

Appendix A: The Seven Criterion

In this appendix we check the robustness of our results. The choice of which countries enter which group is currently arbitrary. Therefore we present the results of the experiment according to seven separate criterions:

Criterion 1: Group 1 – The countries defined as developed in Table 1.

Group 2 – All other countries.

Criterion 2: Group 1 – Same as criterion 1 with the addition of Israel.

Group 2 – All other countries.

Criterion 3: Group 1 – Countries whose income per worker is above the sample median.

Group 2 – All other countries.

Criterion 4: Group 1 – Countries whose income per worker is above the sample mean.

Group 2 – All other countries.

Criterion 5: Group 1 – Countries from node 4 in Durlauf and Johnson (1995, p. 374).

Group 2 – All other countries.

Criterion 6: Group 1 – OECD membership in 1965.

Group 2 – All other countries.

Criterion 7: Group 1 – OECD membership in 1990.

Group 2 – All other countries.

There is no reason to present the results for Tables 1 and 2 because these do not change. In what follows we will present the results for the Simar-Zelenyuk adapted Li Tests for equality of efficiency distributions across groups as well as the group-wise heterogeneous sub-sampling bootstrap for aggregate efficiency results.

		Group 1 vs. Group 2		1965 vs. 1990 for	
		In 1965	In 1990	Group 1	Group 2
Criterion 1	Test statistics	4.5394	3.9755	-0.3453	-0.0295
	p-values	0.0002	0.0012	0.6260	0.9666
Criterion 2	Test statistics	4.9387	3.4819	-0.2302	-0.0987
	p-values	0.0006	0.0050	0.7534	0.8974
Criterion 3	Test statistics	5.7657	6.4979	-0.4108	0.2594
	p-values	0.0000	0.0000	0.5508	0.7182
Criterion 4	Test statistics	5.9334	5.6100	-0.3218	0.1247
	p-values	0.0000	0.0004	0.6318	0.8628
Criterion 5	Test statistics	5.1416	3.7494	0.1200	0.2122
	p-values	0.0004	0.0018	0.8742	0.7800
Criterion 6	Test statistics	2.8567	2.2098	-0.0787	-0.1102
	p-values	0.0030	0.0136	0.9228	0.8832
Criterion 7	Test statistics	4.6101	3.3296	-0.0321	-0.1578
	p-values	0.0008	0.0028	0.9700	0.8268

Notes: The results for criterion 1 are slightly different from the results in the main text due to randomness in the bootstrap procedure. The same methods that were used to calculate Table 3 were used to calculate the above table.

Table A.1: Simar-Zelenyuk Adapted Li-Tests for the Equality of Efficiency Distributions Across Groups

The results in Table A.1 are not significantly different from those in the main text. The distributions of efficiency scores between groups 1 and 2 are significantly different in each time period. Further, the distributions of the efficiency scores within each group do not significantly differ over time regardless of the criterion employed.

Now that we have seen that the distributions were unaffected by the criterion, we attempt to show that the stories for the aggregate efficiencies are also left unchanged. Tables A.2 and A.3 show the results for each criterion in the years 1965 and 1990 respectively. From first glance it is obvious that the majority of the conclusions do not change amongst the criterion. The only noticeable change is in the confidence bound of the weighted measures. Whereas criteria 1, 2, 5, 6 and 7 note that group 1 cannot be

