

Results of the Simulation Study of Random Effects AR(1) Model

Table 27: The results summarized from 1000 replications of the data of $N = 50$ individuals with each having $T = 10$ observations and with random effects

Par.	True	Est.	Bias.abs	Bias.rel	SE.emp	SE.avg	MSE	Cover	Conv
ψ	25	25.7250	0.7250	0.0290	2.0529	2.6109	23.0989	0.9616	0.6510
α	0.4	0.4653	0.0653	0.1633	0.0743	0.1269	0.0630	0.9908	
μ	15	13.3765	1.6235	0.1082	2.0088	3.2104	38.4738	0.9831	
$var(\alpha)$	0.02	0.0281	0.0081	0.4054	0.0166	0.0453	0.4119	0.9616	
$cov(\alpha, \mu)$	-0.5	-0.6987	0.1987	0.3975	0.4417	0.5566	1.1158	0.9739	
$var(\mu)$	30	29.4925	0.5075	0.0169	13.3329	15.3085	522.9579	0.9478	

Note: With the same notations as in Table 1.

Table 28: The results summarized from 1000 replications of the data of $N = 100$ individuals with each having $T = 10$ observations and with random effects

Par.	True	Est.	Bias.abs	Bias.rel	SE.emp	SE.avg	MSE	Cover	Conv
ψ	25	25.8072	0.8072	0.0323	1.4890	1.9969	56.0122	0.9642	0.8390
α	0.4	0.4748	0.0748	0.1871	0.0627	0.0981	0.1762	0.9893	
μ	15	13.1381	1.8619	0.1241	1.6385	2.4997	110.2215	0.9702	
$var(\alpha)$	0.02	0.0270	0.0070	0.3507	0.0126	0.0138	0.0007	0.9535	
$cov(\alpha, \mu)$	-0.5	-0.6761	0.1761	0.3522	0.3259	0.3596	0.4313	0.9595	
$var(\mu)$	30	28.5857	1.4143	0.0471	9.3152	10.5394	377.7922	0.9190	

Note: With the same notations as in Table 1.

Table 29: The results summarized from 1000 replications of the data of $N = 150$ individuals with each having $T = 10$ observations and with random effects

Par.	True	Est.	Bias.abs	Bias.rel	SE.emp	SE.avg	MSE	Cover	Conv
ψ	25	25.8944	0.8944	0.0358	1.2451	1.4949	6.2702	0.9553	0.9170
α	0.4	0.4823	0.0823	0.2058	0.0548	0.0727	0.0201	0.9651	
μ	15	12.9480	2.0520	0.1368	1.4076	1.8599	12.8131	0.9444	
$var(\alpha)$	0.02	0.0275	0.0075	0.3765	0.0105	0.0106	0.0003	0.8986	
$cov(\alpha, \mu)$	-0.5	-0.6883	0.1883	0.3766	0.2752	0.2778	0.2006	0.9029	
$var(\mu)$	30	28.3490	1.6510	0.0550	7.7542	8.3900	167.4362	0.9258	

Note: With the same notations as in Table 1.

Table 30: The results summarized from 1000 replications of the data of $N = 200$ individuals with each having $T = 10$ observations and with random effects

Par.	True	Est.	Bias.abs	Bias.rel	SE.emp	SE.avg	MSE	Cover	Conv
ψ	25	25.8878	0.8878	0.0355	1.1105	1.2427	4.0912	0.9448	0.9420
α	0.4	0.4837	0.0837	0.2091	0.0472	0.0602	0.0146	0.8694	
μ	15	12.9040	2.0960	0.1397	1.2135	1.5413	9.3320	0.8397	
$var(\alpha)$	0.02	0.0277	0.0077	0.3830	0.0092	0.0089	0.0002	0.8726	
$cov(\alpha, \mu)$	-0.5	-0.6891	0.1891	0.3782	0.2415	0.2338	0.1504	0.8907	
$var(\mu)$	30	28.2127	1.7873	0.0596	6.7353	6.9657	103.2224	0.9151	

Note: With the same notations as in Table 1.

