Métodos numéricos - Lista 1

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Question 1

For the Tauchen discretization method I created a function that receives ρ, σ, m (with 3 as default), N (the number of states) and μ (with 0 as default). The output of the function is a list with two elements. The first is the transition matrix and the second the finite state grid. Here is the output for Julia using $\mu = 0$, $\rho = 0.95$, $\sigma = 0.007$, $m = 3$ and $N = 9$. Since the R table is the same I opted to omit it.

$$\begin{bmatrix} 0.76442 & 0.23469 & 0.0009 & 0.0 & 0.0 & 0.0 & 0.0 & 0.0 & 0.0 \\ 0.05923 & 0.7405 & 0.19967 & 0.00059 & 0.0 & 0.0 & 0.0 & 0.0 & 0.0 \\ 6.0e-5 & 0.07471 & 0.7569 & 0.16795 & 0.00039 & 0.0 & 0.0 & 0.0 & 0.0 \\ 0.0 & 0.0001 & 0.09314 & 0.76688 & 0.13963 & 0.00025 & 0.0 & 0.0 & 0.0 \\ 0.0 & 0.0 & 0.00016 & 0.11473 & 0.77023 & 0.11473 & 0.00016 & 0.0 & 0.0 \\ 0.0 & 0.0 & 0.0 & 0.00025 & 0.13963 & 0.76688 & 0.09314 & 0.0001 & 0.0 \\ 0.0 & 0.0 & 0.0 & 0.0 & 0.00039 & 0.16795 & 0.7569 & 0.07471 & 6.0e-5 \\ 0.0 & 0.0 & 0.0 & 0.0 & 0.0 & 0.00059 & 0.19967 & 0.7405 & 0.05923 \\ 0.0 & 0.0 & 0.0 & 0.0 & 0.0 & 0.0 & 0.0009 & 0.23469 & 0.76442 \end{bmatrix}$$

$$\begin{bmatrix} -0.06725 \\ -0.05044 \\ -0.03363 \\ -0.01681 \\ 0.0 \\ 0.01681 \\ 0.03363 \\ 0.05044 \\ 0.06725 \end{bmatrix}$$

Tauchen - Julia

Question 2

For the Rouwenhorst method I did a new function, but this time the m was not necessary as an input. The output is in the same format as the function before. Here I print just the Julia output again. I am using the same parameters.

$$\begin{bmatrix} 0.81665 & 0.16752 & 0.01503 & 0.00077 & 2.0e-5 & 0.0 & 0.0 & 0.0 & 0.0 \\ 0.02094 & 0.82041 & 0.14687 & 0.01129 & 0.00048 & 1.0e-5 & 0.0 & 0.0 & 0.0 \\ 0.00054 & 0.04196 & 0.8231 & 0.12605 & 0.00807 & 0.00028 & 1.0e-5 & 0.0 & 0.0 \\ 1.0e-5 & 0.00161 & 0.06303 & 0.82472 & 0.10511 & 0.00538 & 0.00014 & 0.0 & 0.0 \\ 0.0 & 6.0e-5 & 0.00323 & 0.08409 & 0.82526 & 0.08409 & 0.00323 & 6.0e-5 & 0.0 \\ 0.0 & 0.0 & 0.00014 & 0.00538 & 0.10511 & 0.82472 & 0.06303 & 0.00161 & 1.0e-5 \\ 0.0 & 0.0 & 1.0e-5 & 0.00028 & 0.00807 & 0.12605 & 0.8231 & 0.04196 & 0.00054 \\ 0.0 & 0.0 & 0.0 & 1.0e-5 & 0.00048 & 0.01129 & 0.14687 & 0.82041 & 0.02094 \\ 0.0 & 0.0 & 0.0 & 0.0 & 2.0e-5 & 0.00077 & 0.01503 & 0.16752 & 0.81665 \end{bmatrix}$$

$$\begin{bmatrix} -0.06341 \\ -0.04756 \\ -0.0317 \\ -0.01585 \\ 0.0 \\ 0.01585 \\ 0.0317 \\ 0.04756 \\ 0.06341 \end{bmatrix}$$

Rouwenhorst - Julia

Question 3

For the simulation of the discrete process I created a new the function that receives the parameters of the Tauchen function and $z0$, that is the initial state (with the median of the grid as default), and a true or false parameter, where true is the default and the simulation will use the Tauchen method.

