1}{2}\rho + \frac{\rho^3}{2-2\rho}\right) & \frac{\sigma_a^2\rho}{1-\rho^2} + \sigma_u^2 \left(\frac{1}{2}\rho + \frac{\rho^3}{2-2\rho}\right) \\
\frac{\sigma_a^2\rho}{1-\rho^2} + \sigma_u^2 \left(\frac{1}{2}\rho + \frac{\rho^3}{2-2\rho}\right) & \sigma_u^2 \left(1.0 + \frac{\rho^2}{2-2\rho}\right) + \frac{\sigma_a^2}{1-\rho^2} & \frac{\sigma_a^2}{1-\rho^2} + \frac{\sigma_u^2\rho^2}{2-2\rho} \\
\frac{\sigma_a^2\rho}{1-\rho^2} + \sigma_u^2 \left(\frac{1}{2}\rho + \frac{\rho^3}{2-2\rho}\right) & \frac{\sigma_a^2}{1-\rho^2} + \frac{\sigma_u^2\rho^2}{2-2\rho} & \sigma_u^2 \left(1.0 + \frac{\rho^2}{2-2\rho}\right) + \frac{\sigma_a^2}{1-\rho^2}
\end{bmatrix} \tag{2}$$

Upon inspection with the 2021-12 note, this output matches the form of the covariance matrix given for the $N = 2, T = 3$ example.

EXAMPLE OF AN N=2 T=10 NUMERICAL MATRIX (True Covariance Matrix)
TRUE: : 0.85 : 1 : 1

7.01	6.01	5.535	5.535	4.703	4.703	4.0	4.0	3.398	3.398	2.889	2.889	2.455	2.455	2.088	2.088	1.774	1.774	1.508	1.508
6.01	7.01	5.535	5.535	4.703	4.703	4.0	4.0	3.398	3.398	2.889	2.889	2.455	2.455	2.088	2.088	1.774	1.774	1.508	1.508
5.535	5.535	7.01	6.01	5.535	5.535	4.703	4.703	4.0	4.0	3.398	3.398	2.889	2.889	2.455	2.455	2.088	2.088	1.774	1.774
5.535	5.535	6.01	7.01	5.535	5.535	4.703	4.703	4.0	4.0	3.398	3.398	2.889	2.889	2.455	2.455	2.088	2.088	1.774	1.774
4.703	4.703	5.535	5.535	7.01	6.01	5.535	5.535	4.703	4.703	4.0	4.0	3.398	3.398	2.889	2.889	2.455	2.455	2.088	2.088
4.703	4.703	5.535	5.535	6.01	7.01	5.535	5.535	4.703	4.703	4.0	4.0	3.398	3.398	2.889	2.889	2.455	2.455	2.088	2.088
4.0	4.0	4.703	4.703	5.535	5.535	7.01	6.01	5.535	5.535	4.703	4.703	4.0	4.0	3.398	3.398	2.889	2.889	2.455	2.455
4.0	4.0	4.703	4.703	5.535	5.535	6.01	7.01	5.535	5.535	4.703	4.703	4.0	4.0	3.398	3.398	2.889	2.889	2.455	2.455
3.398	3.398	4.0	4.0	4.703	4.703	5.535	5.535	7.01	6.01	5.535	5.535	4.703	4.703	4.0	4.0	3.398	3.398	2.889	2.889
3.398	3.398	4.0	4.0	4.703	4.703	5.535	5.535	6.01	7.01	5.535	5.535	4.703	4.703	4.0	4.0	3.398	3.398	2.889	2.889
2.889	2.889	3.398	3.398	4.0	4.0	4.703	4.703	5.535	5.535	7.01	6.01	5.535	5.535	4.703	4.703	4.0	4.0	3.398	3.398
2.889	2.889	3.398	3.398	4.0	4.0	4.703	4.703	5.535	5.535	6.01	7.01	5.535	5.535	4.703	4.703	4.0	4.0	3.398	3.398
2.455	2.455	2.889	2.889	3.398	3.398	4.0	4.0	4.703	4.703	5.535	5.535	7.01	6.01	5.535	5.535	4.703	4.703	4.0	4.0
2.455	2.455	2.889	2.889	3.398	3.398	4.0	4.0	4.703	4.703	5.535	5.535	6.01	7.01	5.535	5.535	4.703	4.703	4.0	4.0
2.088	2.088	2.455	2.455	2.889	2.889	3.398	3.398	4.0	4.0	4.703	4.703	5.535	5.535	7.01	6.01	5.535	5.535	4.703	4.703
2.088	2.088	2.455	2.455	2.889	2.889	3.398	3.398	4.0	4.0	4.703	4.703	5.535	5.535	6.01	7.01	5.535	5.535	4.703	4.703
1.774	1.774	2.088	2.088	2.455	2.455	2.889	2.889	3.398	3.398	4.0	4.0	4.703	4.703	5.535	5.535	7.01	6.01	5.535	5.535
1.774	1.774	2.088	2.088	2.455	2.455	2.889	2.889	3.398	3.398	4.0	4.0	4.703	4.703	5.535	5.535	6.01	7.01	5.535	5.535
1.508	1.508	1.774	1.774	2.088	2.088	2.455	2.455	2.889	2.889	3.398	3.398	4.0	4.0	4.703	4.703	5.535	5.535	7.01	6.01
1.508	1.508	1.774	1.774	2.088	2.088	2.455	2.455	2.889	2.889	3.398	3.398	4.0	4.0	4.703	4.703	5.535	5.535	6.01	7.01