Table 31: The results summarized from 1000 replications of the data of $N = 50$ individuals with each having $T = 15$ observations and with random effects

Par.	True	Est.	Bias.abs	Bias.rel	SE.emp	SE.avg	MSE	Cover	Conv
ψ	25	25.0735	0.0735	0.0029	1.4470	1.4294	4.1724	0.9459	0.8870
α	0.4	0.4223	0.0223	0.0557	0.0513	0.0516	0.0058	0.9357	0.8870
μ	15	14.4601	0.5399	0.0360	1.4278	1.4372	4.4288	0.9256	0.8870
$var(\alpha)$	0.02	0.0219	0.0019	0.0960	0.0134	0.0281	0.0975	0.9583	0.8870
$cov(\alpha, \mu)$	-0.5	-0.5522	0.0522	0.1044	0.3602	0.3800	0.4216	0.9628	0.8870
$var(\mu)$	30	29.3436	0.6564	0.0219	11.4016	11.1031	266.5692	0.9143	0.8870

Note: With the same notations as in Table 1.

Table 32: The results summarized from 1000 replications of the data of $N = 100$ individuals with each having $T = 15$ observations and with random effects

Par.	True	Est.	Bias.abs	Bias.rel	SE.emp	SE.avg	MSE	Cover	Conv
ψ	25	25.1442	0.1442	0.0058	0.9835	1.0195	2.0336	0.9567	0.9710
α	0.4	0.4218	0.0218	0.0546	0.0366	0.0362	0.0031	0.9135	0.9710
μ	15	14.4574	0.5426	0.0362	1.0191	1.0114	2.3630	0.9156	0.9710
$var(\alpha)$	0.02	0.0216	0.0016	0.0815	0.0101	0.0094	0.0002	0.9341	0.9710
$cov(\alpha, \mu)$	-0.5	-0.5400	0.0400	0.0799	0.2682	0.2557	0.1410	0.9434	0.9710
$var(\mu)$	30	29.1457	0.8543	0.0285	8.1827	7.7830	130.8041	0.9104	0.9710

Note: With the same notations as in Table 1.

Table 33: The results summarized from 1000 replications of the data of $N = 150$ individuals with each having $T = 15$ observations and with random effects

Par.	True	Est.	Bias.abs	Bias.rel	SE.emp	SE.avg	MSE	Cover	Conv
ψ	25	25.1393	0.1393	0.0056	0.8279	0.8339	1.4026	0.9567	0.9930
α	0.4	0.4228	0.0228	0.0569	0.0298	0.0296	0.0023	0.8862	0.9930
μ	15	14.4318	0.5682	0.0379	0.8286	0.8273	1.6967	0.8953	0.9930
$var(\alpha)$	0.02	0.0221	0.0021	0.1059	0.0084	0.0078	0.0001	0.9255	0.9930
$cov(\alpha, \mu)$	-0.5	-0.5516	0.0516	0.1033	0.2242	0.2106	0.0982	0.9335	0.9930
$var(\mu)$	30	29.3844	0.6156	0.0205	6.7599	6.4117	88.3230	0.9174	0.9930

Note: With the same notations as in Table 1.

Table 34: The results summarized from 1000 replications of the data of $N = 200$ individuals with each having $T = 15$ observations and with random effects

Par.	True	Est.	Bias.abs	Bias.rel	SE.emp	SE.avg	MSE	Cover	Conv
ψ	25	25.1307	0.1307	0.0052	0.7163	0.7231	1.0543	0.9570	0.9990
α	0.4	0.4227	0.0227	0.0566	0.0251	0.0257	0.0018	0.8679	0.9990
μ	15	14.4318	0.5682	0.0379	0.7010	0.7171	1.3299	0.8679	0.9990
$var(\alpha)$	0.02	0.0224	0.0024	0.1207	0.0073	0.0068	0.0001	0.9269	0.9990
$cov(\alpha, \mu)$	-0.5	-0.5582	0.0582	0.1165	0.1975	0.1835	0.0766	0.9279	0.9990
$var(\mu)$	30	29.5216	0.4784	0.0159	5.9158	5.5740	66.9291	0.9329	0.9990

Note: With the same notations as in Table 1.

