APPENDICES FOR

"Bias-Corrected Production Frontiers: Application to Productivity Growth and Convergence"

Appendix A 1965−2000, H&R sample less Germany, Hong Kong, Iceland, Israel, Sri Lanka, Sierra Leone, and Taiwan

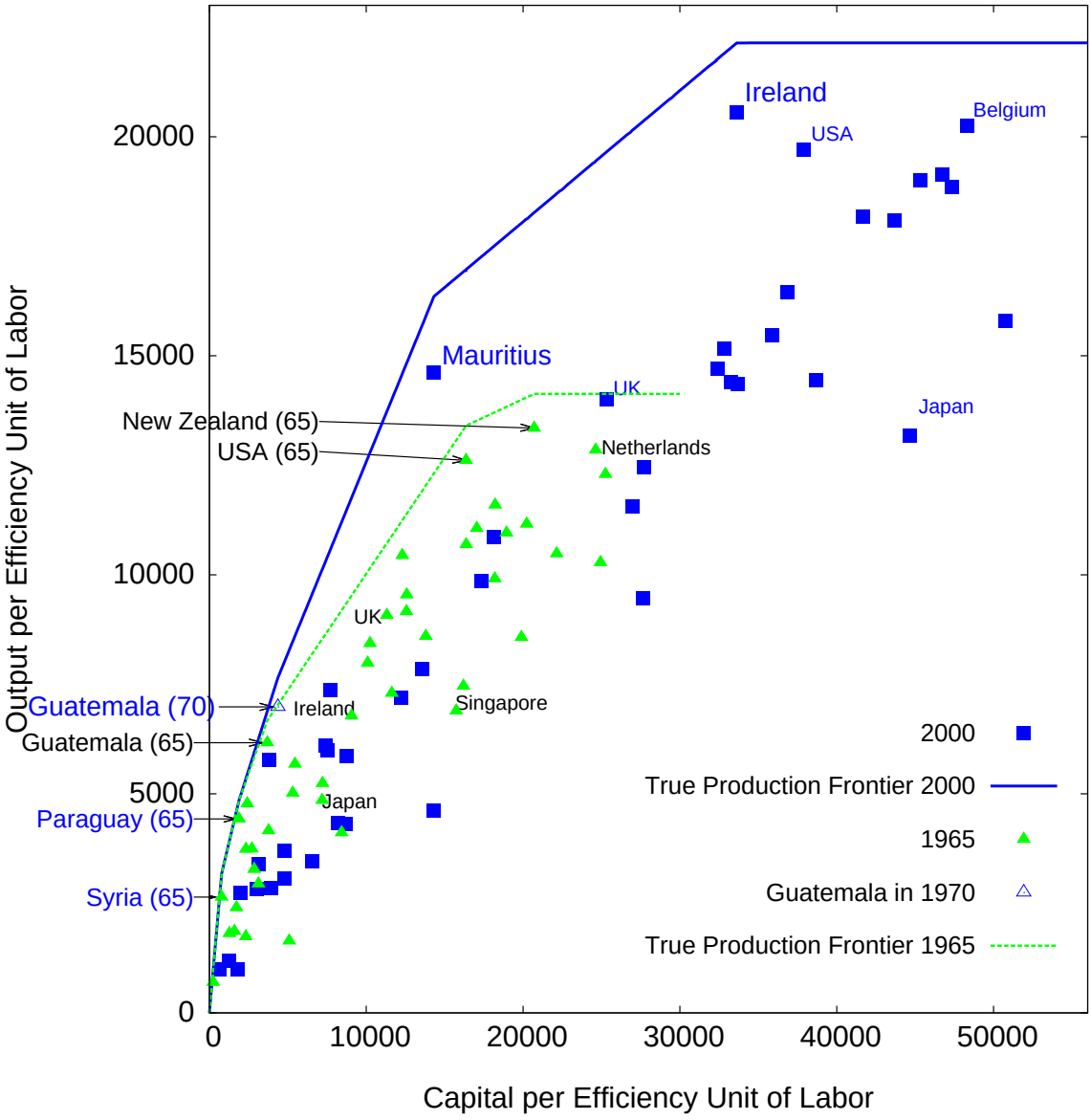

Figure A.1: Estimated "true" best-practice world production frontiers and scatterplots of the data for 1965 and 2000

Table A.1: Efficiency scores, 1965−2000, H&R Sample

#	Country	eff_b	eff_b^{bc}	eff_b^{true}	eff_c	eff_c^{bc}	eff_c^{true}
1	Argentina	0.990	0.955	0.930	0.687	0.666	0.648
2	Australia	0.767	0.730	0.724	0.698	0.662	0.662
3	Austria	0.760	0.728	0.715	0.918	0.891	0.870
4	Belgium	0.839	0.799	0.793	0.986	0.957	0.934
5	Bolivia	0.670	0.620	0.619	0.509	0.488	0.471
6	Canada	0.897	0.854	0.847	0.705	0.670	0.668
7	Chile	0.595	0.562	0.561	0.634	0.612	0.598
8	Colombia	0.804	0.765	0.746	0.650	0.633	0.613
9	Denmark	0.869	0.823	0.820	0.753	0.721	0.714
10	Dominican Republic	0.966	0.909	0.887	0.767	0.748	0.724
11	Ecuador	0.480	0.463	0.448	0.416	0.405	0.392
12	Finland	0.649	0.616	0.613	0.703	0.678	0.666
13	France	0.848	0.799	0.799	0.925	0.897	0.876
14	Greece	0.715	0.691	0.671	0.625	0.610	0.591
15	Guatemala	1.000	0.924	0.924	0.901	0.868	0.839
16	Honduras	0.717	0.676	0.660	0.418	0.402	0.394
17	India	0.527	0.474	0.462	0.596	0.573	0.552
18	Ireland	0.762	0.736	0.713	1.000	0.948	0.948
19	Italy	0.785	0.746	0.742	0.880	0.854	0.834
20	Jamaica	0.659	0.633	0.614	0.396	0.384	0.374
21	Japan	0.611	0.587	0.569	0.641	0.622	0.608
22	Kenya	0.470	0.430	0.422	0.352	0.320	0.307
23	Korea	0.575	0.528	0.521	0.506	0.493	0.479
24	Malawi	0.829	0.719	0.688	0.442	0.377	0.367
25	Mauritius	0.893	0.860	0.839	1.000	0.941	0.941
26	Mexico	0.888	0.858	0.832	0.558	0.530	0.525
27	Netherlands	0.963	0.919	0.910	0.885	0.857	0.839
28	New Zealand	1.000	0.945	0.945	0.665	0.649	0.630
29	Norway	0.770	0.735	0.728	0.931	0.903	0.882
30	Panama	0.718	0.682	0.666	0.552	0.530	0.520
31	Paraguay	1.000	0.914	0.914	0.634	0.617	0.598
32	Peru	0.561	0.531	0.528	0.433	0.422	0.409
33	Philippines	0.611	0.575	0.562	0.503	0.483	0.474
34	Portugal	0.847	0.820	0.794	0.747	0.712	0.708
35	Spain	0.858	0.827	0.806	0.800	0.768	0.758
36	Sweden	0.841	0.797	0.795	0.729	0.697	0.691
37	Switzerland	0.921	0.879	0.870	0.769	0.746	0.729
38	Syria	1.000	0.830	0.830	0.605	0.562	0.554
39	Thailand	0.359	0.337	0.329	0.317	0.299	0.299
40	Turkey	0.769	0.722	0.706	0.563	0.549	0.531

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Table A.1 (*Continued*)

#	Country	eff_b	eff_b^{bc}	eff_b^{true}	eff_c	eff_c^{bc}	eff_c^{true}
41	United States	1.000	0.943	0.943	0.958	0.923	0.908
42	United Kingdom	0.904	0.873	0.848	0.778	0.760	0.735
43	Zambia	0.239	0.226	0.222	0.229	0.211	0.208
44	Zimbabwe	0.524	0.490	0.482	0.436	0.420	0.407
	Average	0.860	0.815	0.807	0.788	0.761	0.746

Table A.2: Efficiency scores and percentage change of tripartite decomposition indexes, 1965−2000

