

Robust Wavelet-based Assessment of Scaling with Applications

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APPENDIX B: Simulation Results from Section 3.3

We present here the rest of the simulation results described in Section 3.3. The paper contains tables for $H = 0.5$, here we provide the results for $H = 0.3, 0.4, 0.6$ and 0.7 .

Tables 7 through 14 summarize estimations of H and MSEs under four different wavelet filters, in the non-contaminated and contaminated 1-D fBm realizations. Tables 15 through 22 summarize the same results from 2-D fBm realizations. As explained earlier, cells highlighted with underline represent lowest bias, and the gray cells indicate the cases with lowest MSE.

Table 7: Estimations of H and MSEs for $H = 0.3$ under four different wavelet filters, in the non-contaminated case.

		Haar	Coiflet4	Daub6	Symmlet8
OLS	H	0.223	0.253	0.255	0.251
	MSE	0.013	0.012	0.010	0.011
AV	H	0.191	0.218	0.219	0.216
	MSE	0.017	0.011	0.011	0.011
TT	H	0.230	0.259	0.260	0.256
	MSE	0.010	0.007	0.007	0.007

Table 8: Estimations of H and MSEs for $H = 0.3$ under four different wavelet filters, in the contaminated case.

		Haar	Coiflet4	Daub6	Symmlet8
OLS	H	0.314	0.325	0.323	0.332
	MSE	0.013	0.013	0.013	0.014
AV	H	0.232	0.251	0.246	0.252
	MSE	0.010	0.007	0.009	0.007
TT	H	0.288	0.302	0.302	0.309
	MSE	0.008	0.006	0.007	0.006

Table 9: Estimations of H and MSEs for $H = 0.4$ under four different wavelet filters, in the non-contaminated case.

		Haar	Coiflet4	Daub6	Symmlet8
OLS	H	0.348	0.345	0.336	0.402
	MSE	0.011	0.009	0.015	0.008
AV	H	0.329	0.331	0.322	0.353
	MSE	0.010	0.008	0.012	0.007
TT	H	0.364	0.363	0.354	0.397
	MSE	0.007	0.005	0.009	0.005

Table 10: Estimations of H and MSEs for $H = 0.4$ under four different wavelet filters, in the contaminated case.

		Haar	Coiflet4	Daub6	Symmlet8
OLS	H	0.452	0.449	0.442	0.446
	MSE	0.016	0.014	0.015	0.015
AV	H	0.371	0.370	0.374	0.367
	MSE	0.007	0.006	0.007	0.006
TT	H	0.416	0.423	0.426	0.415
	MSE	0.008	0.007	0.010	0.007

Table 11: Estimations of H and MSEs for $H = 0.6$ under four different wavelet filters, in the non-contaminated case.

		Haar	Coiflet4	Daub6	Symmlet8
OLS	H	0.534	0.526	0.544	0.554
	MSE	0.016	0.014	0.012	0.011
AV	H	0.528	0.462	0.520	0.532
	MSE	0.012	0.027	0.013	0.010
TT	H	0.557	0.511	0.555	0.566
	MSE	0.010	0.015	0.009	0.007

Table 12: Estimations of H and MSEs for $H = 0.6$ under four different wavelet filters, in the contaminated case.

		Haar	Coiflet4	Daub6	Symmlet8
OLS	H	0.628	0.596	0.598	0.612
	MSE	0.016	0.014	0.012	0.012
AV	H	0.568	0.457	0.530	0.494
	MSE	0.007	0.028	0.011	0.017
TT	H	0.615	0.531	0.576	0.561
	MSE	0.008	0.012	0.008	0.008

Table 13: Estimations of H and MSEs for $H = 0.7$ under four different wavelet filters, in the non-contaminated case.