Table 35: The results summarized from 1000 replications of the data of $N = 50$ individuals with each having $T = 20$ observations and with random effects

Par.	True	Est.	Bias.abs	Bias.rel	SE.emp	SE.avg	MSE	Cover	Conv
ψ	25	25.0196	0.0196	0.0008	1.1943	1.1939	2.8699	0.9515	0.9270
α	0.4	0.4113	0.0113	0.0283	0.0417	0.0416	0.0037	0.9299	0.9270
μ	15	14.7216	0.2784	0.0186	1.2463	1.2117	3.1165	0.9299	0.9270
$var(\alpha)$	0.02	0.0204	0.0004	0.0187	0.0115	0.0142	0.0109	0.9266	0.9270
$cov(\alpha, \mu)$	-0.5	-0.5077	0.0077	0.0154	0.3155	0.3031	0.2128	0.9288	0.9270
$var(\mu)$	30	28.9976	1.0024	0.0334	10.3666	9.7872	211.6219	0.8889	0.9270

Note: With the same notations as in Table 1.

Table 36: The results summarized from 1000 replications of the data of $N = 100$ individuals with each having $T = 20$ observations and with random effects

Par.	True	Est.	Bias.abs	Bias.rel	SE.emp	SE.avg	MSE	Cover	Conv
ψ	25	25.0533	0.0533	0.0021	0.8278	0.8515	1.4170	0.9538	0.9950
α	0.4	0.4106	0.0106	0.0264	0.0294	0.0292	0.0018	0.9307	0.9950
μ	15	14.7401	0.2599	0.0173	0.8566	0.8577	1.5412	0.9387	0.9950
$var(\alpha)$	0.02	0.0203	0.0003	0.0133	0.0087	0.0078	0.0001	0.8925	0.9950
$cov(\alpha, \mu)$	-0.5	-0.5055	0.0055	0.0109	0.2366	0.2148	0.1036	0.9085	0.9950
$var(\mu)$	30	29.1753	0.8247	0.0275	7.5241	6.9982	108.1816	0.9095	0.9950

Note: With the same notations as in Table 1.

Table 37: The results summarized from 1000 replications of the data of $N = 150$ individuals with each having $T = 20$ observations and with random effects

Par.	True	Est.	Bias.abs	Bias.rel	SE.emp	SE.avg	MSE	Cover	Conv
ψ	25	25.0553	0.0553	0.0022	0.6899	0.6965	0.9658	0.9510	1.0000
α	0.4	0.4104	0.0104	0.0261	0.0242	0.0239	0.0013	0.9180	1.0000
μ	15	14.7398	0.2602	0.0173	0.7075	0.7020	1.0627	0.9330	1.0000
$var(\alpha)$	0.02	0.0208	0.0008	0.0413	0.0070	0.0064	0.0001	0.9260	1.0000
$cov(\alpha, \mu)$	-0.5	-0.5199	0.0199	0.0399	0.1924	0.1783	0.0699	0.9260	1.0000
$var(\mu)$	30	29.5964	0.4036	0.0135	6.2131	5.8171	73.4876	0.9210	1.0000

Note: With the same notations as in Table 1.

Table 38: The results summarized from 1000 replications of the data of $N = 200$ individuals with each having $T = 20$ observations and with random effects

Par.	True	Est.	Bias.abs	Bias.rel	SE.emp	SE.avg	MSE	Cover	Conv
ψ	25	25.0465	0.0465	0.0019	0.5966	0.6041	0.7238	0.9400	1.0000
α	0.4	0.4103	0.0103	0.0257	0.0206	0.0208	0.0010	0.9160	1.0000
μ	15	14.7406	0.2594	0.0173	0.6046	0.6086	0.8041	0.9270	1.0000
$var(\alpha)$	0.02	0.0211	0.0011	0.0542	0.0061	0.0056	0.0001	0.9240	1.0000
$cov(\alpha, \mu)$	-0.5	-0.5264	0.0264	0.0528	0.1684	0.1555	0.0536	0.9310	1.0000
$var(\mu)$	30	29.7708	0.2292	0.0076	5.3907	5.0699	55.3104	0.9250	1.0000

Note: With the same notations as in Table 1.