Here I present the graphs for the Tauchen and Rouwenhorst methods for both Julia and R.

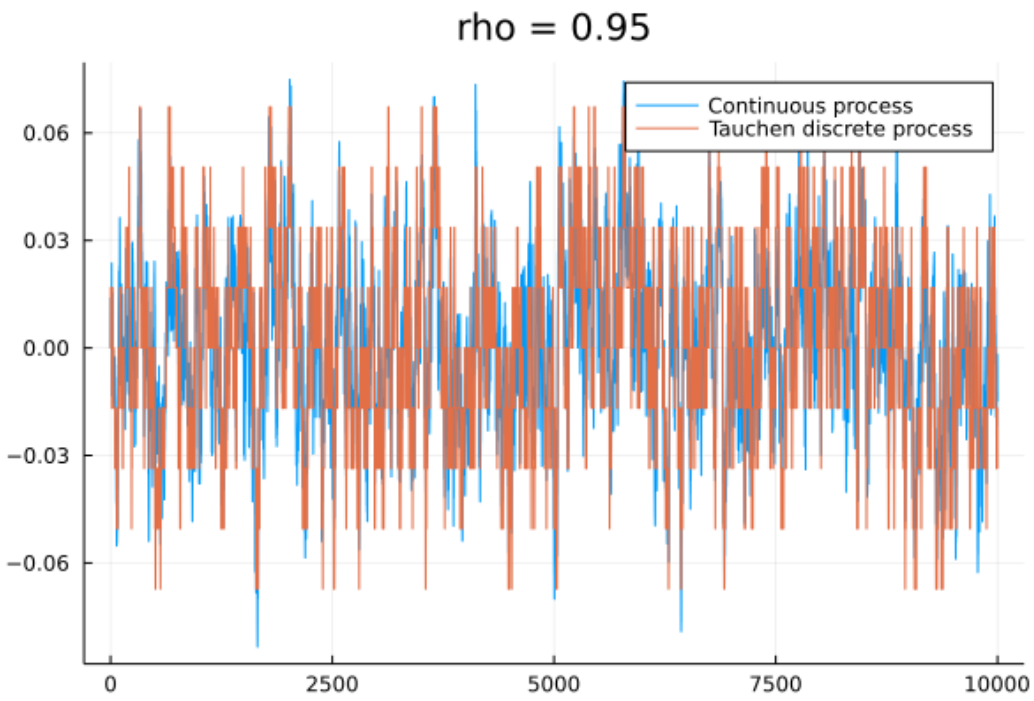

Figure 1: Tauchen - Julia ($\rho = 0.95$)