		Haar	Coiflet4	Daub6	Symmlet8
OLS	H	0.662	0.572	0.567	0.592
	MSE	0.008	0.027	0.028	0.021
AV	H	0.653	0.507	0.553	0.527
	MSE	0.006	0.051	0.030	0.041
TT	H	0.683	0.556	0.585	0.577
	MSE	0.005	0.032	0.022	0.025

Table 14: Estimations of H and MSEs for $H = 0.7$ under four different wavelet filters, in the contaminated case.

		Haar	Coiflet4	Daub6	Symmlet8
OLS	H	0.733	0.603	0.616	0.636
	MSE	0.011	0.020	0.017	0.014
AV	H	0.678	0.438	0.536	0.489
	MSE	0.005	0.075	0.032	0.053
TT	H	0.719	0.522	0.584	0.562
	MSE	0.007	0.038	0.020	0.027

Table 15: Estimations of H and MSEs for $H = 0.3$ from three directions; under four different wavelet filters, in the non-contaminated case.

		Haar			Coiflet4		
		diagonal	horizontal	vertical	diagonal	horizontal	vertical
OLS	H	<u>0.213</u>	<u>0.266</u>	<u>0.260</u>	<u>0.252</u>	<u>0.319</u>	<u>0.317</u>
	MSE	0.008	0.002	0.003	0.003	0.002	0.002
AV	H	<u>0.111</u>	<u>0.231</u>	<u>0.227</u>	<u>0.168</u>	<u>0.249</u>	<u>0.249</u>
	MSE	0.036	0.005	0.006	0.018	0.003	0.003
TT	H	<u>0.141</u>	<u>0.243</u>	<u>0.238</u>	<u>0.193</u>	<u>0.263</u>	<u>0.262</u>
	MSE	0.025	0.004	0.004	0.012	0.002	0.002

		Daub6			Symmlet8		
		diagonal	horizontal	vertical	diagonal	horizontal	vertical
OLS	H	<u>0.244</u>	<u>0.316</u>	<u>0.317</u>	<u>0.253</u>	<u>0.316</u>	<u>0.325</u>
	MSE	0.004	0.002	0.002	0.003	0.002	0.003
AV	H	<u>0.160</u>	<u>0.281</u>	<u>0.282</u>	<u>0.166</u>	<u>0.254</u>	<u>0.258</u>
	MSE	0.020	0.001	0.001	0.018	0.002	0.002
TT	H	<u>0.186</u>	<u>0.293</u>	<u>0.293</u>	<u>0.192</u>	<u>0.267</u>	<u>0.271</u>
	MSE	0.013	0.001	0.001	0.012	0.002	0.001

Table 16: Estimations of H and MSEs for $H = 0.3$ from three directions; under four different wavelet filters, in the contaminated case.

		Haar			Coiflet4		
		diagonal	horizontal	vertical	diagonal	horizontal	vertical
OLS	H	<u>0.312</u>	<u>0.362</u>	<u>0.356</u>	<u>0.356</u>	<u>0.409</u>	<u>0.424</u>
	MSE	0.002	0.006	0.005	0.005	0.014	0.018
AV	H	<u>0.122</u>	<u>0.244</u>	<u>0.242</u>	<u>0.181</u>	<u>0.260</u>	<u>0.260</u>
	MSE	0.032	0.003	0.004	0.014	0.002	0.002
TT	H	<u>0.164</u>	<u>0.265</u>	<u>0.264</u>	<u>0.217</u>	<u>0.283</u>	<u>0.285</u>
	MSE	0.019	0.002	0.002	0.007	0.001	0.001

		Daub6			Symmlet8		
		diagonal	horizontal	vertical	diagonal	horizontal	vertical
OLS	H	<u>0.346</u>	<u>0.418</u>	<u>0.414</u>	<u>0.353</u>	<u>0.415</u>	<u>0.413</u>
	MSE	0.003	0.017	0.015	0.004	0.016	0.015
AV	H	<u>0.175</u>	<u>0.299</u>	<u>0.294</u>	<u>0.182</u>	<u>0.265</u>	<u>0.266</u>
	MSE	0.016	0.001	0.001	0.014	0.002	0.001
TT	H	<u>0.211</u>	<u>0.320</u>	<u>0.316</u>	<u>0.217</u>	<u>0.288</u>	<u>0.288</u>
	MSE	0.008	0.002	0.001	0.007	0.001	0.000

Table 17: Estimations of H and MSEs for $H = 0.4$ from three directions; under four different wavelet filters, in the non-contaminated case.