Table 39: The results summarized from 1000 replications of the data of $N = 50$ individuals with each having $T = 30$ observations and with random effects

Par.	True	Est.	Bias.abs	Bias.rel	SE.emp	SE.avg	MSE	Cover	Conv
ψ	25	24.9791	0.0209	0.0008	0.9112	0.9429	1.7299	0.9532	0.9820
α	0.4	0.4037	0.0037	0.0092	0.0335	0.0333	0.0023	0.9328	0.9820
μ	15	14.9179	0.0821	0.0055	1.0496	1.0388	2.1984	0.9389	0.9820
$var(\alpha)$	0.02	0.0191	0.0009	0.0466	0.0093	0.0083	0.0002	0.8747	0.9820
$cov(\alpha, \mu)$	-0.5	-0.4746	0.0254	0.0508	0.2567	0.2380	0.1267	0.9002	0.9820
$var(\mu)$	30	28.7207	1.2793	0.0426	8.9197	8.5065	158.5300	0.8931	0.9820

Note: With the same notations as in Table 1.

Table 40: The results summarized from 1000 replications of the data of $N = 100$ individuals with each having $T = 30$ observations and with random effects

Par.	True	Est.	Bias.abs	Bias.rel	SE.emp	SE.avg	MSE	Cover	Conv
ψ	25	25.0079	0.0079	0.0003	0.6511	0.6732	0.8793	0.9580	0.9990
α	0.4	0.4038	0.0038	0.0095	0.0238	0.0237	0.0011	0.9449	0.9990
μ	15	14.9062	0.0938	0.0063	0.7335	0.7396	1.0965	0.9499	0.9990
$var(\alpha)$	0.02	0.0197	0.0003	0.0127	0.0067	0.0061	0.0001	0.9039	0.9990
$cov(\alpha, \mu)$	-0.5	-0.4923	0.0077	0.0155	0.1862	0.1747	0.0662	0.9109	0.9990
$var(\mu)$	30	29.3617	0.6383	0.0213	6.3595	6.1959	80.5969	0.9249	0.9990

Note: With the same notations as in Table 1.

Table 41: The results summarized from 1000 replications of the data of $N = 150$ individuals with each having $T = 30$ observations and with random effects

Par.	True	Est.	Bias.abs	Bias.rel	SE.emp	SE.avg	MSE	Cover	Conv
ψ	25	25.0043	0.0043	0.0002	0.5444	0.5515	0.6013	0.9530	1.0000
α	0.4	0.4038	0.0038	0.0095	0.0195	0.0194	0.0008	0.9340	1.0000
μ	15	14.9026	0.0974	0.0065	0.6060	0.6058	0.7448	0.9440	1.0000
$var(\alpha)$	0.02	0.0202	0.0002	0.0100	0.0053	0.0051	0.0001	0.9270	1.0000
$cov(\alpha, \mu)$	-0.5	-0.5043	0.0043	0.0085	0.1519	0.1454	0.0447	0.9120	1.0000
$var(\mu)$	30	29.7655	0.2345	0.0078	5.3867	5.1525	56.2781	0.9260	1.0000

Note: With the same notations as in Table 1.

Table 42: The results summarized from 1000 replications of the data of $N = 200$ individuals with each having $T = 30$ observations and with random effects

Par.	True	Est.	Bias.abs	Bias.rel	SE.emp	SE.avg	MSE	Cover	Conv
ψ	25	25.0002	0.0002	0.0000	0.4683	0.4782	0.4484	0.9550	1.0000
α	0.4	0.4037	0.0037	0.0092	0.0167	0.0169	0.0006	0.9420	1.0000
μ	15	14.9033	0.0967	0.0064	0.5233	0.5253	0.5598	0.9370	1.0000
$var(\alpha)$	0.02	0.0204	0.0004	0.0190	0.0047	0.0045	0.0000	0.9400	1.0000
$cov(\alpha, \mu)$	-0.5	-0.5092	0.0092	0.0184	0.1345	0.1269	0.0346	0.9230	1.0000
$var(\mu)$	30	29.9154	0.0846	0.0028	4.7252	4.4990	42.9557	0.9220	1.0000

Note: With the same notations as in Table 1.