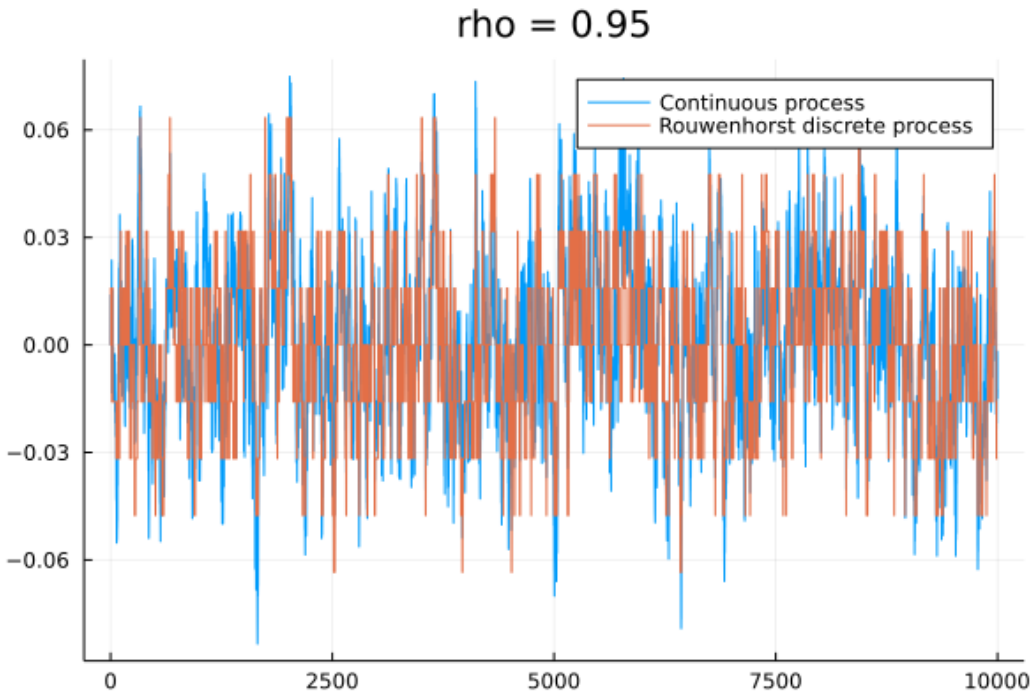

Figure 2: Rouwenhorst - Julia ($\rho = 0.95$)

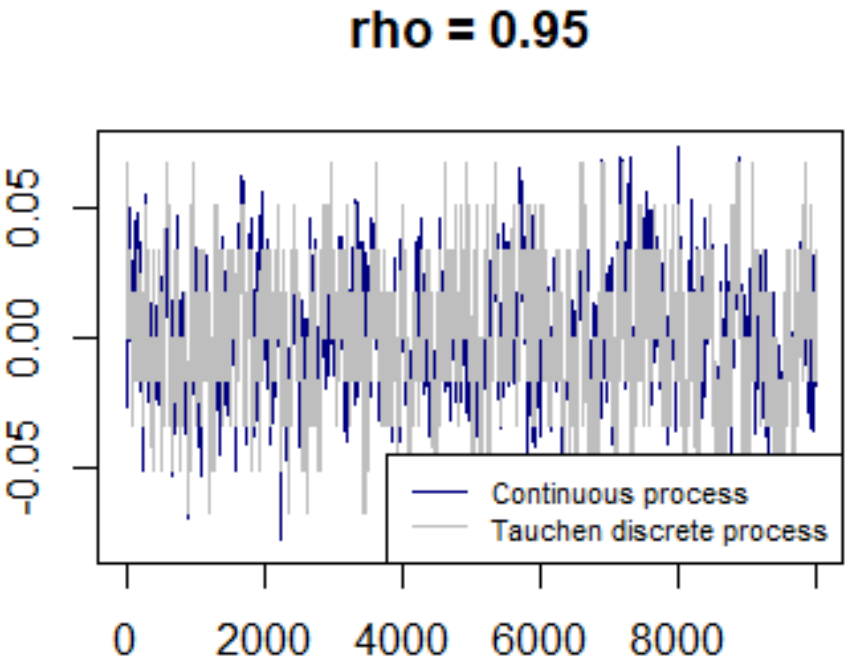

Figure 3: Tauchen - R ($\rho = 0.95$)

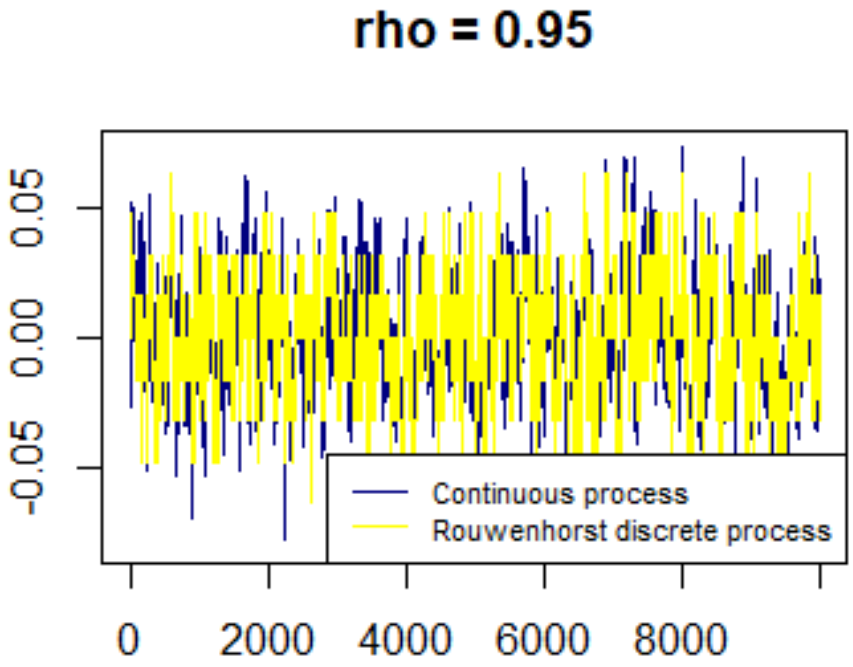

Figure 4: Rouwenhorst - R ($\rho = 0.95$)

Question 4

In this question I constructed a new series lagging the discrete simulation from the previous item and did the estimation. I had, for both Julia and R, a very similar result and for both Tauchen and Rouwenhorst I found a parameter close to 0.95, the real one.