#	Country	productivity change	EFF−1 × 100	TECH−1 × 100	KACC−1 × 100	HACC−1 × 100
1	Argentina	24.9	−30.3	23.1	31.3	11.0
2	Australia	72.8	−8.5	37.1	18.9	15.9
3	Austria	160.6	21.6	38.9	38.2	11.6
4	Belgium	125.2	17.8	37.5	18.0	17.8
5	Bolivia	0.5	−24.0	1.4	6.6	22.2
6	Canada	52.9	−21.1	36.8	19.1	19.0
7	Chile	70.4	6.5	21.6	11.5	18.1
8	Colombia	43.7	−17.8	12.4	34.9	15.4
9	Denmark	65.5	−12.9	36.6	20.8	15.2
10	Dominican Republic	109.7	−18.3	7.8	103.5	17.0
11	Ecuador	45.8	−12.5	17.5	22.6	15.5
12	Finland	119.4	8.7	37.9	17.6	24.5
13	France	121.7	9.7	36.3	25.4	18.3
14	Greece	108.3	−12.0	30.4	51.3	19.9
15	Guatemala	33.8	−9.1	1.8	18.5	22.2
16	Honduras	11.9	−40.3	4.2	50.6	19.4
17	India	170.3	19.4	0.5	82.9	23.1
18	Ireland	260.5	33.0	34.9	78.4	12.6
19	Italy	131.1	12.4	40.0	15.6	27.1
20	Jamaica	−10.6	−39.1	13.7	11.3	16.1
21	Japan	223.5	6.8	32.6	101.7	13.3
22	Kenya	−2.4	−27.2	0.0	9.0	23.0
23	Korea	513.6	−8.2	18.4	305.9	39.1
24	Malawi	86.7	−46.7	0.0	238.5	3.4
25	Mauritius	125.7	12.2	25.2	33.3	20.5
26	Mexico	31.4	−36.8	23.0	44.2	17.2
27	Netherlands	66.5	−7.8	43.0	10.9	13.9
28	New Zealand	11.1	−33.4	32.0	9.5	15.4
29	Norway	124.8	21.2	43.4	11.2	16.3
30	Panama	99.1	−22.0	16.3	89.5	15.8
31	Paraguay	68.9	−34.6	7.4	116.4	11.1
32	Peru	−12.0	−22.6	19.6	−18.0	15.9
33	Philippines	50.3	−15.7	4.2	45.5	17.6
34	Portugal	168.4	−10.9	35.1	75.9	26.6
35	Spain	133.6	−5.9	38.1	51.4	18.8
36	Sweden	54.0	−13.1	36.7	14.0	13.7
37	Switzerland	41.7	−16.3	43.8	8.9	8.0
38	Syria	72.0	−33.3	0.0	125.3	14.4
39	Thailand	324.0	−9.3	12.6	213.9	32.3

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Table A.2 (*Continued*)

#	Country	productivity change	EFF−1 × 100	TECH−1 × 100	KACC−1 × 100	HACC−1 × 100
40	Turkey	132.4	−24.7	8.8	134.7	20.8
41	United States	80.2	−3.7	36.2	21.9	12.7
42	United Kingdom	95.7	−13.3	28.5	50.0	17.1
43	Zambia	−20.0	−6.0	4.3	−29.4	15.6
44	Zimbabwe	47.5	−15.7	2.0	34.2	27.9
	Average	96.2	−11.0	22.3	54.0	18.0

Table A.3: Mean percentage changes of the quadripartite decomposition indices (country groupings)

Country Group	Productivity Change	EFF−1 ×100	TECH−1 ×100	KACC−1 ×100	HACC−1 ×100
OECD [A.3a]	110.2	−8.0	38.1	40.3	17.9
Non−OECD	50.5	−22.2	11.6	47.5	17.5
Asian Tigers [A.3b]	345.5	−3.2	27.8	187.2	25.4
Latin America [A.3c]	36.3	−25.0	14.7	36.2	16.3
Africa [A.3d]	37.1	−20.3	7.6	36.2	17.5
EU 15 [A.3e]	118.4	−1.0	40.8	32.7	18.2
Asia [A.3f]	170.1	−12.2	5.5	137.1	23.0

[A.3a] Australia, Austria, Belgium, Canada, Denmark, Finland, France, Greece, Ireland, Italy, Japan, Korea, Mexico, Netherlands, New Zealand, Norway, Portugal, Spain, Sweden, Switzerland, Turkey, United Kingdom, and United States.

[A.3b] Japan and Korea.

[A.3c] Argentina, Bolivia, Chile, Colombia, Dominican Republic, Ecuador, Guatemala, Honduras, Jamaica, Panama, Paraguay, Peru, and Philippines.

[A.3d] Kenya, Malawi, Mauritius, Zambia, and Zimbabwe.

[A.3e] Austria, Belgium, Denmark, Finland, France, Greece, Ireland, Italy, Netherlands, Portugal, Spain, Sweden, and United Kingdom.

[A.3f] India, Syria, and Thailand.

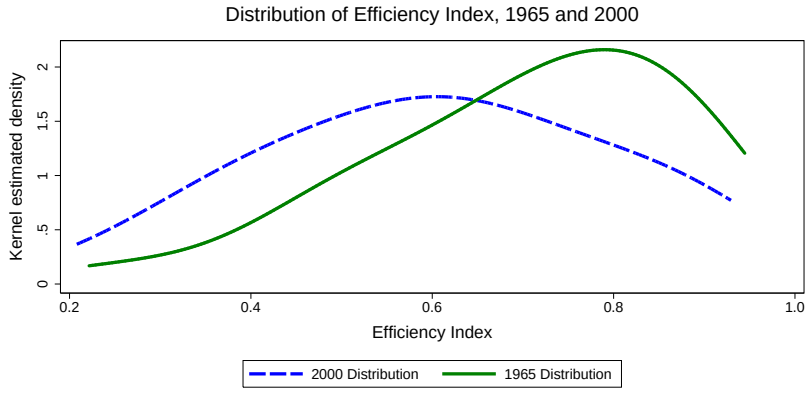

Figure A.2: Distribution of Efficiency Index, 1965 and 2000

Table A.4: Growth Regressions of the Percentage Change in Output per Worker and the Four Decomposition Indices on Output per Worker in Base Period

	Regression (A)	Regression (B)	Regression (C)	Regression (D)	Regression (E)
	$PROD-1$ $\times$ 100	$EFF-1$ $\times$ 100	$TECH-1$ $\times$ 100	$KACCUM-1$ $\times$ 100	$HACCUM-1$ $\times$ 100
Constant	113.6	-20.2	5.5	101.2	20.4
	0.000	0.000	0.017	0.000	0.000
Slope	-1.1E−03	4.4E−04	1.3E−03	−2.9E−03	−1.6E−04
	0.418	0.081	0.000	0.001	0.060

Notes: *p*-values under estimates, based on 'heteroskedasticity-consistent' estimators for the variance (Huber (1981) and White (1980)).