Table 43: The results summarized from 1000 replications of the data of $N = 50$ individuals with each having $T = 40$ observations and with random effects

Par.	True	Est.	Bias.abs	Bias.rel	SE.emp	SE.avg	MSE	Cover	Conv
ψ	25	24.9809	0.0191	0.0008	0.7867	0.8084	1.2796	0.9599	0.9980
α	0.4	0.4018	0.0018	0.0045	0.0303	0.0298	0.0018	0.9409	0.9980
μ	15	14.9623	0.0377	0.0025	0.9812	0.9629	1.8998	0.9469	0.9980
$var(\alpha)$	0.02	0.0190	0.0010	0.0478	0.0081	0.0072	0.0001	0.8808	0.9980
$cov(\alpha, \mu)$	-0.5	-0.4715	0.0285	0.0571	0.2281	0.2100	0.0995	0.8818	0.9980
$var(\mu)$	30	28.6668	1.3332	0.0444	8.2016	7.8383	134.5448	0.8858	0.9980

Note: With the same notations as in Table 1.

Table 44: The results summarized from 1000 replications of the data of $N = 100$ individuals with each having $T = 40$ observations and with random effects

Par.	True	Est.	Bias.abs	Bias.rel	SE.emp	SE.avg	MSE	Cover	Conv
ψ	25	24.9987	0.0013	0.0001	0.5583	0.5757	0.6446	0.9480	1.0000
α	0.4	0.4019	0.0019	0.0049	0.0216	0.0212	0.0009	0.9450	1.0000
μ	15	14.9539	0.0461	0.0031	0.6917	0.6870	0.9545	0.9520	1.0000
$var(\alpha)$	0.02	0.0197	0.0003	0.0151	0.0057	0.0053	0.0001	0.9070	1.0000
$cov(\alpha, \mu)$	-0.5	-0.4906	0.0094	0.0189	0.1611	0.1543	0.0506	0.9220	1.0000
$var(\mu)$	30	29.4230	0.5770	0.0192	5.7528	5.7385	67.4163	0.9230	1.0000

Note: With the same notations as in Table 1.

Table 45: The results summarized from 1000 replications of the data of $N = 150$ individuals with each having $T = 40$ observations and with random effects

Par.	True	Est.	Bias.abs	Bias.rel	SE.emp	SE.avg	MSE	Cover	Conv
ψ	25	24.9999	0.0001	0.0000	0.4587	0.4722	0.4340	0.9570	1.0000
α	0.4	0.4019	0.0019	0.0047	0.0178	0.0174	0.0006	0.9360	1.0000
μ	15	14.9513	0.0487	0.0032	0.5665	0.5626	0.6406	0.9420	1.0000
$var(\alpha)$	0.02	0.0200	0.0000	0.0001	0.0045	0.0044	0.0000	0.9320	1.0000
$cov(\alpha, \mu)$	-0.5	-0.4985	0.0015	0.0030	0.1310	0.1281	0.0339	0.9340	1.0000
$var(\mu)$	30	29.7579	0.2421	0.0081	4.8533	4.7703	46.8981	0.9280	1.0000

Note: With the same notations as in Table 1.

Table 46: The results summarized from 1000 replications of the data of $N = 200$ individuals with each having $T = 40$ observations and with random effects

Par.	True	Est.	Bias.abs	Bias.rel	SE.emp	SE.avg	MSE	Cover	Conv
ψ	25	24.9998	0.0002	0.0000	0.3996	0.4096	0.3277	0.9540	1.0000
α	0.4	0.4019	0.0019	0.0048	0.0152	0.0151	0.0005	0.9430	1.0000
μ	15	14.9474	0.0526	0.0035	0.4891	0.4878	0.4803	0.9360	1.0000
$var(\alpha)$	0.02	0.0202	0.0002	0.0078	0.0039	0.0039	0.0000	0.9410	1.0000
$cov(\alpha, \mu)$	-0.5	-0.5027	0.0027	0.0055	0.1152	0.1119	0.0260	0.9330	1.0000
$var(\mu)$	30	29.8802	0.1198	0.0040	4.2455	4.1644	35.6872	0.9260	1.0000

Note: With the same notations as in Table 1.

