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A
Apêndice

A *hazard rate h(t)* é a probabilidade por unidade de tempo do *crash* ocorrer no próximo instante dado que ele ainda não ocorreu, dada por $h(t) = \frac{q(t)}{1 - Q(t)}$.

Prova:

Pelo teorema da probabilidade total, considerando dois eventos a e b complementares, tem-se que:

P(a) = P(b)*P(a/b) + P(~b)*P(a/~b) (A.1)

Definindo os eventos a e b como:

a = ocorrência do *crash* entre t* e t*+dt

b = não ocorrência do *crash* entre 0 e t*

Tem-se também que: ~b = ocorrência do *crash* entre 0 e t*

Lembrando que a data de ocorrência do *crash* é uma variável estocástica sujeita a uma função densidade de probabilidade *q(t)* e a uma função de distribuição cumulativa $Q(t) = \int_{-\infty}^{t} q(t')dt'$, desta forma, Q(t*) é a probabilidade acumulada do *crash* ocorrer até t*, e complementarmente, 1 – Q(t*) é a probabilidade do *crash* ocorrer depois de t*.

Considerando um intervalo de tempo dt pequeno, tem-se que:

P(a) = q(t*)dt (A.2)

P(b) = 1 – Q(t*) (A.3)

De acordo com a definição da *hazard rate*:

P(a/b) = h(t*)dt (A.4)

Além disso, por razões de mercado:

P(a/~b) = 0. (A.5)

Aplicando (A.2), (A.3), (A.4), (A.5) em (A.1), conclui-se que:

q(t*)dt = (1 – Q(t*)) h(t*)dt + 0 ➔ q(t*) = (1 – Q(t*)) h(t*), ou seja, $h(t^*) = \frac{q(t^*)}{1 - Q(t^*)}$.

B
Apêndice

A razão das distâncias, entre dois máximos consecutivos e o tempo crítico t_c, segue uma progressão geométrica igual ao fator característico do mercado λ, ou seja, $\frac{t_c - t_{n+1}}{t_c - t_n} = \lambda$.

Prova:

Considerando: $p(t) = A + B(t_c - t)^{\beta}\{1 + C\cos[w\ln(t_c - t) + \phi]\}$.

Os máximos locais de p(t) ocorrem quando a função cosseno for máxima. Assim, os máximos locais têm datas t_n dadas por: $w\ln(t_c - t_n) + \phi = 2\pi n$.

Considerando tempos consecutivos t_n e t_{n+1}:

$w\ln(t_c - t_{n+1}) - w\ln(t_c - t_n) = 2\pi$, ou seja, $w\ln\left(\frac{t_c - t_{n+1}}{t_c - t_n}\right) = 2\pi$.

Daí, $\frac{t_c - t_{n+1}}{t_c - t_n} = e^{\frac{2\pi}{w}}$.

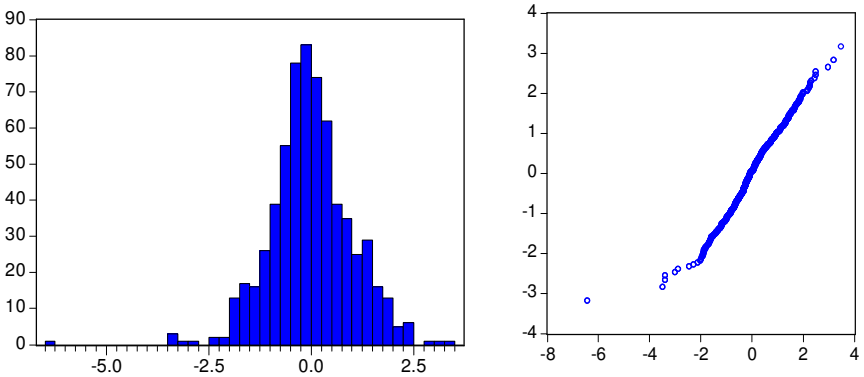
Sabendo-se que $e^{\frac{2\pi}{w}} = \lambda$ (ver eq.(33)), conclui-se que: $\frac{t_c - t_{n+1}}{t_c - t_n} = \lambda$.

C
Apêndice

Histograma, QQ-plot, teste BDS, correlogramas e matriz variância-covariância das séries analisadas no capítulo 4.

- HANG SENG INDEX (Hong Kong) – 1997

  - Histograma e QQ-plot

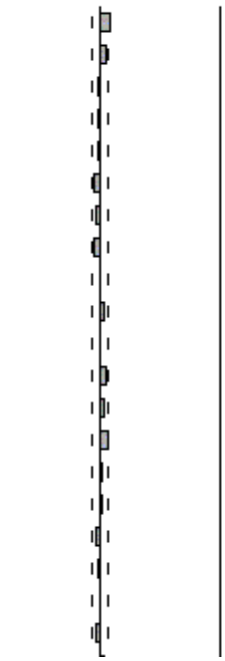


  - Teste BDS

m \ ε	0.5σ	1.0σ	1.5σ	2.0σ
2	0.13640	0.30440	0.38640	0.44240
3	0.32800	0.47120	0.47720	0.59240
4	0.24280	0.33360	0.28880	0.32320
5	0.17040	0.25880	0.15920	0.23600
6	0.13680	0.17640	0.09840	0.22240

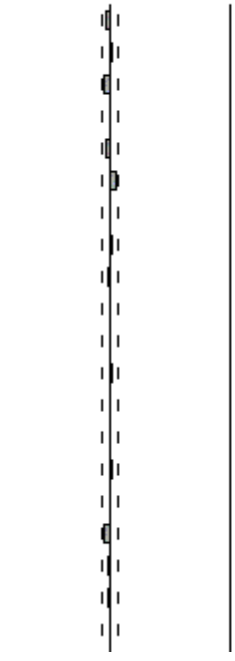
p-valores *bootstrapeados* da estatística BDS, com 5000 repetições.