		DEA	Bias	Estimated	Standard	Confidence Bounds	
		Estimates	Corrected	Bias	Error	Lower	Upper
Criterion 1	Group 1 (weighted)	1.1884	1.2168	-0.0284	0.1289	0.8988	1.3601
	Group 2 (weighted)	1.8274	2.0690	-0.2417	0.3163	1.4509	2.5444
	All (weighted)	1.2954	1.3515	-0.0561	0.1470	0.9984	1.5409
	Group 1 (unweighted)	1.3024	1.3943	-0.0920	0.0785	1.2337	1.5314
	Group 2 (unweighted)	1.9734	2.1949	-0.2214	0.2463	1.6513	2.6114
	All (unweighted)	1.6766	1.8420	-0.1653	0.1425	1.5252	2.0865
	Eff1/Eff2 (weighted)	0.6503	0.5397	0.1106	0.1730	0.1865	0.8044
	Eff1/Eff2 (unweighted)	0.6599	0.6159	0.0441	0.1059	0.3887	0.8066
Criterion 2	Group 1 (weighted)	1.1874	1.2118	-0.0245	0.1316	0.8757	1.3568
	Group 2 (weighted)	1.8252	2.0799	-0.2548	0.3139	1.4600	2.5507
	All (weighted)	1.2954	1.3575	-0.0621	0.1454	0.9951	1.5444
	Group 1 (unweighted)	1.2874	1.3724	-0.0851	0.0776	1.2132	1.5110
	Group 2 (unweighted)	1.9621	2.1844	-0.2223	0.2347	1.6606	2.5727
	All (unweighted)	1.6766	1.8523	-0.1757	0.1355	1.5547	2.0820
	Eff1/Eff2 (weighted)	0.6505	0.5310	0.1195	0.1748	0.1460	0.8055
	Eff1/Eff2 (unweighted)	0.6561	0.6090	0.0471	0.1028	0.3995	0.7941
Criterion 3	Group 1 (weighted)	1.1240	1.1569	-0.0329	0.0594	1.0095	1.2336
	Group 2 (weighted)	2.0295	2.2504	-0.2209	0.2862	1.7813	2.8664
	All (weighted)	1.2954	1.3445	-0.0492	0.1496	0.9809	1.5413
	Group 1 (unweighted)	1.2730	1.3597	-0.0867	0.0684	1.2170	1.4772
	Group 2 (unweighted)	2.0802	2.3122	-0.2320	0.2609	1.7372	2.7536
	All (unweighted)	1.6766	1.8359	-0.1593	0.1356	1.5412	2.0737
	Eff1/Eff2 (weighted)	0.5538	0.4877	0.0661	0.1132	0.1982	0.6444
	Eff1/Eff2 (unweighted)	0.6119	0.5696	0.0423	0.0968	0.3821	0.7487
Criterion 4	Group 1 (weighted)	1.1170	1.1511	-0.0341	0.0585	1.0016	1.2226
	Group 2 (weighted)	2.0095	2.2571	-0.2476	0.2581	1.8032	2.7833
	All (weighted)	1.2954	1.3547	-0.0593	0.1447	1.0100	1.5414
	Group 1 (unweighted)	1.2241	1.3046	-0.0806	0.0598	1.1775	1.4050
	Group 2 (unweighted)	2.0355	2.2689	-0.2333	0.2426	1.7415	2.6745
	All (unweighted)	1.6766	1.8438	-0.1672	0.1382	1.5473	2.0781
	Eff1/Eff2 (weighted)	0.5559	0.4827	0.0731	0.1056	0.2319	0.6384
	Eff1/Eff2 (unweighted)	0.6014	0.5571	0.0443	0.0902	0.3670	0.7195
Criterion 5	Group 1 (weighted)	1.1221	1.1537	-0.0316	0.0642	0.9921	1.2343
	Group 2 (weighted)	1.8116	2.0323	-0.2208	0.2728	1.4683	2.4981
	All (weighted)	1.2954	1.3691	-0.0738	0.1359	1.0285	1.5434
	Group 1 (unweighted)	1.2123	1.2948	-0.0825	0.0602	1.1680	1.3906
	Group 2 (unweighted)	1.9440	2.1533	-0.2093	0.2181	1.6720	2.5172
	All (unweighted)	1.6766	1.8538	-0.1772	0.1366	1.5461	2.0886
	Eff1/Eff2 (weighted)	0.6194	0.5317	0.0878	0.1355	0.2429	0.7524
	Eff1/Eff2 (unweighted)	0.6236	0.5861	0.0375	0.0867	0.4052	0.7405