		Haar			Coiflet4		
		diagonal	horizontal	vertical	diagonal	horizontal	vertical
OLS	H	<u>0.334</u>	<u>0.375</u>	<u>0.375</u>	<u>0.372</u>	<u>0.413</u>	<u>0.414</u>
	MSE	0.005	0.002	0.002	0.002	0.002	0.002
AV	H	0.254	0.353	0.354	0.311	0.342	0.340
	MSE	0.021	0.003	0.003	0.008	0.004	0.004
TT	H	0.278	0.361	0.362	0.329	0.352	0.350
	MSE	0.015	0.002	0.002	0.005	0.003	0.003

		Daub6			Symmlet8		
		diagonal	horizontal	vertical	diagonal	horizontal	vertical
OLS	H	<u>0.369</u>	<u>0.401</u>	<u>0.406</u>	<u>0.373</u>	<u>0.421</u>	<u>0.411</u>
	MSE	0.002	0.002	0.001	0.002	0.002	0.002
AV	H	0.306	0.385	0.387	0.313	0.350	0.349
	MSE	0.009	0.001	0.001	0.008	0.003	0.003
TT	H	0.326	0.393	<u>0.395</u>	0.331	0.360	0.358
	MSE	0.006	0.001	0.001	0.005	0.002	0.002

Table 18: Estimations of H and MSEs for $H = 0.4$ from three directions; under four different wavelet filters, in the contaminated case.

		Haar			Coiflet4		
		diagonal	horizontal	vertical	diagonal	horizontal	vertical
OLS	H	<u>0.437</u>	0.478	0.474	0.476	0.516	0.520
	MSE	0.003	0.008	0.007	0.007	0.015	0.016
AV	H	0.267	0.368	0.368	0.324	0.355	0.351
	MSE	0.018	0.001	0.001	0.006	0.002	0.003
TT	H	0.303	<u>0.386</u>	<u>0.387</u>	<u>0.353</u>	<u>0.375</u>	<u>0.372</u>
	MSE	0.010	0.001	0.001	0.002	0.001	0.001

		Daub6			Symmlet8		
		diagonal	horizontal	vertical	diagonal	horizontal	vertical
OLS	H	0.465	0.511	0.509	0.472	0.511	0.520
	MSE	0.006	0.015	0.014	0.007	0.015	0.016
AV	H	0.318	<u>0.403</u>	<u>0.406</u>	0.326	0.361	0.363
	MSE	0.007	0.001	0.001	0.006	0.002	0.002
TT	H	<u>0.348</u>	0.422	0.425	<u>0.353</u>	<u>0.380</u>	<u>0.382</u>
	MSE	0.003	0.001	0.001	0.002	0.001	0.001

Table 19: Estimations of H and MSEs for $H = 0.6$ from three directions; under four different wavelet filters, in the non-contaminated case.

		Haar			Coiflet4		
		diagonal	horizontal	vertical	diagonal	horizontal	vertical
OLS	H	0.556	0.584	0.575	0.604	0.510	0.512
	MSE	0.003	0.002	0.003	0.001	0.009	0.008
AV	H	0.506	0.574	0.572	0.559	0.383	0.381
	MSE	0.009	0.001	0.002	0.002	0.051	0.052
TT	H	0.522	0.579	0.575	0.571	0.396	0.393
	MSE	0.006	0.001	0.002	0.001	0.046	0.047

		Daub6			Symmlet8		
		diagonal	horizontal	vertical	diagonal	horizontal	vertical
OLS	H	0.595	0.507	0.506	0.597	0.518	0.519
	MSE	0.001	0.010	0.010	0.001	0.008	0.008
AV	H	0.558	0.484	0.481	0.557	0.400	0.400
	MSE	0.002	0.014	0.015	0.002	0.044	0.044
TT	H	0.570	0.492	0.490	0.568	0.410	0.410
	MSE	0.001	0.012	0.013	0.001	0.039	0.040

Table 20: Estimations of H and MSEs for $H = 0.6$ from three directions; under four different wavelet filters, in the contaminated case.

