

**Table A1: Simulation results for different weights factor copula model  
with N=10, W=I**

	$\nu_z^{-1}$	$\lambda_z$	$\beta_1$	$\beta_2$	$\beta_3$	$\beta_4$	$\beta_5$	$\beta_6$	$\beta_7$	$\beta_8$	$\beta_9$	$\beta_{10}$
True value	0.25	-0.5	0.25	0.5	0.75	1	1.25	1.5	1.75	2	2.25	2.5
Normal												
Bias	-	-	-0.0001	-0.0033	-0.0085	0.0004	0.0034	0.0119	0.0075	-0.0031	0.0071	-0.0902
Std	-	-	0.0337	0.0448	0.0535	0.0753	0.0991	0.1089	0.1243	0.1669	0.2061	0.2243
Median	-	-	0.2500	0.4920	0.7466	0.9831	1.2365	1.5021	1.7509	1.9932	2.2281	2.3963
90%	-	-	0.2949	0.5588	0.8032	1.1013	1.3919	1.6698	1.9289	2.1878	2.5385	2.6649
10%	-	-	0.2064	0.4369	0.6727	0.9180	1.1513	1.3938	1.6059	1.7796	1.9910	2.1087
90-10 diff	-	-	0.0886	0.1219	0.1305	0.1833	0.2407	0.2761	0.3229	0.4081	0.5476	0.5562
t(4)-Normal												
Bias	-0.0032	-	-0.0008	0.0089	0.0022	0.0089	0.0118	0.0133	0.0004	0.0107	0.0195	0.0487
Std	0.0474	-	0.0468	0.0596	0.0798	0.0874	0.1111	0.1482	0.1991	0.2068	0.3063	0.3472
Median	0.2468	-	0.2490	0.5046	0.7344	1.0104	1.2639	1.4930	1.7313	1.9750	2.2259	2.5285
90%	0.2941	-	0.3079	0.5869	0.8475	1.0968	1.4107	1.6629	1.9567	2.2495	2.5667	2.7873
10%	0.1845	-	0.1879	0.4394	0.6692	0.9085	1.1244	1.3755	1.5623	1.7729	1.9852	2.2032
90-10 diff	0.1096	-	0.1200	0.1475	0.1782	0.1883	0.2863	0.2874	0.3943	0.4766	0.5815	0.5841
Skew t(4,-0.5)-Normal												
Bias	-0.0020	-0.0032	0.0042	0.0034	0.0024	0.0175	0.0293	0.0187	0.0308	0.0355	0.0739	0.1035
Std	0.0481	0.0594	0.0527	0.0593	0.0812	0.1215	0.1270	0.1404	0.1857	0.2292	0.3335	0.3639
Median	0.2474	-0.5017	0.2507	0.4962	0.7430	1.0137	1.2635	1.5152	1.7547	2.0018	2.2757	2.5508
90%	0.3119	-0.4283	0.3226	0.5830	0.8570	1.1679	1.4554	1.7246	2.0268	2.3648	2.7511	3.0743
10%	0.1825	-0.5868	0.1863	0.4340	0.6522	0.8765	1.1469	1.3595	1.5586	1.7609	2.0021	2.2101
90-10 diff	0.1293	0.1586	0.1363	0.1491	0.2048	0.2914	0.3085	0.3651	0.4682	0.6039	0.7490	0.8642