- Correlograma do resíduo padronizado



	Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
			1	0.082	0.082	4.3889	0.036
			2	0.048	0.041	5.8510	0.054
			3	-0.020	-0.027	6.1031	0.107
			4	-0.014	-0.012	6.2276	0.183
			5	-0.015	-0.011	6.3686	0.272
			6	-0.042	-0.040	7.5166	0.276
			7	-0.033	-0.026	8.2329	0.313
			8	-0.044	-0.037	9.4919	0.303
			9	-0.006	0.000	9.5195	0.391
			10	0.025	0.027	9.9364	0.446
			11	-0.001	-0.008	9.9372	0.536
			12	0.052	0.048	11.700	0.470
			13	0.037	0.028	12.583	0.480
			14	0.063	0.051	15.172	0.366
			15	0.019	0.008	15.413	0.422
			16	0.019	0.015	15.642	0.478
			17	-0.030	-0.029	16.230	0.508
			18	-0.015	-0.004	16.373	0.566
			19	0.006	0.017	16.400	0.630
			20	-0.029	-0.023	16.963	0.655

- Correlograma do quadrado do resíduo padronizado



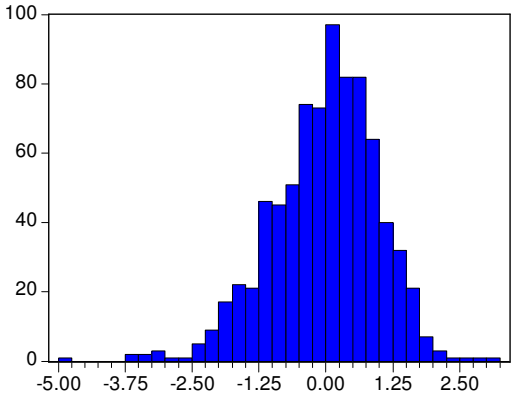
	Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
			1	-0.030	-0.030	0.5916	0.442
			2	0.016	0.015	0.7582	0.684
			3	-0.054	-0.053	2.6546	0.448
			4	0.007	0.004	2.6878	0.611
			5	-0.027	-0.025	3.1591	0.675
			6	0.056	0.051	5.1824	0.521
			7	0.007	0.012	5.2190	0.633
			8	0.022	0.019	5.5441	0.698
			9	-0.015	-0.008	5.6912	0.770
			10	-0.002	-0.003	5.6940	0.840
			11	-0.008	-0.003	5.7361	0.890
			12	0.022	0.018	6.0632	0.913
			13	-0.002	-0.001	6.0657	0.944
			14	0.007	0.003	6.0999	0.964
			15	0.023	0.027	6.4635	0.971
			16	-0.002	-0.001	6.4652	0.982
			17	-0.053	-0.052	8.3540	0.958
			18	-0.014	-0.017	8.4817	0.971
			19	-0.014	-0.014	8.6139	0.979
			20	0.007	0.001	8.6476	0.987

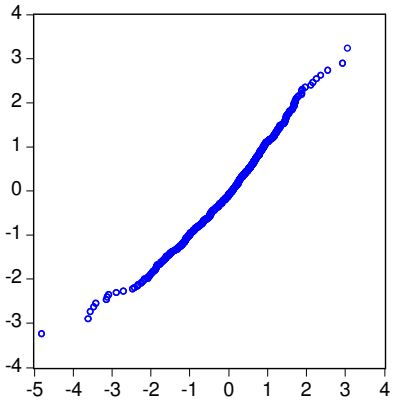
- Matriz Variância-Covariância

	A	B	C	tc	β	w	φp	φar	α0	α1	α2
A	**4.970E+05**	-5.107E+05	-1.374E+04	-1.214E-03	-3.885E+01	7.147E+00	1.607E+00	2.346E+00	1.452E+04	1.106E+00	-2.028E+00
B	-5.107E+05	**5.519E+05**	1.940E+04	1.371E-03	4.416E+01	-6.795E+00	-1.425E+00	-2.733E+00	-1.189E+04	-7.855E-01	1.568E+00
C	-1.374E+04	1.940E+04	**3.387E+04**	2.003E-04	-2.248E+00	3.865E+00	-6.536E-04	-1.299E+00	-4.977E+03	-2.081E-01	5.281E-01
tc	-1.214E-03	1.371E-03	2.003E-04	**1.391E-08**	1.860E-07	1.410E-07	-1.439E-06	-2.048E-08	-8.135E-04	-2.852E-08	8.087E-08
β	-3.885E+01	4.416E+01	-2.248E+00	1.860E-07	**5.554E-03**	-2.079E-03	-4.165E-04	-7.454E-05	-8.025E-01	3.429E-05	3.396E-05
w	7.147E+00	-6.795E+00	3.865E+00	1.410E-07	-2.079E-03	**2.558E-02**	1.774E-03	-7.460E-05	5.752E-01	-3.761E-05	-6.685E-06
φp	1.607E+00	-1.425E+00	-6.536E-04	-1.439E-06	-4.165E-04	1.774E-03	**5.821E-03**	2.476E-05	6.531E-01	1.841E-05	-5.996E-05
φar	2.346E+00	-2.733E+00	-1.299E+00	-2.048E-08	-7.454E-05	-7.460E-05	2.476E-05	**1.514E-04**	2.851E-01	5.411E-06	-2.431E-05
α0	1.452E+04	-1.189E+04	-4.977E+03	-8.135E-04	-8.025E-01	5.752E-01	6.531E-01	2.851E-01	**7.975E+04**	1.716E+00	-7.021E+00
α1	1.106E+00	-7.855E-01	-2.081E-01	-2.852E-08	3.429E-05	-3.761E-05	1.841E-05	5.411E-06	1.716E+00	**4.781E-04**	-5.009E-04
α2	-2.028E+00	1.568E+00	5.281E-01	8.087E-08	3.396E-05	-6.685E-06	-5.996E-05	-2.431E-05	-7.021E+00	-5.009E-04	**9.314E-04**

- NASDAQ (Estados Unidos) – 2000

➢ Histograma e QQ-plot



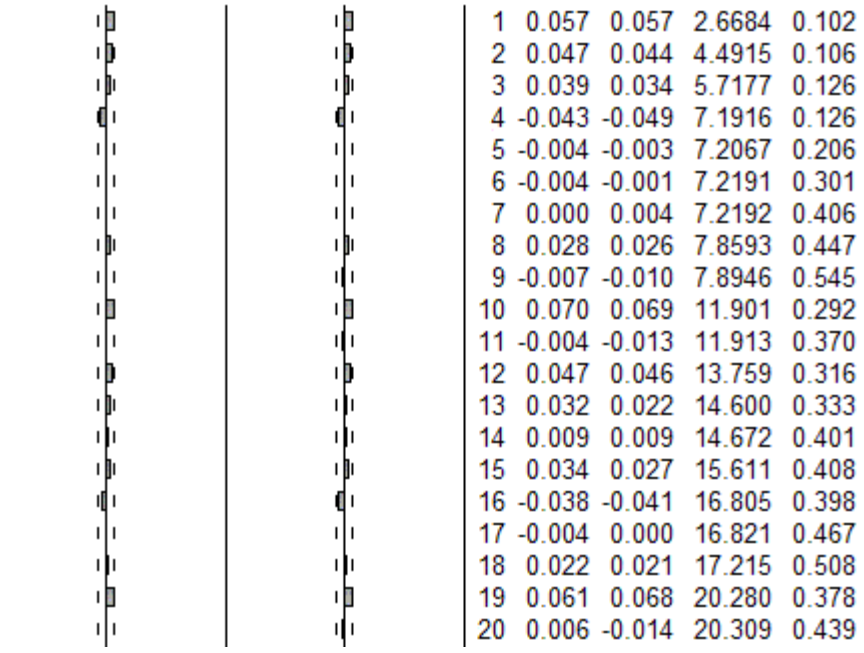


➢ Teste BDS

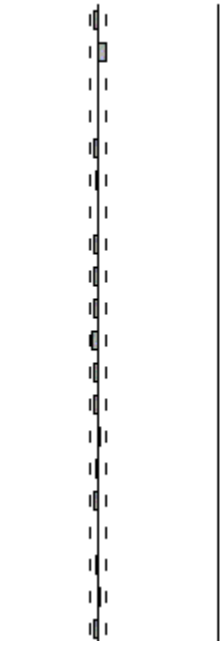
m \ ε	0.5σ	1.0σ	1.5σ	2.0σ
2	0.53800	0.44920	0.15760	0.21480
3	0.93880	0.83520	0.87600	0.87560
4	0.96280	0.90760	0.98160	0.67280
5	0.93040	0.94280	0.98800	0.57400
6	0.87520	0.89120	0.91640	0.51000

p-valores *bootstrapeados* da estatística BDS, com 5000 repetições.