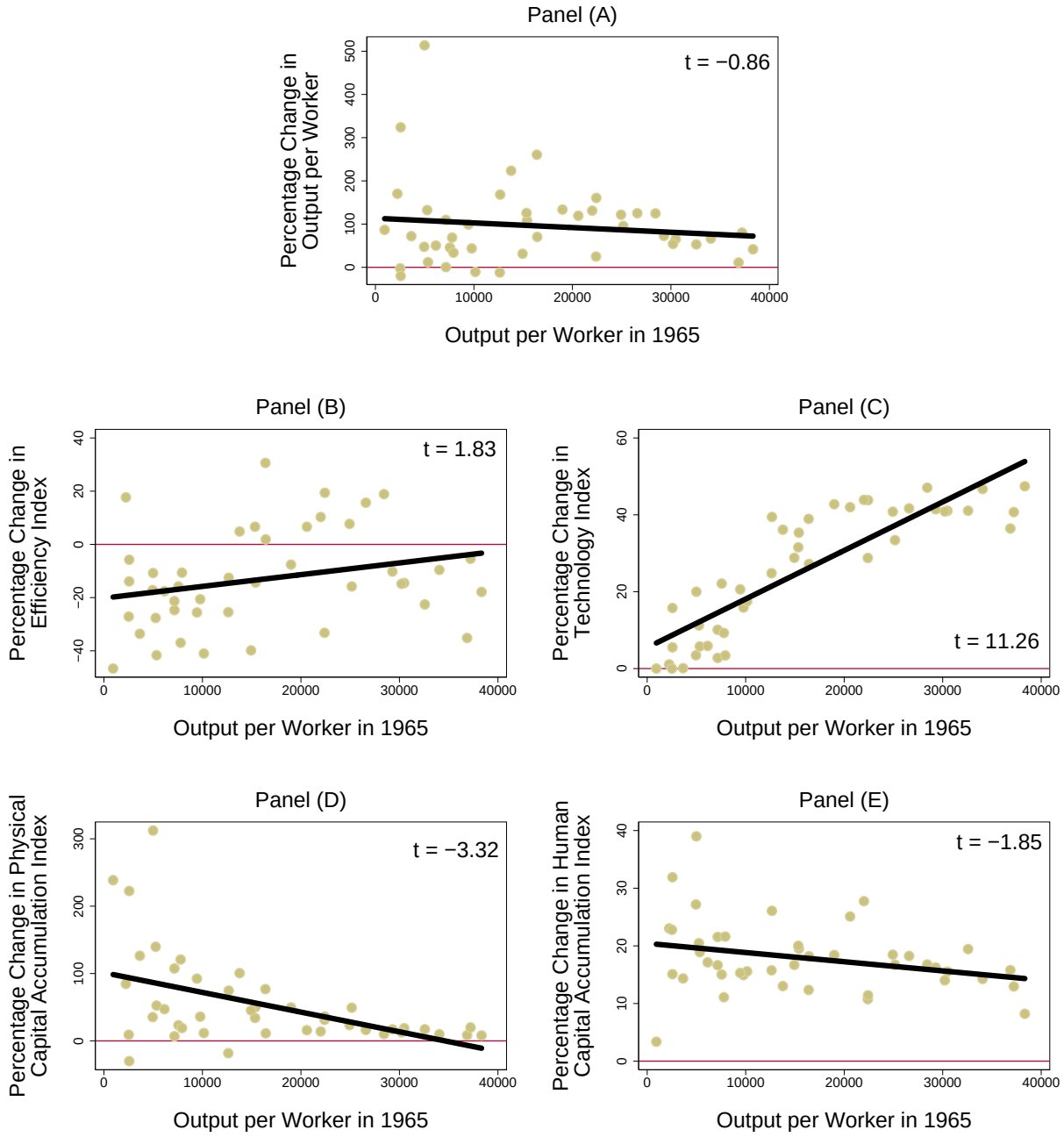

Figure A.3: Percentage change (from 1965 to 2000) in output per worker and four decomposition indexes, plotted against output per worker in 1965

Note: Each panel contains a GLS regression line.

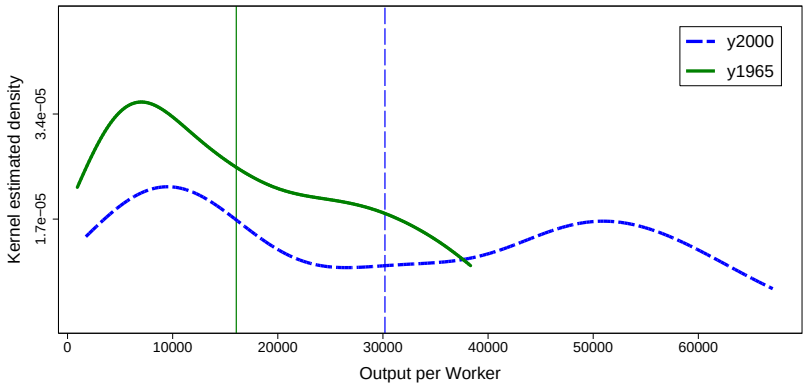

Figure A.4: Actual Output per Worker Distributions

Table A.5: Modality tests (*p-values*)

	Distribution	H_0: One Mode H_A: More Than One Mode
1	$f(y_{1965})$	0.867
2	$f(y_{2000})$	0.001
3	$f(y_{1965} \times EFF)$	0.030
4	$f(y_{1965} \times TECH)$	0.843
5	$f(y_{1965} \times KACC)$	0.017
6	$f(y_{1965} \times HACC)$	0.427
7	$f(y_{1965} \times EFF \times TECH)$	0.041
8	$f(y_{1965} \times EFF \times KACC)$	0.004
9	$f(y_{1965} \times EFF \times HACC)$	0.020
10	$f(y_{1965} \times TECH \times KACC)$	0.015
11	$f(y_{1965} \times TECH \times HACC)$	0.360
12	$f(y_{1965} \times KACC \times HACC)$	0.007
13	$f(y_{1965} \times EFF \times TECH \times KACC)$	0.004
14	$f(y_{1965} \times EFF \times TECH \times HACC)$	0.028
15	$f(y_{1965} \times EFF \times KACC \times HACC)$	0.000
16	$f(y_{1965} \times TECH \times KACC \times HACC)$	0.002

Notes: We used the bootstrapped calibrated Silverman tests for multimodality due to Hall and York (2001) with 1000 bootstrap replications.

Table A.6: Distribution hypothesis tests (*p-values*)

	Distribution	Li Test
1	$g(y_{2000})$ vs. $f(y_{1965})$	0.000
2	$g(y_{2000})$ vs. $f(y_{1965} \times EFF)$	0.000
3	$g(y_{2000})$ vs. $f(y_{1965} \times TECH)$	0.021
4	$g(y_{2000})$ vs. $f(y_{1965} \times KACC)$	0.000
5	$g(y_{2000})$ vs. $f(y_{1965} \times HACC)$	0.000
6	$g(y_{2000})$ vs. $f(y_{1965} \times EFF \times TECH)$	0.004
7	$g(y_{2000})$ vs. $f(y_{1965} \times EFF \times KACC)$	0.000
8	$g(y_{2000})$ vs. $f(y_{1965} \times EFF \times HACC)$	0.000
9	$g(y_{2000})$ vs. $f(y_{1965} \times TECH \times KACC)$	0.795
10	$g(y_{2000})$ vs. $f(y_{1965} \times TECH \times HACC)$	0.461
11	$g(y_{2000})$ vs. $f(y_{1965} \times KACC \times HACC)$	0.007
12	$g(y_{2000})$ vs. $f(y_{1965} \times EFF \times TECH \times KACC)$	0.422
13	$g(y_{2000})$ vs. $f(y_{1965} \times EFF \times TECH \times HACC)$	0.090
14	$g(y_{2000})$ vs. $f(y_{1965} \times EFF \times KACC \times HACC)$	0.003
15	$g(y_{2000})$ vs. $f(y_{1965} \times TECH \times KACC \times HACC)$	0.848

Notes: We used the bootstrapped Li (1996) Tests with 5000 bootstrap replications and the Sheather and Jones (1991) bandwidth.