Criterion 6	Group 1 (weighted)	1.1886	1.2089	-0.0204	0.1293	0.8851	1.3585
	Group 2 (weighted)	1.7657	1.9937	-0.2280	0.2985	1.3694	2.4022
	All (weighted)	1.2954	1.3549	-0.0596	0.1455	0.9957	1.5443
	Group 1 (unweighted)	1.3012	1.3764	-0.0752	0.0828	1.2008	1.5200
	Group 2 (unweighted)	1.9112	2.1146	-0.2034	0.2187	1.6345	2.4880
	All (unweighted)	1.6766	1.8483	-0.1716	0.1317	1.5650	2.0764
	Eff1/Eff2 (weighted)	0.6732	0.5584	0.1147	0.1730	0.1837	0.8376
	Eff1/Eff2 (unweighted)	0.6808	0.6323	0.0485	0.1032	0.4208	0.8203
Criterion 7	Group 1 (weighted)	1.1936	1.2169	-0.0233	0.1310	0.8871	1.3664
	Group 2 (weighted)	1.8284	2.0798	-0.2513	0.3252	1.4571	2.5540
	All (weighted)	1.2954	1.3483	-0.0529	0.1534	0.9876	1.5401
	Group 1 (unweighted)	1.3082	1.3976	-0.0894	0.0809	1.2354	1.5465
	Group 2 (unweighted)	1.9688	2.1889	-0.2201	0.2340	1.6781	2.5892
	All (unweighted)	1.6766	1.8400	-0.1634	0.1366	1.5364	2.0827
	Eff1/Eff2 (weighted)	0.6528	0.5324	0.1204	0.1763	0.1518	0.8081
	Eff1/Eff2 (unweighted)	0.6645	0.6200	0.0445	0.1020	0.4112	0.8085

Notes: The results for criterion 1 are slightly different from the results in the main text due to randomness in the bootstrap procedure. The same methods that were used to calculate Table 4 were used to calculate the above table.

Table A.2: Group-Wise Heterogeneous Sub-Sampling Bootstrap for Aggregate Efficiencies (1965)

rejected as fully efficient in 1965, the other criteria fail to find the same result (although all of the lower bounds are near unity). At the same time, only criteria 1, 2, 3, 6 and 7 shows that all the countries grouped together are considered technically efficient when the weights are used. This finding suggests that the results for 1965 are more or less invariant to the criterion chosen.

The results from Table A.3 are even more homogenous. Here we do not see any of the main conclusions of the paper change. For example, Group 1 in each scenario is now significantly different from unity. This again suggests that the weighted Group 1 went from efficient to inefficient, as a group, from 1965 to 1990. This result is invariant to which criterion we use.

This appendix has attempted to show that the criterion used to group the countries does not significantly alter the conclusions of the paper. However, there are many alternative groups we could have chosen. We leave this task to future research. However, one question that may arise is why do we only choose two groups? We address this issue in the following appendix.