➢ Correlograma do resíduo padronizado



- Correlograma do quadrado do resíduo padronizado

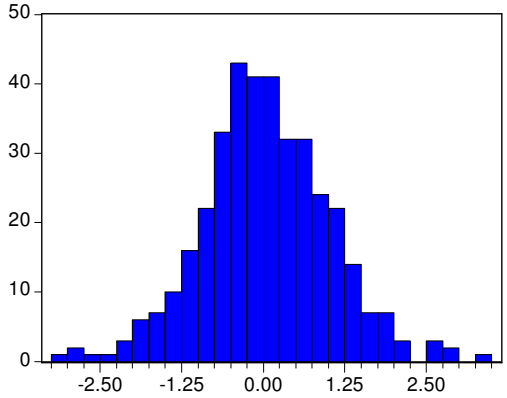


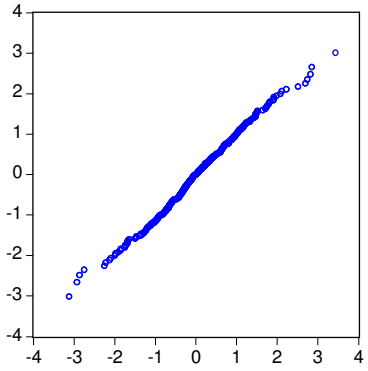
Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
		1	-0.026	-0.026	0.5638	0.453
		2	0.065	0.065	4.0090	0.135
		3	-0.007	-0.003	4.0449	0.257
		4	0.002	-0.003	4.0467	0.400
		5	-0.027	-0.026	4.6289	0.463
		6	-0.021	-0.022	4.9854	0.546
		7	0.008	0.010	5.0377	0.655
		8	-0.040	-0.038	6.3657	0.606
		9	-0.026	-0.029	6.9011	0.647
		10	-0.030	-0.028	7.6546	0.663
		11	-0.051	-0.051	9.8245	0.546
		12	-0.034	-0.034	10.799	0.546
		13	-0.030	-0.028	11.547	0.565
		14	0.018	0.017	11.803	0.622
		15	-0.009	-0.007	11.866	0.689
		16	-0.026	-0.035	12.440	0.713
		17	-0.004	-0.010	12.452	0.772
		18	-0.021	-0.023	12.814	0.803
		19	0.024	0.018	13.281	0.824
		20	-0.031	-0.033	14.062	0.827

- Matriz Variância-Covariância

	A	B	C	tc	β	w	φp	φar	α0	α1	α2
A	**6.392E+05**	-6.581E+05	-1.199E+04	7.150E-01	-6.014E+01	7.901E+01	-2.133E+01	-3.401E+00	7.576E+01	8.382E-01	-7.353E-01
B	-6.581E+05	**6.804E+05**	1.245E+04	-7.300E-01	6.295E+01	-8.144E+01	1.903E+01	3.534E+00	-4.159E+01	-4.413E-01	4.064E-01
C	-1.199E+04	1.245E+04	**1.716E+03**	-1.523E-02	1.472E+00	-1.976E+00	7.284E-01	1.500E-01	-1.950E+01	-6.732E-02	7.983E-02
tc	7.150E-01	-7.300E-01	-1.523E-02	**5.140E-06**	-6.927E-05	4.177E-04	-2.116E-04	-2.079E-06	5.344E-05	7.024E-07	-8.982E-07
β	-6.014E+01	6.295E+01	1.472E+00	-6.927E-05	**6.177E-03**	-8.139E-03	4.278E-04	3.438E-04	-3.353E-03	8.300E-06	6.793E-06
w	7.901E+01	-8.144E+01	-1.976E+00	4.177E-04	-8.139E-03	**4.610E-02**	-1.280E-02	-1.772E-04	1.106E-02	1.594E-04	-1.765E-04
φp	-2.133E+01	1.903E+01	7.284E-01	-2.116E-04	4.278E-04	-1.280E-02	**5.057E-02**	3.991E-04	-1.930E-02	2.036E-04	-1.198E-04
φar	-3.401E+00	3.534E+00	1.500E-01	-2.079E-06	3.438E-04	-1.772E-04	3.991E-04	**7.314E-05**	-6.182E-03	-4.732E-05	4.779E-05
α0	7.576E+01	-4.159E+01	-1.950E+01	5.344E-05	-3.353E-03	1.106E-02	-1.930E-02	-6.182E-03	**3.291E+01**	1.191E-01	-1.443E-01
α1	8.382E-01	-4.413E-01	-6.732E-02	7.024E-07	8.300E-06	1.594E-04	2.036E-04	-4.732E-05	1.191E-01	**2.039E-03**	-1.652E-03
α2	-7.353E-01	4.064E-01	7.983E-02	-8.982E-07	6.793E-06	-1.765E-04	-1.198E-04	4.779E-05	-1.443E-01	-1.652E-03	**1.494E-03**