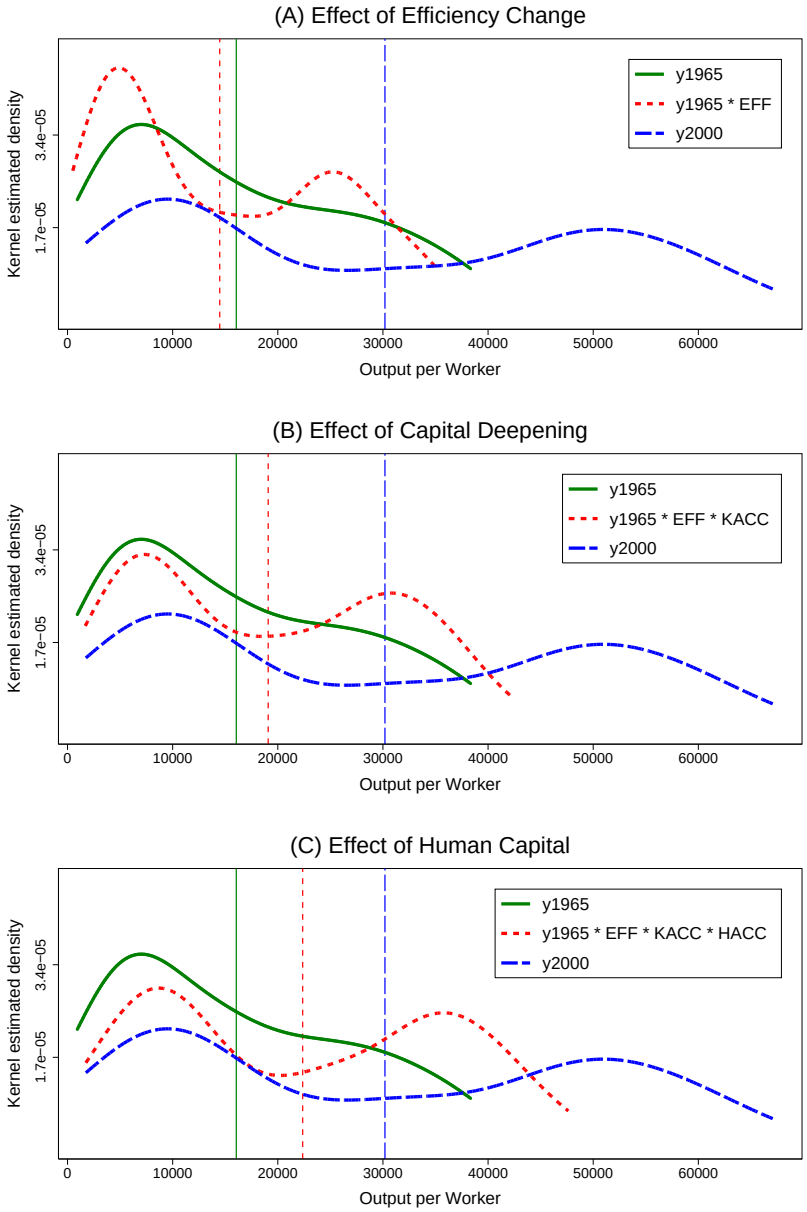

Figure A.5: Counterfactual Distributions of Output per Worker. Sequence of introducing effects of decomposition: EFF, KACC, and HACC

In each panel, the solid curve is the estimated 1965 distribution and the solid vertical line represents the 1965 mean value. The dashed curve is the estimated 2000 distribution and the dashed vertical line represents the 2000 mean value. The dotted curves in each panel are the counterfactual distributions isolating, sequentially, the effects of efficiency change, capital deepening, and human capital accumulation on the 1965 distribution, and the dotted vertical line represents the respective counterfactual mean.

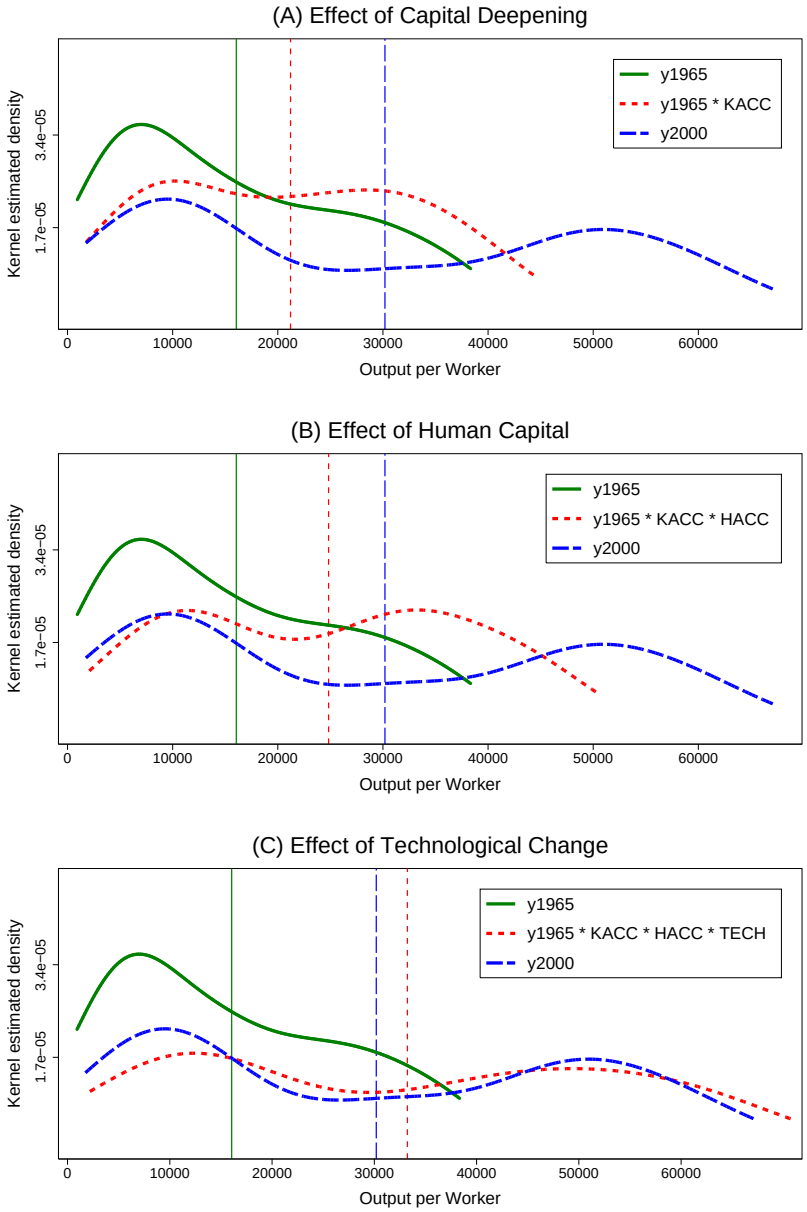

Figure A.6: Counterfactual Distributions of Output per Worker. Sequence of introducing effects of decomposition: KACC, HACC, and TECH

In each panel, the solid curve is the estimated 1965 distribution and the solid vertical line represents the 1965 mean value. The dashed curve is the estimated 2000 distribution and the dashed vertical line represents the 2000 mean value. The dotted curves in each panel are the counterfactual distributions isolating, sequentially, the effects of capital deepening, human capital accumulation, and technological change on the 1965 distribution, and the dotted vertical line represents the respective counterfactual mean.