EXAMPLE OF AN N=2 T=10 NUMERICAL MATRIX (Estimated Covariance Matrix)
ESTIMATED: : 0.217 : 0.688 : 0.899

1.33	0.522	0.2017	0.2017	0.0439	0.0439	0.0096	0.0096	0.0021	0.0021	0.0005	0.0005	9.9e-5	9.9e-5	2.2e-5	2.2e-5	4.7e-6	4.7e-6	1.0e-6	1.0e-6
0.522	1.33	0.2017	0.2017	0.0439	0.0439	0.0096	0.0096	0.0021	0.0021	0.0005	0.0005	9.9e-5	9.9e-5	2.2e-5	2.2e-5	4.7e-6	4.7e-6	1.0e-6	1.0e-6
0.2017	0.2017	1.33	0.522	0.2017	0.2017	0.0439	0.0439	0.0096	0.0096	0.0021	0.0021	0.0005	0.0005	9.9e-5	9.9e-5	2.2e-5	2.2e-5	4.7e-6	4.7e-6
0.2017	0.2017	0.522	1.33	0.2017	0.2017	0.0439	0.0439	0.0096	0.0096	0.0021	0.0021	0.0005	0.0005	9.9e-5	9.9e-5	2.2e-5	2.2e-5	4.7e-6	4.7e-6
0.0439	0.0439	0.2017	0.2017	1.33	0.522	0.2017	0.2017	0.0439	0.0439	0.0096	0.0096	0.0021	0.0021	0.0005	0.0005	9.9e-5	9.9e-5	2.2e-5	2.2e-5
0.0439	0.0439	0.2017	0.2017	0.522	1.33	0.2017	0.2017	0.0439	0.0439	0.0096	0.0096	0.0021	0.0021	0.0005	0.0005	9.9e-5	9.9e-5	2.2e-5	2.2e-5
0.0096	0.0096	0.0439	0.0439	0.2017	0.2017	1.33	0.522	0.2017	0.2017	0.0439	0.0439	0.0096	0.0096	0.0021	0.0021	0.0005	0.0005	9.9e-5	9.9e-5
0.0096	0.0096	0.0439	0.0439	0.2017	0.2017	0.522	1.33	0.2017	0.2017	0.0439	0.0439	0.0096	0.0096	0.0021	0.0021	0.0005	0.0005	9.9e-5	9.9e-5
0.0021	0.0021	0.0096	0.0096	0.0439	0.0439	0.2017	0.2017	1.33	0.522	0.2017	0.2017	0.0439	0.0439	0.0096	0.0096	0.0021	0.0021	0.0005	0.0005
0.0021	0.0021	0.0096	0.0096	0.0439	0.0439	0.2017	0.2017	0.522	1.33	0.2017	0.2017	0.0439	0.0439	0.0096	0.0096	0.0021	0.0021	0.0005	0.0005
0.0005	0.0005	0.0021	0.0021	0.0096	0.0096	0.0439	0.0439	0.2017	0.2017	1.33	0.522	0.2017	0.2017	0.0439	0.0439	0.0096	0.0096	0.0021	0.0021
0.0005	0.0005	0.0021	0.0021	0.0096	0.0096	0.0439	0.0439	0.2017	0.2017	0.522	1.33	0.2017	0.2017	0.0439	0.0439	0.0096	0.0096	0.0021	0.0021
9.9e-5	9.9e-5	0.0005	0.0005	0.0021	0.0021	0.0096	0.0096	0.0439	0.0439	0.2017	0.2017	1.33	0.522	0.2017	0.2017	0.0439	0.0439	0.0096	0.0096
9.9e-5	9.9e-5	0.0005	0.0005	0.0021	0.0021	0.0096	0.0096	0.0439	0.0439	0.2017	0.2017	0.522	1.33	0.2017	0.2017	0.0439	0.0439	0.0096	0.0096
2.2e-5	2.2e-5	9.9e-5	9.9e-5	0.0005	0.0005	0.0021	0.0021	0.0096	0.0096	0.0439	0.0439	0.2017	0.2017	1.33	0.522	0.2017	0.2017	0.0439	0.0439
2.2e-5	2.2e-5	9.9e-5	9.9e-5	0.0005	0.0005	0.0021	0.0021	0.0096	0.0096	0.0439	0.0439	0.2017	0.2017	0.522	1.33	0.2017	0.2017	0.0439	0.0439
4.7e-6	4.7e-6	2.2e-5	2.2e-5	9.9e-5	9.9e-5	0.0005	0.0005	0.0021	0.0021	0.0096	0.0096	0.0439	0.0439	0.2017	0.2017	1.33	0.522	0.2017	0.2017
4.7e-6	4.7e-6	2.2e-5	2.2e-5	9.9e-5	9.9e-5	0.0005	0.0005	0.0021	0.0021	0.0096	0.0096	0.0439	0.0439	0.2017	0.2017	0.522	1.33	0.2017	0.2017
1.0e-6	1.0e-6	4.7e-6	4.7e-6	2.2e-5	2.2e-5	9.9e-5	9.9e-5	0.0005	0.0005	0.0021	0.0021	0.0096	0.0096	0.0439	0.0439	0.2017	0.2017	1.33	0.522
1.0e-6	1.0e-6	4.7e-6	4.7e-6	2.2e-5	2.2e-5	9.9e-5	9.9e-5	0.0005	0.0005	0.0021	0.0021	0.0096	0.0096	0.0439	0.0439	0.2017	0.2017	0.522	1.33