- IBOVESPA (Brasil) – 1997
  - Histograma e QQ-plot



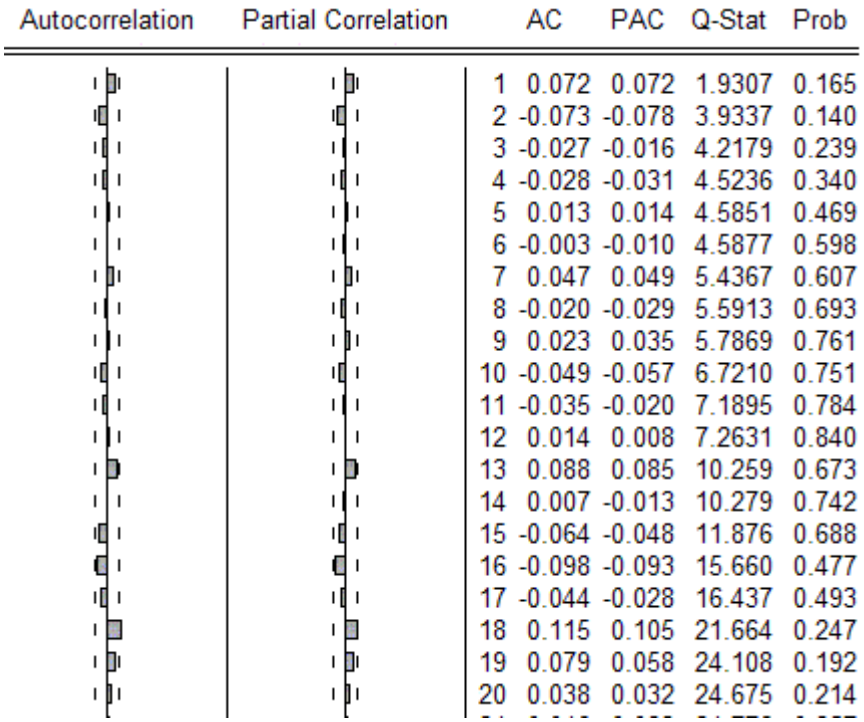


  - Teste BDS

m \ ε	0.5σ	1.0σ	1.5σ	2.0σ
2	0.83000	0.99720	0.85960	0.98520
3	0.86840	0.86360	0.85480	0.75560
4	0.96960	0.91760	0.86280	0.63200
5	0.47880	0.69000	0.64480	0.83640
6	0.36440	0.35400	0.40680	0.88800

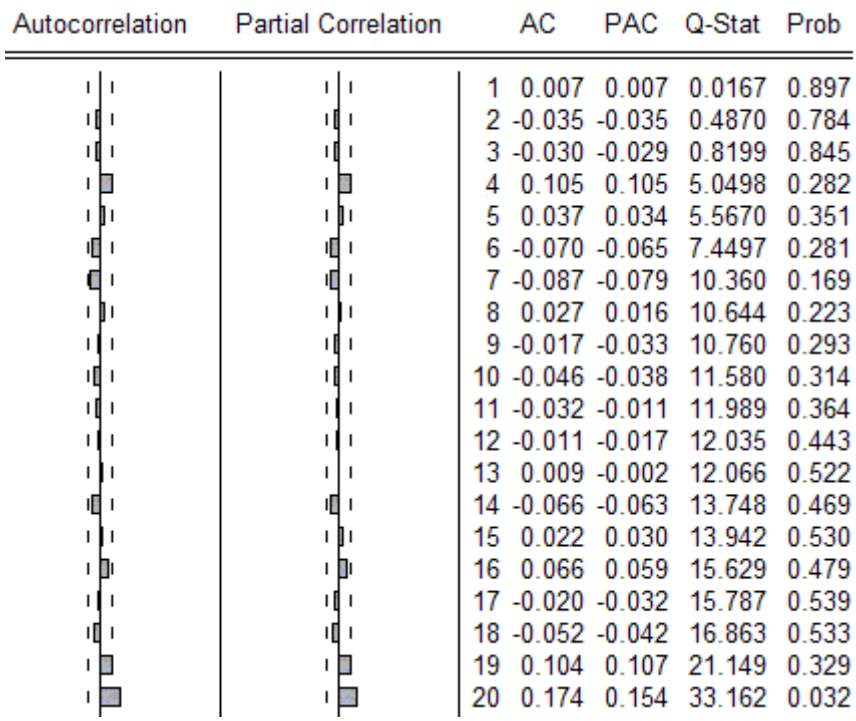
p-valores *bootstrapeados* da estatística BDS, com 5000 repetições.

  - Correlograma do resíduo padronizado



		AC	PAC	Q-Stat	Prob
1		0.072	0.072	1.9307	0.165
2		-0.073	-0.078	3.9337	0.140
3		-0.027	-0.016	4.2179	0.239
4		-0.028	-0.031	4.5236	0.340
5		0.013	0.014	4.5851	0.469
6		-0.003	-0.010	4.5877	0.598
7		0.047	0.049	5.4367	0.607
8		-0.020	-0.029	5.5913	0.693
9		0.023	0.035	5.7869	0.761
10		-0.049	-0.057	6.7210	0.751
11		-0.035	-0.020	7.1895	0.784
12		0.014	0.008	7.2631	0.840
13		0.088	0.085	10.259	0.673
14		0.007	-0.013	10.279	0.742
15		-0.064	-0.048	11.876	0.688
16		-0.098	-0.093	15.660	0.477
17		-0.044	-0.028	16.437	0.493
18		0.115	0.105	21.664	0.247
19		0.079	0.058	24.108	0.192
20		0.038	0.032	24.675	0.214

- Correlograma do quadrado do resíduo padronizado

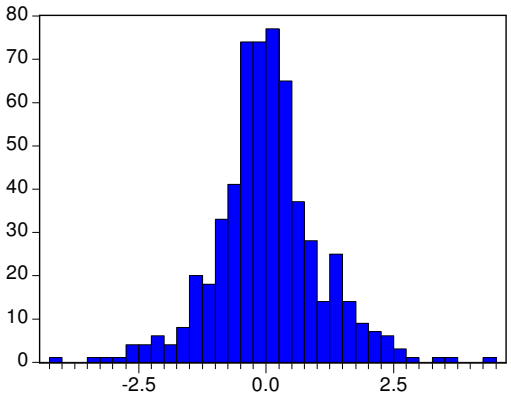


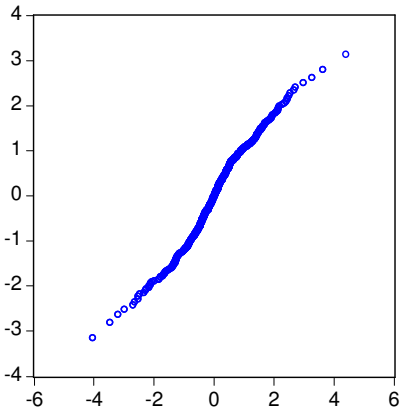
Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
		1	0.007	0.007	0.0167	0.897
		2	-0.035	-0.035	0.4870	0.784
		3	-0.030	-0.029	0.8199	0.845
		4	0.105	0.105	5.0498	0.282
		5	0.037	0.034	5.5670	0.351
		6	-0.070	-0.065	7.4497	0.281
		7	-0.087	-0.079	10.360	0.169
		8	0.027	0.016	10.644	0.223
		9	-0.017	-0.033	10.760	0.293
		10	-0.046	-0.038	11.580	0.314
		11	-0.032	-0.011	11.989	0.364
		12	-0.011	-0.017	12.035	0.443
		13	0.009	-0.002	12.066	0.522
		14	-0.066	-0.063	13.748	0.469
		15	0.022	0.030	13.942	0.530
		16	0.066	0.059	15.629	0.479
		17	-0.020	-0.032	15.787	0.539
		18	-0.052	-0.042	16.863	0.533
		19	0.104	0.107	21.149	0.329
		20	0.174	0.154	33.162	0.032