Julia	Tauchen	Rouwenhorst
ρ	0.952***	0.951***
sd	(0.003)	(0.003)
N	10000	10000
R^2	0.907	0.904
R	Tauchen	Rouwenhorst
ρ	0.94582***	0.950216 ***
sd	(0.003)	(0.003)
N	10000	10000
R^2	0.8944	0.9029

Question 5

Finally I did the same thing as in questions 3 and 4, but now using $\rho = 0.99$. In the estimation, once more I found a parameter really close to the real one.

Julia	Tauchen	Rouwenhorst
ρ	0.999***	0.991***
sd	(0.0005)	(0.001)
N	10000	10000
R^2	0.997	0.983
R	Tauchen	Rouwenhorst
ρ	0.9985079***	0.991816***
sd	(0.0005)	(0.001)
N	10000	10000
R^2	0.997	0.9837

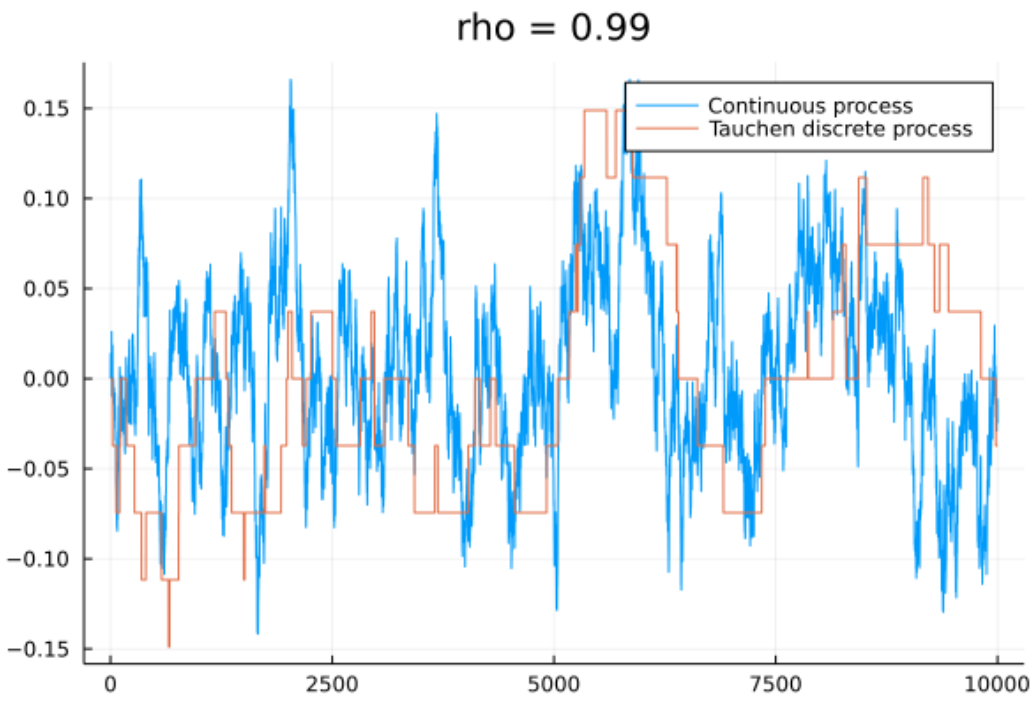

Figure 5: Tauchen - Julia R ($\rho = 0.99$)