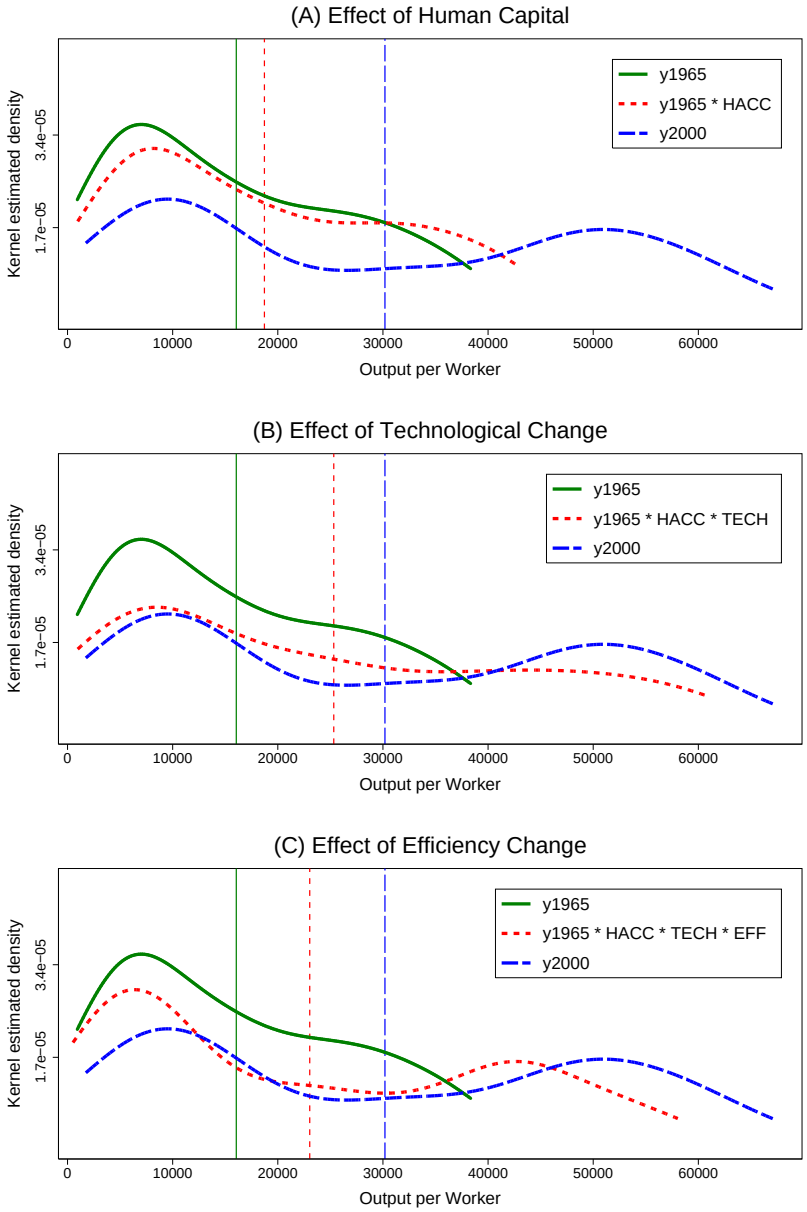

Figure A.7: Counterfactual Distributions of Output per Worker. Sequence of introducing effects of decomposition: HACC, TECH, and EFF

In each panel, the solid curve is the estimated 1965 distribution and the solid vertical line represents the 1965 mean value. The dashed curve is the estimated 2000 distribution and the dashed vertical line represents the 2000 mean value. The dotted curves in each panel are the counterfactual distributions isolating, sequentially, the effects of human capital deepening, technological change, and efficiency change on the 1965 distribution, and the dotted vertical line represents the respective counterfactual mean.

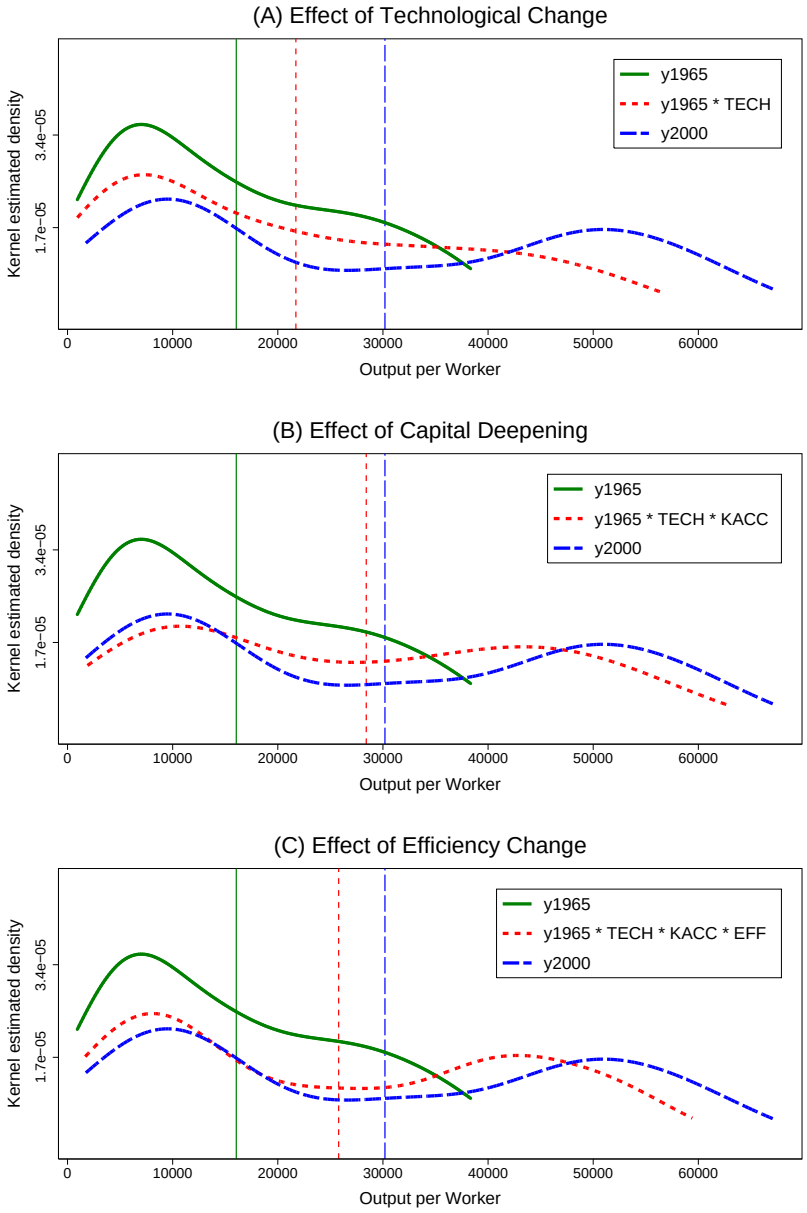

Figure A.8: Counterfactual Distributions of Output per Worker. Sequence of introducing effects of decomposition: TECH, KACC, and EFF

In each panel, the solid curve is the estimated 1965 distribution and the solid vertical line represents the 1965 mean value. The dashed curve is the estimated 2000 distribution and the dashed vertical line represents the 2000 mean value. The dotted curves in each panel are the counterfactual distributions isolating, sequentially, the effects of technological change, capital deepening, and efficiency change on the 1965 distribution, and the dotted vertical line represents the respective counterfactual mean.