➢ Matriz Variância-Covariância

	A	B	C	tc	β	w	φ	ρ	α0	α1	α2
A	**8000400**	-7855400	-208030	7.83900	-228.44	106.550	6.63730	-5.78290	7316.80	4.22070	-3.40810
B	-7855400	**7724000**	198640	-7.62420	223.45	-102.970	-7.66050	5.73270	-6306.90	-4.15760	3.27050
C	-208030	198640	**20176**	-0.19393	6.98150	-3.34000	3.33680	-0.33150	-1594.70	-0.31157	0.41653
tc	7.83900	-7.62420	-0.19393	**0.00005**	-0.00018	0.00034	-0.00062	0.00000	-0.00450	0.00000	0.00000
β	-228.440	223.450	6.98150	-0.00018	**0.00686**	-0.00302	-0.00158	0.00014	-0.33278	-0.00014	0.00013
w	106.55000	-102.97000	-3.34000	0.00034	-0.00302	**0.02332**	0.00556	0.00007	-0.22112	-0.00002	0.00005
φ	6.63730	-7.66050	3.33680	-0.00062	-0.00158	0.00556	**0.11515**	0.00044	-0.00387	0.00085	-0.00080
ρ	-5.78290	5.73270	-0.33150	0.00000	0.00014	0.00007	0.00044	**0.00034**	0.13707	0.00002	-0.00002
α0	7316.80	-6306.90	-1594.70	-0.00450	-0.33278	-0.22112	-0.00387	0.13707	**11536.0**	0.63258	-1.87530
α1	4.22070	-4.15760	-0.31157	0.00000	-0.00014	-0.00002	0.00085	0.00002	0.63258	**0.00070**	-0.00062
α2	-3.40810	3.27050	0.41653	0.00000	0.00013	0.00005	-0.00080	-0.00002	-1.87530	-0.00062	**0.00075**

- MERVAL (Argentina) – 2004
  - Histograma e QQ-plot



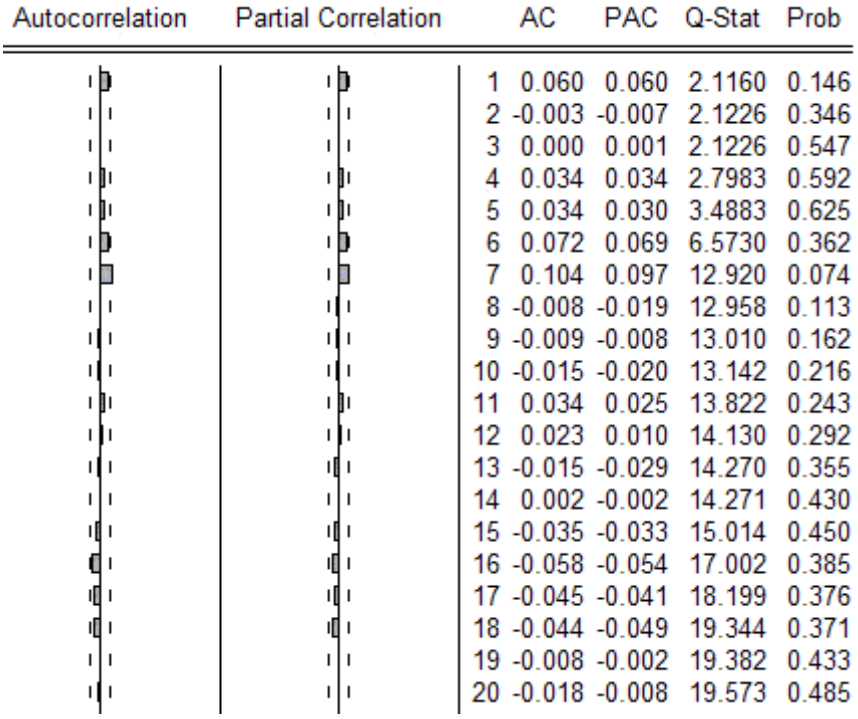


  - Teste BDS

m \ ε	0.5σ	1.0σ	1.5σ	2.0σ
2	0.23040	0.24560	0.28600	0.91760
3	0.79440	0.67920	0.85440	0.45480
4	0.98400	0.80400	0.95000	0.42240
5	0.69680	0.89520	0.80920	0.53720
6	0.55880	0.83720	0.69680	0.59320

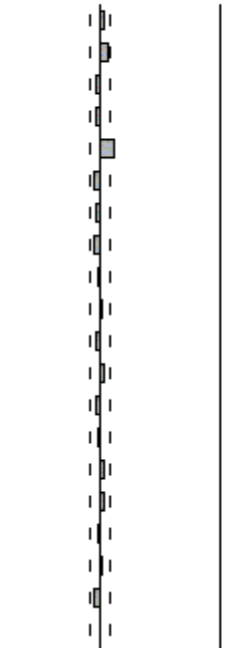
p-valores *bootstrapeados* da estatística BDS, com 5000 repetições.

  - Correlograma do resíduo padronizado



	AC	PAC	Q-Stat	Prob
1	0.060	0.060	2.1160	0.146
2	-0.003	-0.007	2.1226	0.346
3	0.000	0.001	2.1226	0.547
4	0.034	0.034	2.7983	0.592
5	0.034	0.030	3.4883	0.625
6	0.072	0.069	6.5730	0.362
7	0.104	0.097	12.920	0.074
8	-0.008	-0.019	12.958	0.113
9	-0.009	-0.008	13.010	0.162
10	-0.015	-0.020	13.142	0.216
11	0.034	0.025	13.822	0.243
12	0.023	0.010	14.130	0.292
13	-0.015	-0.029	14.270	0.355
14	0.002	-0.002	14.271	0.430
15	-0.035	-0.033	15.014	0.450
16	-0.058	-0.054	17.002	0.385
17	-0.045	-0.041	18.199	0.376
18	-0.044	-0.049	19.344	0.371
19	-0.008	-0.002	19.382	0.433
20	-0.018	-0.008	19.573	0.485