Table 47: The results summarized from 1000 replications of the data of $N = 50$ individuals with each having $T = 50$ observations and with random effects

Par.	True	Est.	Bias.abs	Bias.rel	SE.emp	SE.avg	MSE	Cover	Conv
ψ	25	25.0053	0.0053	0.0002	0.7076	0.7187	1.0226	0.9510	1.0000
α	0.4	0.4012	0.0012	0.0030	0.0281	0.0277	0.0016	0.9440	1.0000
μ	15	14.9782	0.0218	0.0015	0.9353	0.9186	1.7268	0.9480	1.0000
$var(\alpha)$	0.02	0.0191	0.0009	0.0461	0.0072	0.0066	0.0001	0.8780	1.0000
$cov(\alpha, \mu)$	-0.5	-0.4723	0.0277	0.0555	0.2032	0.1932	0.0815	0.8930	1.0000
$var(\mu)$	30	28.7054	1.2946	0.0432	7.6668	7.4392	119.3558	0.9060	1.0000

Note: With the same notations as in Table 1.

Table 48: The results summarized from 1000 replications of the data of $N = 100$ individuals with each having $T = 50$ observations and with random effects

Par.	True	Est.	Bias.abs	Bias.rel	SE.emp	SE.avg	MSE	Cover	Conv
ψ	25	25.0009	0.0009	0.0000	0.4993	0.5110	0.5116	0.9500	1.0000
α	0.4	0.4014	0.0014	0.0034	0.0201	0.0198	0.0008	0.9340	1.0000
μ	15	14.9672	0.0328	0.0022	0.6598	0.6560	0.8686	0.9450	1.0000
$var(\alpha)$	0.02	0.0197	0.0003	0.0131	0.0050	0.0048	0.0000	0.9180	1.0000
$cov(\alpha, \mu)$	-0.5	-0.4905	0.0095	0.0190	0.1446	0.1422	0.0418	0.9230	1.0000
$var(\mu)$	30	29.4151	0.5849	0.0195	5.4197	5.4597	60.4943	0.9270	1.0000

Note: With the same notations as in Table 1.

Table 49: The results summarized from 1000 replications of the data of $N = 150$ individuals with each having $T = 50$ observations and with random effects

Par.	True	Est.	Bias.abs	Bias.rel	SE.emp	SE.avg	MSE	Cover	Conv
ψ	25	24.9986	0.0014	0.0001	0.4094	0.4195	0.3441	0.9560	1.0000
α	0.4	0.4011	0.0011	0.0029	0.0167	0.0162	0.0005	0.9360	1.0000
μ	15	14.9698	0.0302	0.0020	0.5464	0.5380	0.5896	0.9470	1.0000
$var(\alpha)$	0.02	0.0200	0.0000	0.0001	0.0041	0.0040	0.0000	0.9310	1.0000
$cov(\alpha, \mu)$	-0.5	-0.4981	0.0019	0.0038	0.1192	0.1180	0.0284	0.9320	1.0000
$var(\mu)$	30	29.7884	0.2116	0.0071	4.5840	4.5399	42.1584	0.9270	1.0000

Note: With the same notations as in Table 1.

Table 50: The results summarized from 1000 replications of the data of $N = 200$ individuals with each having $T = 50$ observations and with random effects

Par.	True	Est.	Bias.abs	Bias.rel	SE.emp	SE.avg	MSE	Cover	Conv
ψ	25	25.0007	0.0007	0.0000	0.3606	0.3639	0.2626	0.9560	1.0000
α	0.4	0.4012	0.0012	0.0030	0.0143	0.0141	0.0004	0.9460	1.0000
μ	15	14.9667	0.0333	0.0022	0.4704	0.4665	0.4404	0.9380	1.0000
$var(\alpha)$	0.02	0.0201	0.0001	0.0054	0.0035	0.0035	0.0000	0.9360	1.0000
$cov(\alpha, \mu)$	-0.5	-0.5013	0.0013	0.0027	0.1051	0.1028	0.0218	0.9300	1.0000
$var(\mu)$	30	29.8922	0.1078	0.0036	4.0312	3.9576	32.2012	0.9290	1.0000

Note: With the same notations as in Table 1.