Appendix B 1965–1990, Full sample

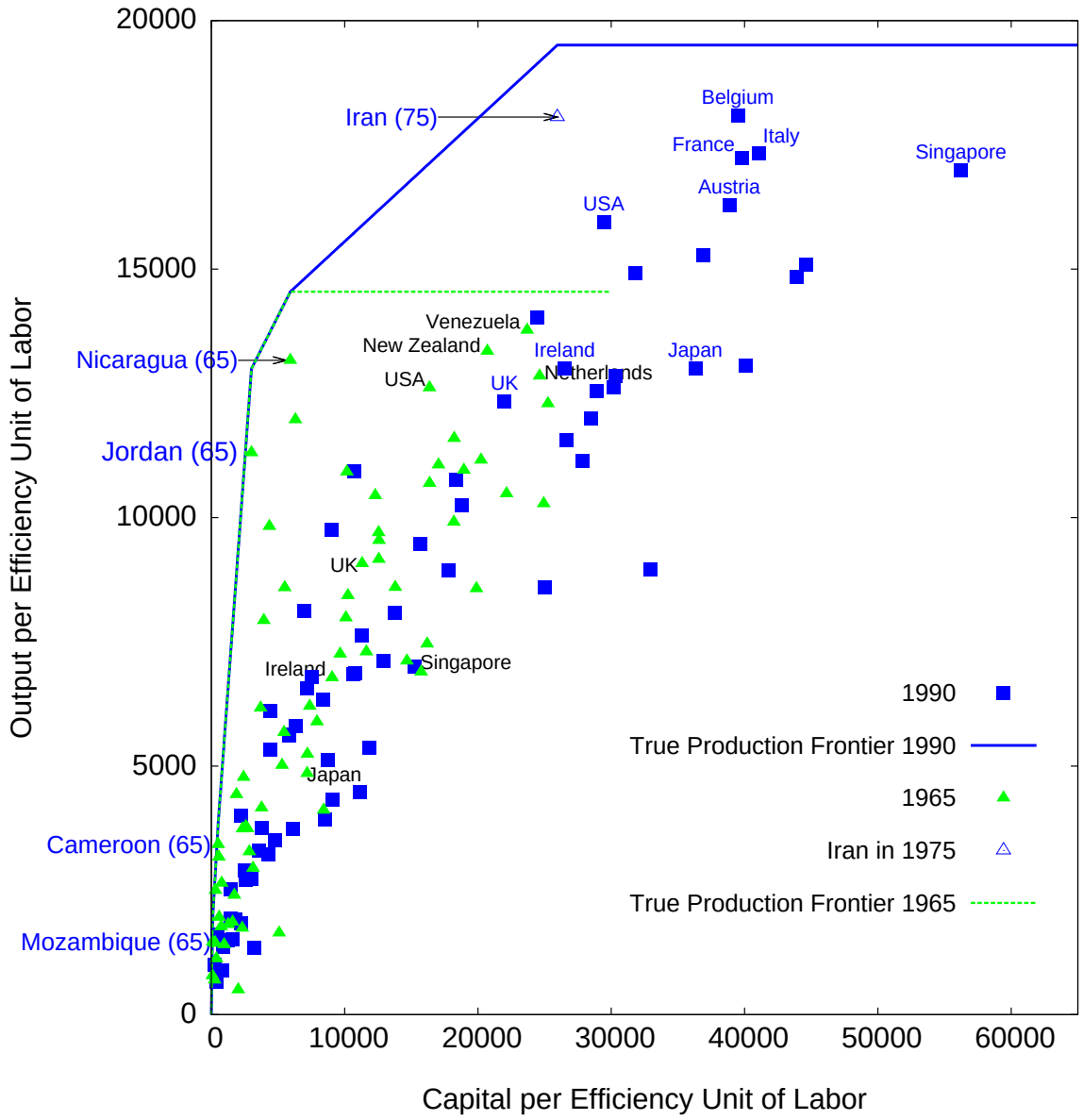

Figure B.1: Estimated "true" best-practice world production frontiers and scatterplots of the data for 1965 and 1990

Table B.1: Efficiency scores, 1965−1990

#	Country	eff_b	eff_b^{bc}	eff_b^{true}	eff_c	eff_c^{bc}	eff_c^{true}
1	Algeria	0.908	0.827	0.822	0.665	0.650	0.615
2	Argentina	0.780	0.746	0.717	0.556	0.544	0.514
3	Australia	0.729	0.699	0.681	0.664	0.640	0.621
4	Austria	0.640	0.613	0.590	0.901	0.878	0.843
5	Belgium	0.805	0.771	0.752	1.000	0.975	0.936
6	Benin	0.431	0.391	0.379	0.257	0.246	0.224
7	Bolivia	0.353	0.317	0.310	0.244	0.221	0.212
8	Brazil	0.445	0.415	0.405	0.479	0.470	0.439
9	Cameroon	1.000	0.881	0.881	0.457	0.432	0.398
10	Canada	0.853	0.818	0.796	0.695	0.670	0.650
11	Chile	0.552	0.529	0.512	0.478	0.469	0.437
12	Colombia	0.441	0.401	0.397	0.487	0.471	0.441
13	Costa Rica	0.808	0.732	0.716	0.606	0.585	0.549
14	Denmark	0.817	0.783	0.760	0.699	0.676	0.654
15	Dominican Republic	0.507	0.459	0.441	0.428	0.410	0.387
16	Ecuador	0.310	0.291	0.283	0.368	0.361	0.337
17	El Salvador	0.667	0.601	0.587	0.437	0.419	0.388
18	Finland	0.628	0.601	0.589	0.722	0.704	0.676
19	France	0.791	0.758	0.734	0.954	0.930	0.893
20	Ghana	0.061	0.056	0.053	0.294	0.280	0.258
21	Greece	0.546	0.521	0.501	0.617	0.594	0.577
22	Guatemala	0.525	0.470	0.461	0.501	0.481	0.444
23	Honduras	0.362	0.323	0.315	0.318	0.301	0.279
24	India	0.313	0.288	0.274	0.297	0.277	0.259
25	Indonesia	0.535	0.478	0.471	0.266	0.255	0.236
26	Iran	0.820	0.778	0.750	0.496	0.482	0.464
27	Ireland	0.511	0.481	0.466	0.720	0.689	0.673
28	Italy	0.764	0.728	0.720	0.958	0.934	0.897
29	Jamaica	0.396	0.367	0.360	0.282	0.270	0.255
30	Japan	0.367	0.340	0.333	0.719	0.700	0.673
31	Jordan	1.000	0.869	0.869	0.370	0.361	0.337
32	Kenya	0.273	0.252	0.238	0.224	0.215	0.195
33	Korea	0.332	0.306	0.289	0.453	0.445	0.417
34	Malawi	0.315	0.271	0.266	0.209	0.197	0.184
35	Malaysia	0.380	0.341	0.330	0.479	0.469	0.437
36	Mali	0.397	0.349	0.346	0.264	0.253	0.231
37	Mauritius	0.713	0.681	0.655	0.763	0.748	0.697
38	Mexico	0.633	0.601	0.579	0.536	0.526	0.493
39	Mozambique	1.000	0.757	0.757	0.515	0.473	0.452
40	Nepal	0.597	0.520	0.514	0.208	0.196	0.181

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Table B.1 (*Continued*)

#	Country	eff_b	eff_b^{bc}	eff_b^{true}	eff_c	eff_c^{bc}	eff_c^{true}
41	Netherlands	0.933	0.888	0.882	0.845	0.823	0.791
42	New Zealand	0.977	0.933	0.917	0.640	0.613	0.599
43	Nicaragua	1.000	0.904	0.904	0.430	0.412	0.389
44	Niger	1.000	0.871	0.866	0.305	0.293	0.266
45	Norway	0.747	0.710	0.706	0.821	0.801	0.769
46	Panama	0.393	0.357	0.352	0.461	0.449	0.419
47	Paraguay	0.573	0.527	0.499	0.501	0.486	0.455
48	Peru	0.511	0.490	0.473	0.310	0.303	0.283
49	Philippines	0.303	0.267	0.263	0.282	0.272	0.252
50	Portugal	0.600	0.569	0.548	0.793	0.763	0.740
51	Romania	0.292	0.267	0.256	0.310	0.305	0.284
52	Senegal	0.889	0.791	0.783	0.404	0.388	0.353
53	Singapore	0.528	0.506	0.489	0.940	0.917	0.880
54	South Africa	0.666	0.605	0.599	0.701	0.685	0.638
55	Spain	0.684	0.654	0.629	0.826	0.801	0.773
56	Sweden	0.817	0.781	0.766	0.711	0.688	0.665
57	Switzerland	0.893	0.849	0.844	0.835	0.814	0.781
58	Syria	0.625	0.568	0.549	0.276	0.257	0.240
59	Tanzania	0.708	0.550	0.536	0.235	0.216	0.205
60	Thailand	0.191	0.174	0.166	0.285	0.278	0.259
61	Trinidad & Tobago	0.724	0.693	0.666	0.482	0.463	0.451
62	Tunisia	0.469	0.435	0.426	0.609	0.597	0.561
63	Turkey	0.408	0.371	0.355	0.437	0.420	0.395
64	Uganda	0.616	0.534	0.526	0.425	0.383	0.363
65	United Kingdom	0.680	0.648	0.623	0.722	0.700	0.672
66	United States	0.933	0.895	0.866	0.883	0.853	0.826
67	Uruguay	0.546	0.516	0.498	0.527	0.517	0.482
68	Venezuela	1.000	0.951	0.946	0.629	0.614	0.582
69	Zambia	0.130	0.118	0.116	0.117	0.108	0.102
70	Zimbabwe	0.259	0.226	0.225	0.283	0.266	0.248
	Average	0.729	0.693	0.673	0.707	0.686	0.658

Table B.2: Efficiency scores and percentage change of tripartite decomposition indexes, 1965−2000