- Correlograma do quadrado do resíduo padronizado



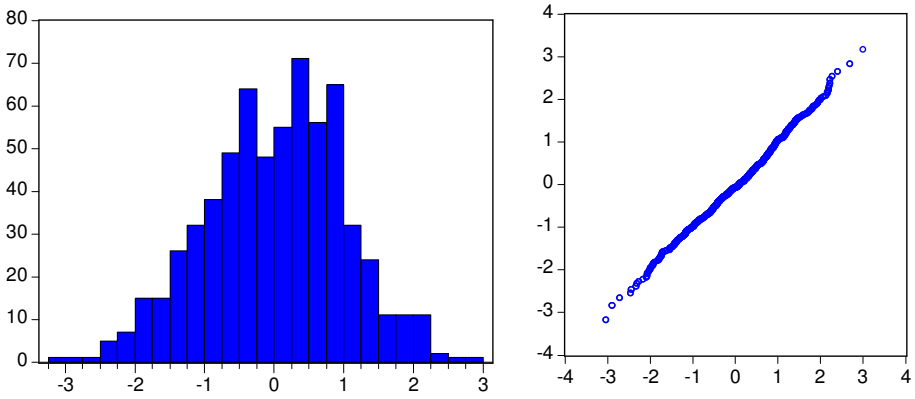
Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
		1	0.039	0.039	0.8705	0.351
		2	0.059	0.058	2.9101	0.233
		3	-0.038	-0.042	3.7399	0.291
		4	-0.040	-0.040	4.6555	0.325
		5	0.117	0.125	12.632	0.027
		6	-0.048	-0.056	13.979	0.030
		7	-0.030	-0.045	14.510	0.043
		8	-0.047	-0.029	15.805	0.045
		9	-0.019	-0.005	16.010	0.067
		10	0.018	0.002	16.203	0.094
		11	-0.025	-0.020	16.585	0.121
		12	0.026	0.030	16.993	0.150
		13	-0.028	-0.023	17.464	0.179
		14	-0.009	-0.014	17.510	0.230
		15	0.030	0.029	18.044	0.260
		16	0.029	0.033	18.532	0.294
		17	-0.013	-0.033	18.627	0.350
		18	0.011	0.019	18.700	0.411
		19	-0.046	-0.039	19.985	0.395
		20	0.008	0.002	20.023	0.456

- Matriz Variância-Covariância

	A	B	C	tc	β	w	φ	ρ	α0	α1	α2
A	**29792.00**	-30503.00	341.6000	0.5270	-13.2360	18.2680	-15.8290	-0.3749	-13.3940	0.0014	0.1157
B	-30503.00	**31448.00**	-378.7900	-0.5239	13.8060	-18.1450	16.4220	0.3623	10.3220	-0.0236	-0.0759
C	341.6000	-378.7900	**182.4000**	0.0163	-0.0387	0.9541	0.2233	-0.0201	1.0988	0.0091	-0.0157
tc	0.5270	-0.5239	0.0163	**0.0001**	-0.0002	0.0024	-0.0012	0.0000	0.0006	0.0000	0.0000
β	-13.2360	13.8060	-0.0387	-0.0002	**0.0070**	-0.0052	0.0103	0.0001	0.0052	0.0000	0.0000
w	18.2680	-18.1450	0.9541	0.0024	-0.0052	**0.1313**	-0.0099	0.0000	0.0364	0.0001	-0.0003
φ	-15.8290	16.4220	0.2233	-0.0012	0.0103	-0.0099	**0.1469**	-0.0002	-0.0089	0.0000	0.0001
ρ	-0.3749	0.3623	-0.0201	0.0000	0.0001	0.0000	-0.0002	**0.0002**	0.0038	0.0000	0.0000
α0	-13.3940	10.3220	1.0988	0.0006	0.0052	0.0364	-0.0089	0.0038	**3.6580**	0.0195	-0.0401
α1	0.0014	-0.0236	0.0091	0.0000	0.0000	0.0001	0.0000	0.0000	0.0195	**0.0005**	-0.0005
α2	0.1157	-0.0759	-0.0157	0.0000	0.0000	-0.0003	0.0001	0.0000	-0.0401	-0.0005	**0.0007**

- FTSE100 (Londres) – 1987

  - Histograma e QQ-plot

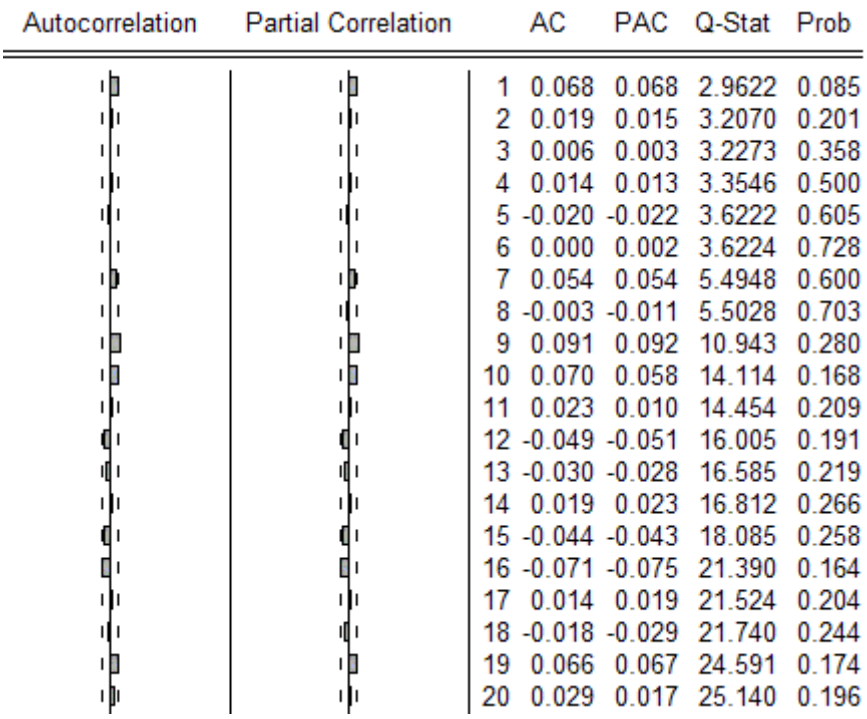


  - Teste BDS

m \ ε	0.5σ	1.0σ	1.5σ	2.0σ
2	0.304	0.743	0.648	0.909
3	0.537	0.870	0.581	0.978
4	0.439	0.499	0.291	0.659
5	0.925	0.760	0.562	0.935
6	0.390	0.574	0.549	0.931

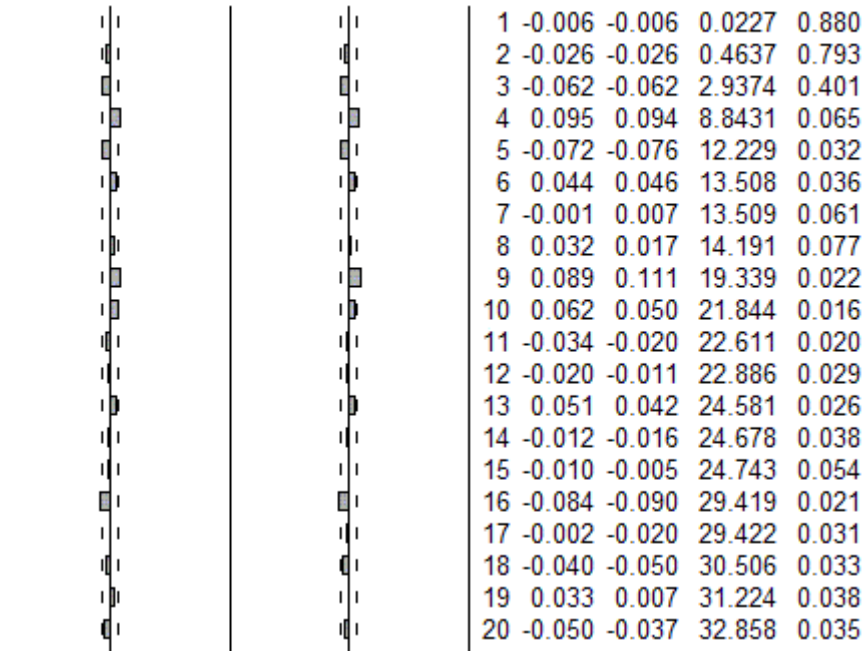
p-valores *bootstrapeados* da estatística BDS, com 5000 repetições.