		DEA	Bias	Estimated	Standard	Confidence Bounds	
		Estimates	Corrected	Bias	Error	Lower	Upper
Criterion 1	Group 1 (weighted)	1.2187	1.3102	-0.0915	0.1082	1.0446	1.4294
	Group 2 (weighted)	1.7739	2.0765	-0.3026	0.2229	1.6173	2.4786
	All (weighted)	1.3416	1.4706	-0.129	0.1233	1.1917	1.6474
	Group 1 (unweighted)	1.2715	1.3824	-0.1109	0.0665	1.2390	1.4933
	Group 2 (unweighted)	1.9374	2.2627	-0.3253	0.2134	1.8224	2.6617
	All (unweighted)	1.6429	1.8743	-0.2314	0.1224	1.6285	2.1010
	Eff1/Eff2 (weighted)	0.6871	0.5903	0.0967	0.1400	0.2766	0.8160
	Eff1/Eff2 (unweighted)	0.6563	0.5799	0.0765	0.1066	0.3485	0.7650
Criterion 2	Group 1 (weighted)	1.2188	1.3035	-0.0847	0.1106	1.0402	1.4279
	Group 2 (weighted)	1.7665	2.0710	-0.3045	0.2204	1.6017	2.4646
	All (weighted)	1.3416	1.4711	-0.1295	0.1193	1.2111	1.6467
	Group 1 (unweighted)	1.2747	1.3830	-0.1083	0.0676	1.2390	1.4977
	Group 2 (unweighted)	1.9128	2.2344	-0.3216	0.2065	1.8483	2.6300
	All (unweighted)	1.6429	1.8833	-0.2404	0.1182	1.6549	2.1088
	Eff1/Eff2 (weighted)	0.6900	0.5859	0.1040	0.1465	0.2521	0.8157
	Eff1/Eff2 (unweighted)	0.6664	0.5870	0.0794	0.1090	0.3395	0.7642
Criterion 3	Group 1 (weighted)						
	Group 2 (weighted)	1.7916	2.0616	-0.2700	0.1900	1.6484	2.4755
	All (weighted)	1.3416	1.4664	-0.1247	0.1219	1.1908	1.6389
	Group 1 (unweighted)	1.3230	1.4487	-0.1257	0.0866	1.2415	1.5796
	Group 2 (unweighted)	1.9627	2.2983	-0.3356	0.2089	1.8847	2.6749
	All (unweighted)	1.6429	1.8735	-0.2306	0.1172	1.6328	2.0924
	Eff1/Eff2 (weighted)	0.6451	0.5639	0.0812	0.0984	0.3192	0.7319
	Eff1/Eff2 (unweighted)	0.6741	0.6007	0.0733	0.1055	0.3714	0.7773
Criterion 4	Group 1 (weighted)	1.1470	1.2160	-0.0691	0.0532	1.0842	1.2859
	Group 2 (weighted)	1.7888	2.0531	-0.2643	0.1844	1.6767	2.4659
	All (weighted)	1.3416	1.4631	-0.1215	0.1224	1.1930	1.6414
	Group 1 (unweighted)	1.2694	1.3871	-0.1178	0.0635	1.2482	1.4920
	Group 2 (unweighted)	1.9391	2.2636	-0.3245	0.1983	1.8531	2.6466
	All (unweighted)	1.6429	1.8769	-0.2341	0.1168	1.6448	2.1026
	Eff1/Eff2 (weighted)	0.6412	0.5650	0.0762	0.0933	0.3269	0.7279
	Eff1/Eff2 (unweighted)	0.6546	0.5856	0.0690	0.0940	0.3837	0.7457
Criterion 5	Group 1 (weighted)	1.1494	1.2136	-0.0642	0.0604	1.0731	1.2913
	Group 2 (weighted)	1.6760	1.9293	-0.2533	0.1854	1.5227	2.2716
	All (weighted)	1.3416	1.4761	-0.1345	0.1171	1.2159	1.6449
	Group 1 (unweighted)	1.2949	1.4212	-0.1263	0.0694	1.2721	1.5370
	Group 2 (unweighted)	1.8432	2.1419	-0.2987	0.1916	1.7222	2.4834
	All (unweighted)	1.6429	1.8874	-0.2446	0.1223	1.6288	2.1080
	Eff1/Eff2 (weighted)	0.6858	0.5957	0.0901	0.1115	0.3421	0.7873
	Eff1/Eff2 (unweighted)	0.7025	0.6373	0.0653	0.1018	0.4185	0.8174

Criterion 6	Group 1 (weighted)	1.2219	1.3019	-0.0800	0.1125	1.0321	1.4345
	Group 2 (weighted)	1.7338	2.0124	-0.2786	0.2087	1.5708	2.3769
	All (weighted)	1.3416	1.4670	-0.1254	0.1170	1.1898	1.6411
	Group 1 (unweighted)	1.2690	1.3729	-0.1039	0.0696	1.2205	1.4886
	Group 2 (unweighted)	1.8765	2.1587	-0.2822	0.2031	1.7287	2.5204
	All (unweighted)	1.6429	1.8721	-0.2293	0.1225	1.6130	2.0919
	Eff1/Eff2 (weighted)	0.7047	0.6090	0.0957	0.1371	0.3103	0.8390
	Eff1/Eff2 (unweighted)	0.6763	0.6102	0.0661	0.1020	0.3910	0.7902
Criterion 7	Group 1 (weighted)	1.2259	1.3105	-0.0846	0.1128	1.0407	1.4424
	Group 2 (weighted)	1.7762	2.0808	-0.3046	0.2316	1.6017	2.4804
	All (weighted)	1.3416	1.4645	-0.1228	0.1275	1.1607	1.6464
	Group 1 (unweighted)	1.2897	1.4042	-0.1145	0.0715	1.2498	1.5273
	Group 2 (unweighted)	1.9229	2.2455	-0.3226	0.2114	1.8056	2.6313
	All (unweighted)	1.6429	1.8743	-0.2315	0.1249	1.6176	2.1015
	Eff1/Eff2 (weighted)	0.6902	0.5860	0.1042	0.1444	0.2689	0.8232
	Eff1/Eff2 (unweighted)	0.6707	0.5947	0.0760	0.1054	0.3647	0.7768

Notes: The results for criterion 1 are slightly different from the results in the main text due to randomness in the bootstrap procedure. The same methods that were used to calculate Table 5 were used to calculate the above table.

Table A.3: Group-Wise Heterogeneous Sub-Sampling Bootstrap for Aggregate Efficiencies (1990)