		Haar			Coiflet4		
		diagonal	horizontal	vertical	diagonal	horizontal	vertical
OLS	H	0.653	0.666	0.668	0.702	0.617	0.607
	MSE	0.004	0.007	0.007	0.012	0.002	0.002
AV	H	0.516	0.585	0.586	0.572	0.402	0.382
	MSE	0.007	0.001	0.001	0.001	0.045	0.051
TT	H	0.543	0.599	0.598	0.594	0.424	0.405
	MSE	0.003	0.001	0.001	0.000	0.036	0.041

		Daub6			Symmlet8		
		diagonal	horizontal	vertical	diagonal	horizontal	vertical
OLS	H	0.696	0.606	0.598	0.700	0.621	0.616
	MSE	0.011	0.002	0.002	0.011	0.002	0.001
AV	H	0.570	0.495	0.493	0.571	0.423	0.408
	MSE	0.001	0.012	0.012	0.001	0.034	0.040
TT	H	0.593	0.513	0.511	0.593	0.443	0.430
	MSE	0.000	0.008	0.009	0.000	0.027	0.032

Table 21: Estimations of H and MSEs for $H = 0.7$ from three directions; under four different wavelet filters, in the non-contaminated case.

		Haar			Coiflet4		
		diagonal	horizontal	vertical	diagonal	horizontal	vertical
OLS	H	0.664	0.675	0.682	0.709	0.517	0.527
	MSE	0.002	0.003	0.003	0.001	0.035	0.032
AV	H	0.620	0.676	0.680	0.670	0.346	0.362
	MSE	0.007	0.002	0.002	0.001	0.130	0.121
TT	H	0.634	0.678	0.683	0.680	0.361	0.377
	MSE	0.005	0.002	0.002	0.001	0.120	0.110

		Daub6			Symmlet8		
		diagonal	horizontal	vertical	diagonal	horizontal	vertical
OLS	H	0.711	0.517	0.516	0.703	0.533	0.527
	MSE	0.002	0.036	0.036	0.001	0.030	0.031
AV	H	0.676	0.486	0.485	0.670	0.382	0.377
	MSE	0.001	0.047	0.048	0.001	0.106	0.109
TT	H	0.687	0.496	0.495	0.679	0.395	0.389
	MSE	0.001	0.043	0.044	0.001	0.098	0.101

Table 22: Estimations of H and MSEs for $H = 0.7$ from three directions; under four different wavelet filters, in the contaminated case.

		Haar			Coiflet4		
		diagonal	horizontal	vertical	diagonal	horizontal	vertical
OLS	H	0.762	0.768	0.771	0.810	0.626	0.628
	MSE	0.005	0.007	0.007	0.014	0.008	0.008
AV	H	0.632	0.691	0.693	0.684	0.373	0.373
	MSE	0.005	0.001	0.001	0.000	0.112	0.113
TT	H	0.658	0.702	0.705	0.703	0.399	0.399
	MSE	0.002	0.001	0.001	0.000	0.096	0.097

		Daub6			Symmlet8		
		diagonal	horizontal	vertical	diagonal	horizontal	vertical
OLS	H	0.808	0.611	0.616	0.802	0.633	0.628
	MSE	0.013	0.010	0.010	0.012	0.007	0.007
AV	H	0.688	0.499	0.496	0.685	0.402	0.395
	MSE	0.000	0.042	0.043	0.000	0.094	0.098
TT	H	0.706	0.519	0.515	0.704	0.425	0.418
	MSE	0.000	0.034	0.036	0.000	0.080	0.084