  - Correlograma do resíduo padronizado



Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
		1	0.068	0.068	2.9622	0.085
		2	0.019	0.015	3.2070	0.201
		3	0.006	0.003	3.2273	0.358
		4	0.014	0.013	3.3546	0.500
		5	-0.020	-0.022	3.6222	0.605
		6	0.000	0.002	3.6224	0.728
		7	0.054	0.054	5.4948	0.600
		8	-0.003	-0.011	5.5028	0.703
		9	0.091	0.092	10.943	0.280
		10	0.070	0.058	14.114	0.168
		11	0.023	0.010	14.454	0.209
		12	-0.049	-0.051	16.005	0.191
		13	-0.030	-0.028	16.585	0.219
		14	0.019	0.023	16.812	0.266
		15	-0.044	-0.043	18.085	0.258
		16	-0.071	-0.075	21.390	0.164
		17	0.014	0.019	21.524	0.204
		18	-0.018	-0.029	21.740	0.244
		19	0.066	0.067	24.591	0.174
		20	0.029	0.017	25.140	0.196

- Correlograma do quadrado do resíduo padronizado



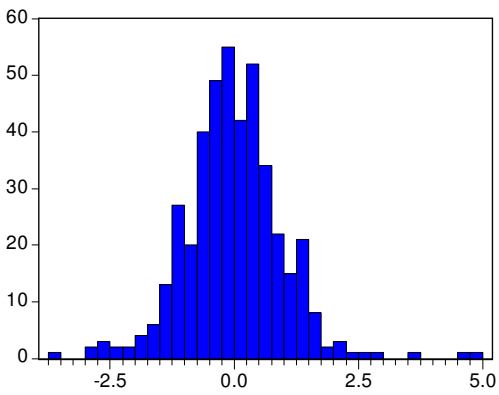
Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
		1	-0.006	-0.006	0.0227	0.880
		2	-0.026	-0.026	0.4637	0.793
		3	-0.062	-0.062	2.9374	0.401
		4	0.095	0.094	8.8431	0.065
		5	-0.072	-0.076	12.229	0.032
		6	0.044	0.046	13.508	0.036
		7	-0.001	0.007	13.509	0.061
		8	0.032	0.017	14.191	0.077
		9	0.089	0.111	19.339	0.022
		10	0.062	0.050	21.844	0.016
		11	-0.034	-0.020	22.611	0.020
		12	-0.020	-0.011	22.886	0.029
		13	0.051	0.042	24.581	0.026
		14	-0.012	-0.016	24.678	0.038
		15	-0.010	-0.005	24.743	0.054
		16	-0.084	-0.090	29.419	0.021
		17	-0.002	-0.020	29.422	0.031
		18	-0.040	-0.050	30.506	0.033
		19	0.033	0.007	31.224	0.038
		20	-0.050	-0.037	32.858	0.035

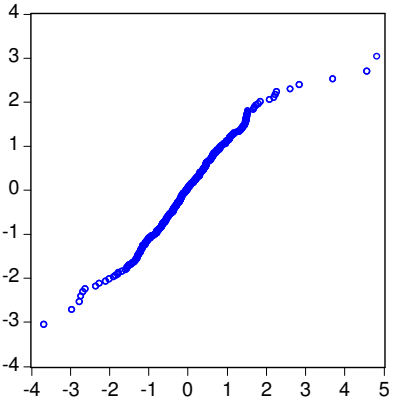
- Matriz Variância-Covariância

	A	B	C	tc	β	w	φ	ρ	α0	α1	α2
A	**720210.00**	-736610.00	-1681.0000	6.5184	-121.2100	199.3100	-142.5100	-10.7090	-461.1500	-3.9807	6.7075
B	-736610.00	**753700.00**	1795.8000	-6.6452	124.1200	-202.7800	145.9800	10.9590	472.0300	4.0843	-6.8723
C	-1681.0000	1795.8000	**219.6100**	-0.0153	0.2585	-0.5989	0.3753	-0.0079	-2.6534	-0.0302	0.0481
tc	6.5184	-6.6452	-0.0153	**0.0001**	-0.0011	0.0032	-0.0015	-0.0001	-0.0045	0.0000	0.0001
β	-121.2100	124.1200	0.2585	-0.0011	**0.0207**	-0.0316	0.0246	0.0018	0.0783	0.0007	-0.0011
w	199.3100	-202.7800	-0.5989	0.0032	-0.0316	**0.1494**	-0.0264	-0.0029	-0.1381	-0.0011	0.0020
φ	-142.5100	145.9800	0.3753	-0.0015	0.0246	-0.0264	**0.1051**	0.0019	0.0948	0.0006	-0.0012
ρ	-10.7090	10.9590	-0.0079	-0.0001	0.0018	-0.0029	0.0019	**0.0003**	0.0067	0.0000	-0.0001
α0	-461.1500	472.0300	-2.6534	-0.0045	0.0783	-0.1381	0.0948	0.0067	**5.3438**	0.0325	-0.0648
α1	-3.9807	4.0843	-0.0302	0.0000	0.0007	-0.0011	0.0006	0.0000	0.0325	**0.0007**	-0.0008
α2	6.7075	-6.8723	0.0481	0.0001	-0.0011	0.0020	-0.0012	-0.0001	-0.0648	-0.0008	**0.0012**