**Table A2: Simulation results for different weights factor copula model  
with N=10, W=optimal**

	$\nu_z^{-1}$	$\lambda_z$	$\beta_1$	$\beta_2$	$\beta_3$	$\beta_4$	$\beta_5$	$\beta_6$	$\beta_7$	$\beta_8$	$\beta_9$	$\beta_{10}$
True value	0.25	-0.5	0.25	0.5	0.75	1	1.25	1.5	1.75	2	2.25	2.5
Normal												
Bias	-	-	-0.0304	-0.0253	-0.0197	-0.0242	-0.0325	-0.0315	-0.0454	-0.0581	-0.0596	-0.0871
Std	-	-	0.0535	0.0410	0.0525	0.0605	0.0641	0.0788	0.0857	0.0978	0.0953	0.1192
Median	-	-	0.2227	0.4794	0.7290	0.9794	1.2114	1.4779	1.7018	1.9403	2.1812	2.4031
90%	-	-	0.2762	0.5185	0.7938	1.0515	1.3109	1.5692	1.8301	2.0783	2.3176	2.5703
10%	-	-	0.1722	0.4209	0.6638	0.9057	1.1395	1.3620	1.5948	1.8123	2.0809	2.2665
90-10 diff	-	-	0.1040	0.0976	0.1300	0.1458	0.1714	0.2072	0.2353	0.2660	0.2367	0.3038
t(4)-Normal												
Bias	-0.0405	-	-0.0241	-0.0224	-0.0351	-0.0408	-0.0530	-0.0684	-0.0712	-0.0971	-0.1210	-0.1195
Std	0.0607	-	0.0466	0.0601	0.0715	0.0931	0.1193	0.1352	0.1881	0.1756	0.2046	0.2203
Median	0.2086	-	0.2286	0.4727	0.7082	0.9394	1.1816	1.4083	1.6381	1.8670	2.0894	2.3503
90%	0.2629	-	0.2811	0.5515	0.8116	1.0613	1.3281	1.5826	1.9200	2.1332	2.3521	2.6717
10%	0.1438	-	0.1642	0.4111	0.6367	0.8515	1.0602	1.2982	1.4833	1.7163	1.9083	2.1203
90-10 diff	0.1191	-	0.1169	0.1404	0.1749	0.2098	0.2679	0.2844	0.4367	0.4169	0.4438	0.5514
Skew t(4,-0.5)-Normal												
Bias	-0.0086	-0.0389	-0.0084	-0.0128	-0.0067	0.0075	0.0014	-0.0029	-0.0127	-0.0184	-0.0095	0.0051
Std	0.0496	0.0675	0.0480	0.0551	0.0816	0.1108	0.1209	0.1289	0.1956	0.2079	0.2680	0.2788
Median	0.2482	-0.5326	0.2404	0.4814	0.7390	0.9928	1.2295	1.4721	1.7087	1.9537	2.1688	2.4487
90%	0.2898	-0.4605	0.2993	0.5586	0.8256	1.1433	1.3845	1.6769	1.9767	2.2569	2.5245	2.8424
10%	0.1791	-0.6349	0.1865	0.4268	0.6506	0.8752	1.1275	1.3569	1.5622	1.7658	2.0016	2.2634
90-10 diff	0.1107	0.1744	0.1128	0.1318	0.1750	0.2681	0.2570	0.3199	0.4145	0.4911	0.5229	0.5790

**Table A3: Simulation results for different weights factor copula model  
with N=100, W=optimal**

	$\nu_z^{-1}$	$\lambda_z$	$\beta_1$	$\beta_2$	$\beta_3$	$\beta_4$	$\beta_5$	$\beta_6$	$\beta_7$	$\beta_8$	$\beta_9$	$\beta_{10}$
True value	0.25	-0.5	0.25	0.5	0.75	1	1.25	1.5	1.75	2	2.25	2.5
Normal												
Bias	-	-	-0.0099	-0.0172	-0.0229	-0.0319	-0.0389	-0.0481	-0.0586	-0.0612	-0.0768	-0.0836
Std	-	-	0.0128	0.0184	0.0242	0.0322	0.0372	0.0454	0.0502	0.0590	0.0622	0.0753
Median	-	-	0.2414	0.4844	0.7259	0.9665	1.2129	1.4507	1.6918	1.9428	2.1678	2.4170
90%	-	-	0.2554	0.5037	0.7574	1.0121	1.2577	1.5105	1.7527	2.0149	2.2589	2.5083
10%	-	-	0.2244	0.4594	0.6970	0.9304	1.1606	1.3983	1.6246	1.8676	2.0960	2.3241
90-10 diff	-	-	0.0311	0.0443	0.0603	0.0818	0.0971	0.1122	0.1281	0.1473	0.1629	0.1842
t(4)-Normal												
Bias	-0.0683	-	-0.0208	-0.0403	-0.0601	-0.0812	-0.1052	-0.1248	-0.1481	-0.1674	-0.1934	-0.2194
Std	0.0524	-	0.0160	0.0287	0.0402	0.0524	0.0674	0.0802	0.0952	0.1058	0.1220	0.1299
Median	0.1820	-	0.2277	0.4567	0.6842	0.9106	1.1377	1.3694	1.5795	1.8226	2.0378	2.2733
90%	0.2452	-	0.2511	0.4982	0.7402	0.9932	1.2320	1.4817	1.7291	1.9630	2.2169	2.4542
10%	0.1183	-	0.2096	0.4208	0.6476	0.8534	1.0665	1.2843	1.5051	1.7154	1.9190	2.1357
90-10 diff	0.1268	-	0.0415	0.0774	0.0926	0.1398	0.1655	0.1974	0.2240	0.2476	0.2979	0.3185
Skew t(4,-0.5)-Normal												
Bias	-0.0335	-0.0391	-0.0139	-0.0273	-0.0403	-0.0556	-0.0713	-0.0868	-0.1022	-0.1149	-0.1330	-0.1500
Std	0.0363	0.0482	0.0150	0.0251	0.0370	0.0476	0.0598	0.0729	0.0825	0.0969	0.1099	0.1221
Median	0.2263	-0.5434	0.2367	0.4719	0.7105	0.9381	1.1796	1.4150	1.6414	1.8823	2.1237	2.3574
90%	0.2582	-0.4719	0.2568	0.5059	0.7567	1.0007	1.2524	1.5053	1.7545	2.0035	2.2631	2.5148
10%	0.1693	-0.6029	0.2168	0.4424	0.6611	0.8823	1.1015	1.3199	1.5542	1.7725	1.9882	2.1904
90-10 diff	0.0889	0.1310	0.0400	0.0634	0.0956	0.1185	0.1509	0.1854	0.2003	0.2311	0.2749	0.3245