#	Country	productivity change	EFF−1 × 100	TECH−1 × 100	KACC−1 × 100	HACC−1 × 100
1	Algeria	36.7	−25.2	10.0	13.4	46.5
2	Argentina	−2.4	−28.3	14.8	5.2	12.8
3	Australia	39.8	−8.7	26.1	6.9	13.5
4	Austria	115.4	42.9	22.3	9.7	12.3
5	Belgium	92.1	24.5	26.8	6.5	14.2
6	Benin	27.6	−41.0	0.0	104.9	5.6
7	Bolivia	−9.6	−31.5	0.0	4.1	26.7
8	Brazil	67.1	8.6	7.2	5.9	35.6
9	Cameroon	60.1	−54.9	0.0	223.1	9.8
10	Canada	26.3	−18.4	26.2	7.0	14.6
11	Chile	13.7	−14.8	12.2	−1.7	20.9
12	Colombia	40.0	11.2	1.0	4.7	19.1
13	Costa Rica	4.2	−23.3	0.8	8.9	23.7
14	Denmark	28.6	−13.9	25.2	7.4	11.2
15	Dominican Republic	46.8	−12.3	0.0	46.7	14.1
16	Ecuador	66.9	19.2	6.9	4.2	25.8
17	El Salvador	−9.2	−34.0	0.0	8.3	27.0
18	Finland	88.5	14.9	27.6	6.7	20.5
19	France	96.6	21.6	24.6	8.7	19.4
20	Ghana	253.0	384.5	0.0	−32.5	7.9
21	Greece	88.8	15.1	20.4	12.0	21.6
22	Guatemala	29.1	−3.6	0.0	9.6	22.2
23	Honduras	28.4	−11.4	0.0	27.7	13.5
24	India	100.3	−5.5	0.0	97.4	7.4
25	Indonesia	152.2	−50.0	0.0	282.5	31.8
26	Iran	17.9	−38.1	19.1	14.1	40.1
27	Ireland	119.4	44.6	18.1	13.3	13.4
28	Italy	106.4	24.6	29.5	5.5	21.3
29	Jamaica	−7.5	−29.1	1.2	0.9	27.7
30	Japan	203.5	102.1	16.3	14.8	12.5
31	Jordan	−25.4	−61.3	2.3	40.1	34.4
32	Kenya	13.1	−18.0	0.0	26.7	8.9
33	Korea	319.7	44.2	7.3	115.0	26.1
34	Malawi	48.4	−31.0	0.0	100.3	7.4
35	Malaysia	170.0	32.5	3.8	54.5	27.2
36	Mali	45.7	−33.4	0.0	111.7	3.4
37	Mauritius	57.7	6.3	9.3	1.2	34.1
38	Mexico	24.7	−14.9	9.8	4.5	27.7
39	Mozambique	32.0	−40.3	0.0	112.9	3.8

(*continued on next page*)

Table B.2 (*Continued*)

#	Country	productivity change	EFF−1 × 100	TECH−1 × 100	KACC−1 × 100	HACC−1 × 100
40	Nepal	51.0	−64.8	0.0	303.6	6.4
41	Netherlands	33.6	−10.3	31.5	2.6	10.4
42	New Zealand	−3.5	−34.7	28.3	4.9	9.8
43	Nicaragua	−40.2	−57.0	0.0	3.0	35.1
44	Niger	−16.2	−69.3	0.0	164.1	3.3
45	Norway	67.8	8.9	31.8	2.9	13.7
46	Panama	67.0	18.8	2.0	6.9	28.9
47	Paraguay	81.2	−8.9	1.3	77.2	10.8
48	Peru	−18.2	−40.3	10.4	−2.2	26.9
49	Philippines	33.0	−4.4	0.0	25.3	11.1
50	Portugal	120.4	35.0	17.9	12.2	23.5
51	Romania	280.8	11.0	4.2	191.3	13.1
52	Senegal	−4.6	−55.0	0.0	99.0	6.5
53	Singapore	186.3	80.1	23.1	9.7	17.8
54	South Africa	27.3	6.5	2.5	5.3	10.7
55	Spain	100.0	22.9	21.2	11.3	20.6
56	Sweden	33.2	−13.2	27.9	5.7	13.6
57	Switzerland	35.2	−7.4	32.1	1.9	8.5
58	Syria	48.7	−56.3	0.0	182.5	20.3
59	Tanzania	−5.2	−61.7	0.0	141.6	2.4
60	Thailand	230.7	56.2	2.1	64.5	26.1
61	Trinidad & Tobago	6.5	−32.3	20.5	10.5	18.2
62	Tunisia	97.3	31.7	8.9	8.1	27.2
63	Turkey	109.7	11.3	0.4	56.4	20.0
64	Uganda	−20.0	−30.9	0.0	7.2	8.1
65	United Kingdom	58.9	7.7	17.2	9.1	15.4
66	United States	44.5	−4.6	24.9	7.7	12.6
67	Uruguay	26.3	−3.2	7.4	2.5	18.6
68	Venezuela	−15.5	−38.4	24.9	−1.4	11.4
69	Zambia	0.3	−12.4	0.0	−3.8	19.1
70	Zimbabwe	53.8	10.1	0.0	17.6	18.8
	Average	61.1	−2.2	10.1	41.7	17.9

Table B.3: Mean percentage changes of the quadripartite decomposition indices (country groupings)

Country Group	Productivity Change	EFF−1 ×100	TECH−1 ×100	KACC−1 ×100	HACC−1 ×100
OECD [B.3a]	75.0	8.3	23.0	13.0	16.2
Non-OECD	36.4	−21.3	4.1	40.9	18.2
Asian Tigers [B.3b]	231.6	72.1	16.1	39.9	18.6
Latin America [B.3c]	15.7	−18.6	5.5	11.1	21.2
Africa [B.3d]	32.4	−23.3	1.8	50.6	12.5
EU 15 [B.3e]	80.1	13.8	24.8	8.8	16.6
Asia [B.3f]	75.3	−34.2	3.4	108.4	23.6

[B.3a] Australia, Austria, Belgium, Canada, Denmark, Finland, France, Greece, Ireland, Italy, Japan, Korea, Mexico, Netherlands, New Zealand, Norway, Portugal, Spain, Sweden, Switzerland, Turkey, United Kingdom, and United States.
[B.3b] Japan, Korea, and Singapore.
[B.3c] Argentina, Bolivia, Brazil, Chile, Colombia, Costa Rica, Dominican Republic, Ecuador, El Salvador, Guatemala, Honduras, Jamaica, Nicaragua, Panama, Paraguay, Peru, Philippines, Trinidad & Tobago, Uruguay, and Venezuela.
[B.3d] Algeria, Benin, Cameroon, Ghana, Kenya, Malawi, Mali, Mauritius, Mozambique, Niger, Senegal, South Africa, Tanzania, Tunisia, Uganda, Zambia, and Zimbabwe.
[B.3e] Austria, Belgium, Denmark, Finland, France, Greece, Ireland, Italy, Netherlands, Portugal, Spain, Sweden, and United Kingdom.
[B.3f] India, Indonesia, Iran, Jordan, Malaysia, Nepal, Syria, and Thailand.

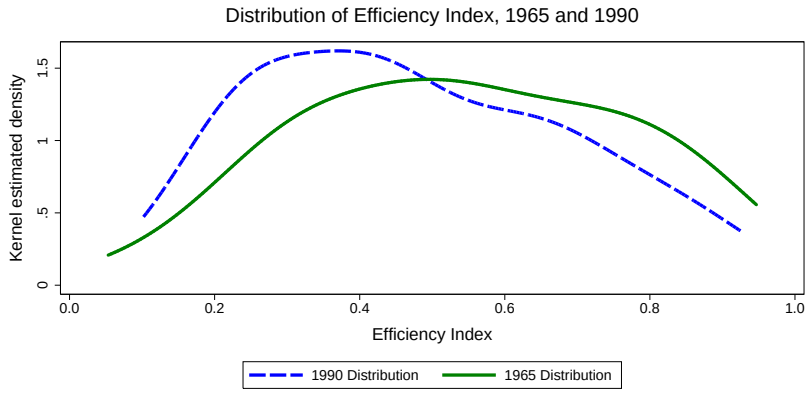

Figure B.2: Distributions of efficiency indices, 1965 and 2000

Table B.4: Growth Regressions of the Percentage Change in Output per Worker and the Four Decomposition Indices on Output per Worker in Base Period

	Regression (A)	Regression (B)	Regression (C)	Regression (D)	Regression (E)
	$PROD-1$ $\times 100$	$EFF-1$ $\times 100$	$TECH-1$ $\times 100$	$KACCUM-1$ $\times 100$	$HACCUM-1$ $\times 100$
Constant	79.0	0.1	−2.5	86.5	17.7
	0.000	0.990	0.025	0.000	0.000
Slope	−1.3E−03	−2.1E−04	9.8E−04	−3.3E−03	1.6E−05
	0.110	0.753	0.000	0.000	0.888

Notes: *p*-values under estimates, based on 'heteroskedasticity-consistent' estimators for the variance (Huber (1981) and White (1980)).