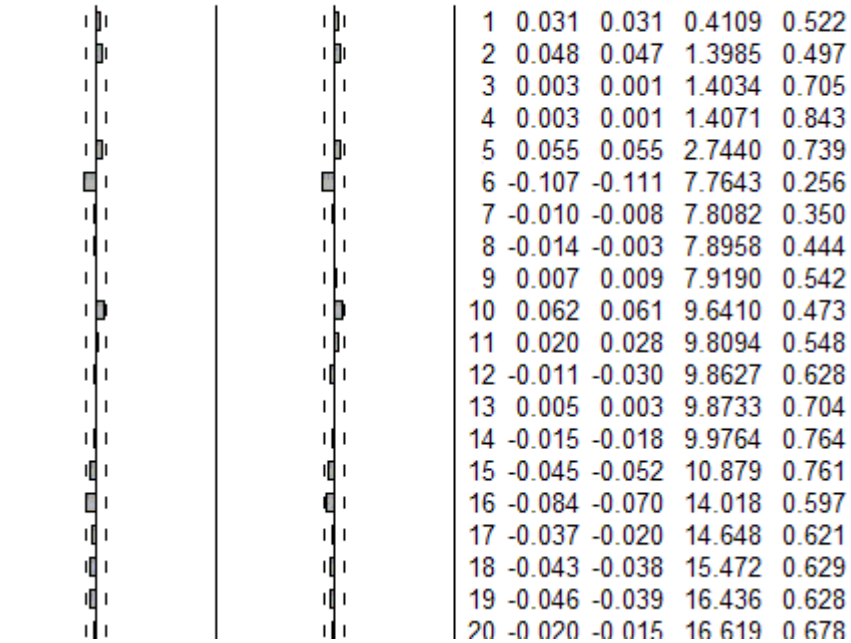
- INDIA BSE NATIONAL (Índia) – 2000

➢ Histograma e QQ-plot



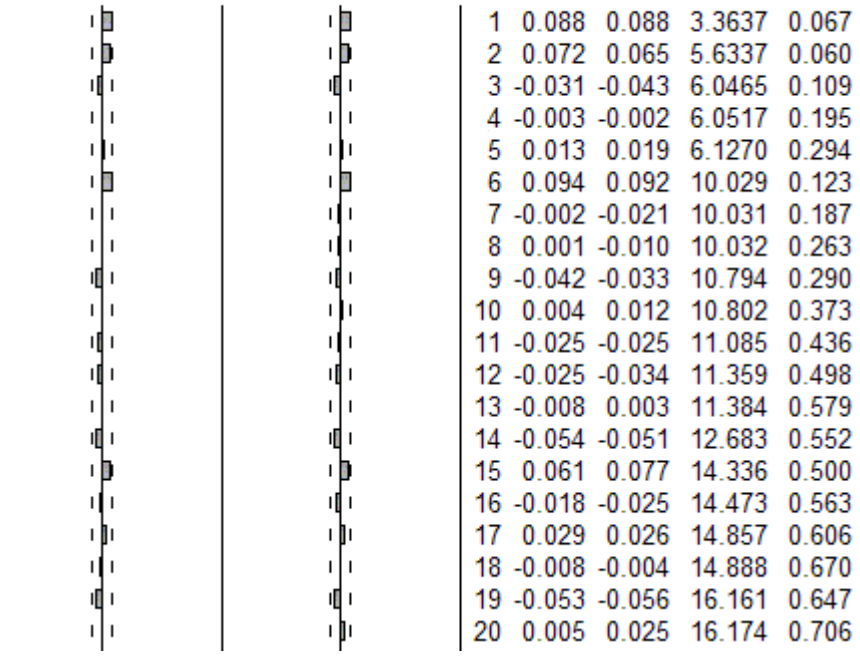


➢ Correlograma do resíduo padronizado



Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
		1	0.031	0.031	0.4109	0.522
		2	0.048	0.047	1.3985	0.497
		3	0.003	0.001	1.4034	0.705
		4	0.003	0.001	1.4071	0.843
		5	0.055	0.055	2.7440	0.739
		6	-0.107	-0.111	7.7643	0.256
		7	-0.010	-0.008	7.8082	0.350
		8	-0.014	-0.003	7.8958	0.444
		9	0.007	0.009	7.9190	0.542
		10	0.062	0.061	9.6410	0.473
		11	0.020	0.028	9.8094	0.548
		12	-0.011	-0.030	9.8627	0.628
		13	0.005	0.003	9.8733	0.704
		14	-0.015	-0.018	9.9764	0.764
		15	-0.045	-0.052	10.879	0.761
		16	-0.084	-0.070	14.018	0.597
		17	-0.037	-0.020	14.648	0.621
		18	-0.043	-0.038	15.472	0.629
		19	-0.046	-0.039	16.436	0.628
		20	-0.020	-0.015	16.619	0.678

- Correlograma do quadrado do resíduo padronizado



Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
		1	0.088	0.088	3.3637	0.067
		2	0.072	0.065	5.6337	0.060
		3	-0.031	-0.043	6.0465	0.109
		4	-0.003	-0.002	6.0517	0.195
		5	0.013	0.019	6.1270	0.294
		6	0.094	0.092	10.029	0.123
		7	-0.002	-0.021	10.031	0.187
		8	0.001	-0.010	10.032	0.263
		9	-0.042	-0.033	10.794	0.290
		10	0.004	0.012	10.802	0.373
		11	-0.025	-0.025	11.085	0.436
		12	-0.025	-0.034	11.359	0.498
		13	-0.008	0.003	11.384	0.579
		14	-0.054	-0.051	12.683	0.552
		15	0.061	0.077	14.336	0.500
		16	-0.018	-0.025	14.473	0.563
		17	0.029	0.026	14.857	0.606
		18	-0.008	-0.004	14.888	0.670
		19	-0.053	-0.056	16.161	0.647
		20	0.005	0.025	16.174	0.706

- Matriz Variância-Covariância

	A	B	C	tc	β	w	φ	ρ	α0	α1	α2
A	**140800.00**	-141960.00	798.0900	0.1754	-9.4025	31.3630	4.4667	-0.2015	-0.1114	-0.0681	0.0491
B	-141960.00	**144680.00**	-843.0700	-0.1743	9.3837	-33.2350	-12.1590	0.0774	0.2271	0.1244	-0.1010
C	798.0900	-843.0700	**398.0100**	0.0025	-0.0593	0.0250	-1.0036	0.0366	-0.0577	-0.0175	0.0166
tc	0.1754	-0.1743	0.0025	**0.00001**	0.0000	0.0007	-0.0002	0.0000	0.0000	0.0000	0.0000
β	-9.4025	9.3837	-0.0593	0.0000	**0.0009**	-0.0008	0.0012	0.0001	0.0001	0.0000	0.0000
w	31.3630	-33.2350	0.0250	0.0007	-0.0008	**0.1592**	0.1597	-0.0002	-0.0002	-0.0002	0.0002
φ	4.4667	-12.1590	-1.0036	-0.0002	0.0012	0.1597	**0.7752**	-0.0012	-0.0007	-0.0009	0.0008
ρ	-0.2015	0.0774	0.0366	0.0000	0.0001	-0.0002	-0.0012	**0.0002**	0.0000	0.0000	0.0000
α0	-0.1114	0.2271	-0.0577	0.0000	0.0001	-0.0002	-0.0007	0.0000	**0.0379**	0.0002	-0.0003
α1	-0.0681	0.1244	-0.0175	0.0000	0.0000	-0.0002	-0.0009	0.0000	0.0002	**0.0001**	-0.0001
α2	0.0491	-0.1010	0.0166	0.0000	0.0000	0.0002	0.0008	0.0000	-0.0003	-0.0001	**0.0001**