**Table A4: 95% Coverage rate for different weights factor copula model  
with N=10 AR-GARCH data W=I**

	$\nu_z^{-1}$	$\lambda_z$	$\beta_1$	$\beta_2$	$\beta_3$	$\beta_4$	$\beta_5$	$\beta_6$	$\beta_7$	$\beta_8$	$\beta_9$	$\beta_{10}$
Normal												
$\varepsilon_T$												
0.1	-	-	96	93	91	95	93	96	96	95	97	89
0.03	-	-	96	92	91	94	93	97	96	96	96	89
0.01	-	-	96	92	91	94	92	97	96	96	96	89
0.003	-	-	96	91	90	94	89	94	97	92	95	88
0.001	-	-	96	93	90	93	90	93	92	84	87	79
0.0003	-	-	90	83	85	75	75	76	74	67	74	67
0.0001	-	-	81	70	70	65	65	66	66	57	65	59
t(4)-Normal												
$\varepsilon_T$												
0.1	96	-	92	97	98	95	94	96	92	94	92	95
0.03	92	-	92	97	97	94	93	97	94	93	94	96
0.01	93	-	92	97	97	93	94	97	92	95	94	96
0.003	91	-	87	94	95	95	91	95	94	90	95	95
0.001	81	-	86	92	91	91	88	89	91	88	84	87
0.0003	76	-	80	82	78	86	76	84	79	71	78	77
0.0001	76	-	81	65	74	77	74	76	64	65	65	79
Skew t(4,-0.5)-Normal												
$\varepsilon_T$												
0.1	96	94	92	97	95	93	98	98	95	94	97	97
0.03	93	95	91	97	95	93	97	98	95	94	95	98
0.01	91	91	91	96	95	92	96	97	94	93	91	91
0.003	88	91	91	96	94	88	92	96	91	88	87	85
0.001	83	86	86	93	94	85	88	88	82	73	72	81
0.0003	73	70	75	86	81	73	80	73	72	60	65	71
0.0001	68	57	68	77	68	66	69	67	68	61	65	74