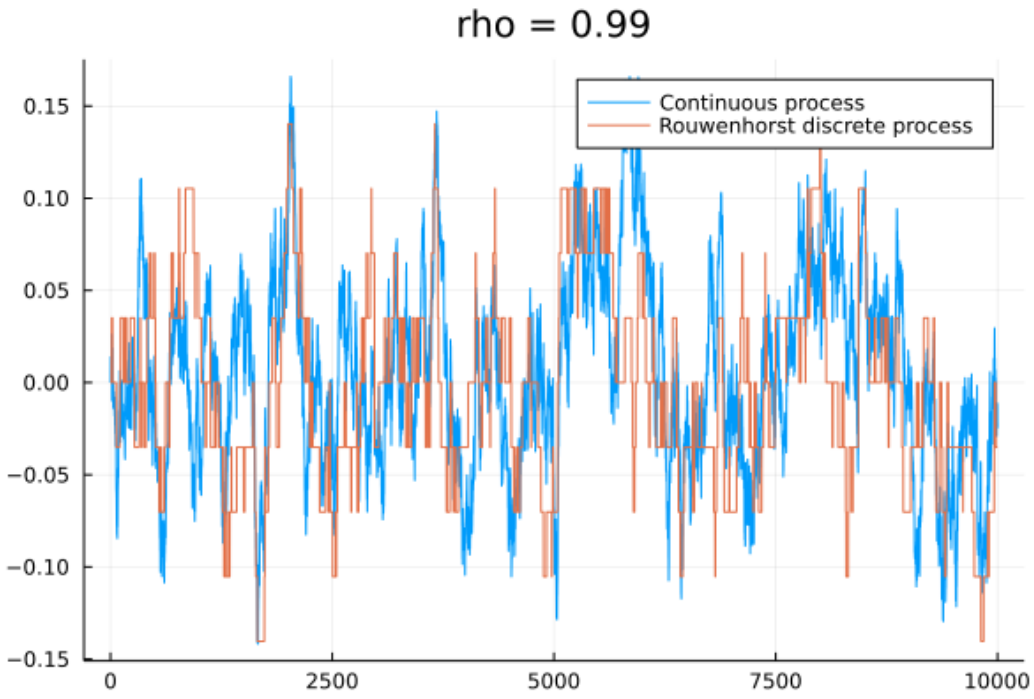

Figure 6: Rouwenhorst - Julia R ($\rho = 0.99$)

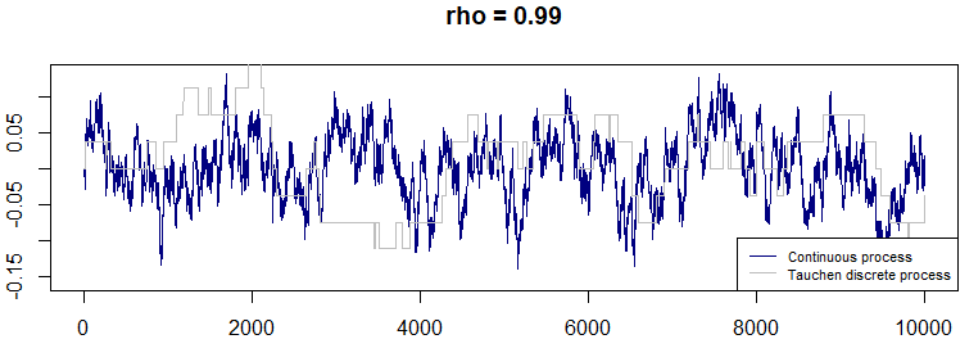

Figure 7: Tauchen - R R ($\rho = 0.99$)

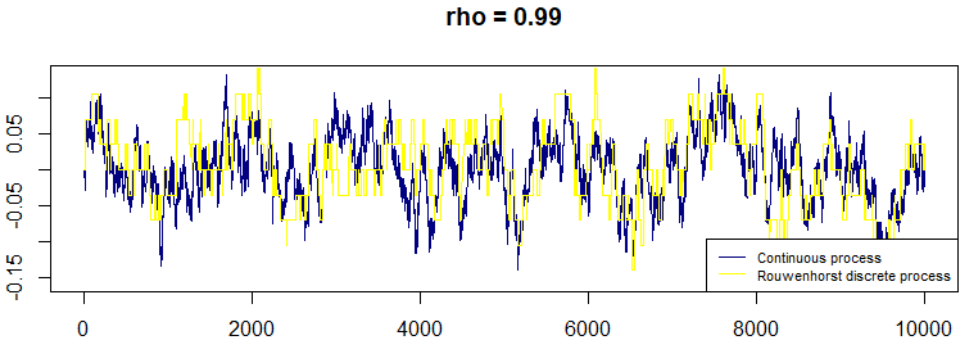

Figure 8: Rouwenhorst - R ($\rho = 0.99$)