**Table A5: 95% Coverage rate for different weights factor copula model  
with N=10 AR-GARCH data W=optimal**

	$\nu_z^{-1}$	$\lambda_z$	$\beta_1$	$\beta_2$	$\beta_3$	$\beta_4$	$\beta_5$	$\beta_6$	$\beta_7$	$\beta_8$	$\beta_9$	$\beta_{10}$
Normal												
$\varepsilon_T$												
0.1	-	-	80	80	81	79	81	80	80	85	91	80
0.03	-	-	80	80	81	79	81	81	80	83	91	80
0.01	-	-	77	80	81	78	80	80	79	82	90	76
0.003	-	-	77	78	80	77	78	78	78	75	90	75
0.001	-	-	73	74	77	70	74	76	69	72	76	62
0.0003	-	-	63	62	67	66	63	70	62	56	71	58
0.0001	-	-	50	53	59	47	57	57	58	57	71	69
t(4)-Normal												
$\varepsilon_T$												
0.1	74	-	81	80	74	77	69	63	70	71	73	71
0.03	69	-	82	80	72	75	65	62	64	66	69	67
0.01	57	-	78	78	68	70	64	56	56	63	62	62
0.003	46	-	78	76	65	62	59	50	51	52	56	54
0.001	38	-	75	69	55	51	51	50	41	43	43	47
0.0003	35	-	66	55	43	42	39	43	32	35	39	39
0.0001	32	-	62	47	38	44	45	41	36	36	46	49
Skew t(4,-0.5)-Normal												
$\varepsilon_T$												
0.1	88	81	90	89	89	89	95	93	89	90	94	96
0.03	82	77	88	88	84	83	89	89	81	84	85	89
0.01	80	75	89	88	80	78	82	86	76	79	84	82
0.003	69	68	84	86	74	71	78	79	69	69	68	74
0.001	61	51	78	83	71	62	70	74	64	62	59	63
0.0003	55	36	67	70	62	57	55	65	57	46	54	62
0.0001	50	37	67	64	57	50	54	57	60	52	59	65

**Table A6: 95% Coverage rate for different weights factor copula model with N=100 AR-GARCH data W=optimal**

	$\nu_z^{-1}$	$\lambda_z$	$\beta_1$	$\beta_2$	$\beta_3$	$\beta_4$	$\beta_5$	$\beta_6$	$\beta_7$	$\beta_8$	$\beta_9$	$\beta_{10}$
Normal												
$\varepsilon_T$												
0.1	-	-	78	67	62	55	60	60	57	58	51	54
0.03	-	-	78	67	62	55	60	60	56	58	51	53
0.01	-	-	77	67	62	52	59	61	55	56	49	52
0.003	-	-	77	67	61	51	56	52	52	53	47	50
0.001	-	-	76	63	58	50	56	48	47	50	42	47
0.0003	-	-	71	58	49	37	42	36	37	40	35	33
0.0001	-	-	67	50	39	34	33	27	33	33	26	25
t(4)-Normal												
$\varepsilon_T$												
0.1	48	-	58	44	37	37	36	36	32	37	34	33
0.03	46	-	54	42	36	35	30	32	29	33	29	29
0.01	44	-	54	40	33	30	27	29	27	32	26	26
0.003	30	-	51	36	29	24	22	20	19	25	22	20
0.001	21	-	47	32	25	21	17	16	14	19	15	14
0.0003	12	-	44	27	22	17	12	10	13	13	11	8
0.0001	6	-	38	21	17	14	11	9	10	8	9	8
Skew t(4,-0.5)-Normal												
$\varepsilon_T$												
0.1	75	73	79	76	70	69	68	65	67	68	69	65
0.03	75	71	78	72	69	63	62	62	63	62	64	63
0.01	71	68	75	63	66	60	58	60	59	60	58	57
0.003	57	60	70	56	55	46	47	46	45	47	49	43
0.001	51	44	67	49	43	35	33	32	28	30	27	30
0.0003	45	25	63	40	33	27	21	22	14	19	18	21
0.0001	34	15	58	36	27	22	16	16	12	10	13	15

**Table A7: Overidentifying restriction test with  $W=optimal$** 

	t(4)- Normal	Skew t(4,-0.5)- Normal	t(4)- Normal	Skew t(4,-0.5)- Normal		
	Equidependce, N=3			Different loading, N=3		
90%	92	92	93	93	96	97
95%	95	95	99	97	98	98
99%	100	98	100	98	100	99
	Equidependce, N=10			Different loading, N=10		
90%	96	92	93	91	95	97
95%	97	94	96	93	98	98
99%	99	96	100	95	99	99
	Equidependce, N=100			Different loading, N=100		
90%	90	89	93	94	90	96
95%	95	92	98	94	95	99
99%	97	96	100	98	99	100