Table B.5: Modality tests (*p-values*)

	Distribution	H_0: One Mode H_A: More Than One Mode
1	$f(y_{1965})$	0.650
2	$f(y_{1990})$	0.005
3	$f(y_{1965} \times EFF)$	0.016
4	$f(y_{1965} \times TECH)$	0.713
5	$f(y_{1965} \times KACC)$	0.684
6	$f(y_{1965} \times HACC)$	0.544
7	$f(y_{1965} \times EFF \times TECH)$	0.007
8	$f(y_{1965} \times EFF \times KACC)$	0.006
9	$f(y_{1965} \times EFF \times HACC)$	0.037
10	$f(y_{1965} \times TECH \times KACC)$	0.578
11	$f(y_{1965} \times TECH \times HACC)$	0.589
12	$f(y_{1965} \times KACC \times HACC)$	0.833
13	$f(y_{1965} \times EFF \times TECH \times KACC)$	0.003
14	$f(y_{1965} \times EFF \times TECH \times HACC)$	0.012
15	$f(y_{1965} \times EFF \times KACC \times HACC)$	0.015
16	$f(y_{1965} \times TECH \times KACC \times HACC)$	0.699

Notes: We used the bootstrapped calibrated Silverman tests for multimodality due to Hall and York (2001) with 1000 bootstrap replications.

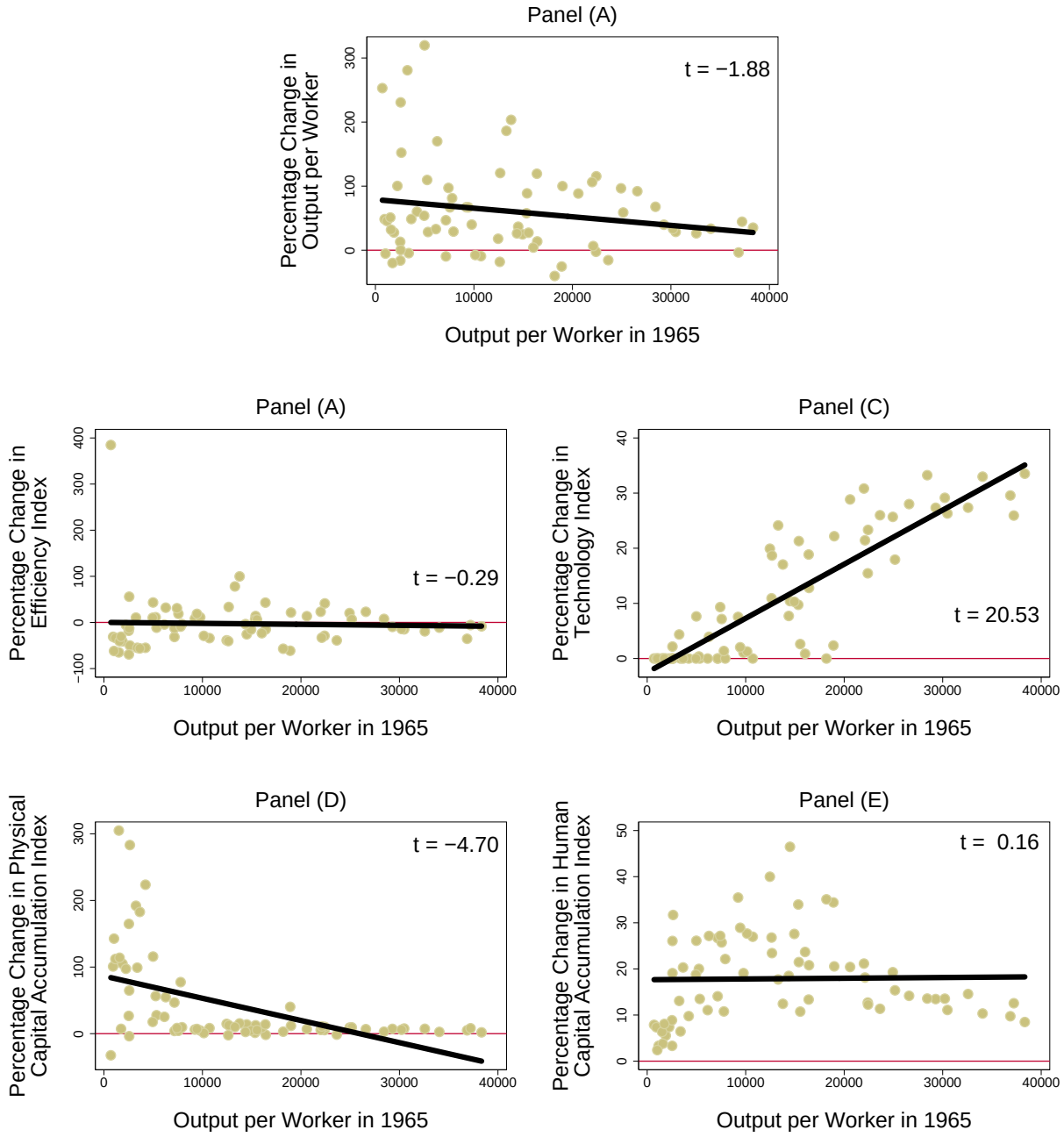

Figure B.3: Percentage change (from 1965 to 1990) in output per worker and four decomposition indexes, plotted against output per worker in 1965

Note: Each panel contains a GLS regression line.

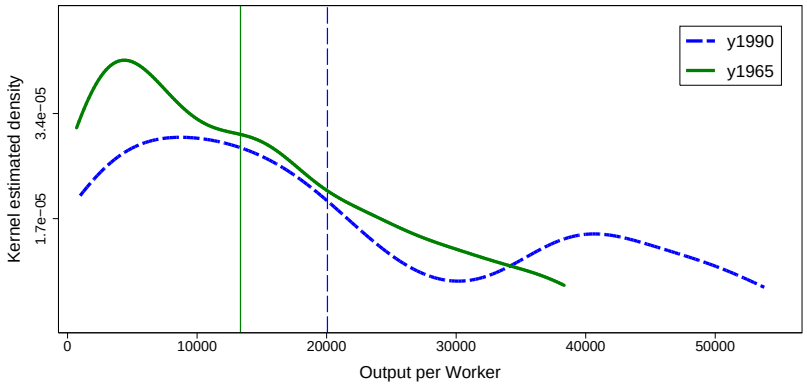

Figure B.4: Actual output per worker distributions

Table B.6: Distribution hypothesis tests (*p-values*)

	Distribution	Li Test
1	$g(y_{2000})$ vs. $f(y_{1965})$	0.001
2	$g(y_{2000})$ vs. $f(y_{1965} \times EFF)$	0.001
3	$g(y_{2000})$ vs. $f(y_{1965} \times TECH)$	0.048
4	$g(y_{2000})$ vs. $f(y_{1965} \times KACC)$	0.001
5	$g(y_{2000})$ vs. $f(y_{1965} \times HACC)$	0.010
6	$g(y_{2000})$ vs. $f(y_{1965} \times EFF \times TECH)$	0.039
7	$g(y_{2000})$ vs. $f(y_{1965} \times EFF \times KACC)$	0.002
8	$g(y_{2000})$ vs. $f(y_{1965} \times EFF \times HACC)$	0.030
9	$g(y_{2000})$ vs. $f(y_{1965} \times TECH \times KACC)$	0.123
10	$g(y_{2000})$ vs. $f(y_{1965} \times TECH \times HACC)$	0.361
11	$g(y_{2000})$ vs. $f(y_{1965} \times KACC \times HACC)$	0.041
12	$g(y_{2000})$ vs. $f(y_{1965} \times EFF \times TECH \times KACC)$	0.146
13	$g(y_{2000})$ vs. $f(y_{1965} \times EFF \times TECH \times HACC)$	0.931
14	$g(y_{2000})$ vs. $f(y_{1965} \times EFF \times KACC \times HACC)$	0.053
15	$g(y_{2000})$ vs. $f(y_{1965} \times TECH \times KACC \times HACC)$	0.994

Notes: We used the bootstrapped Li (1996) Tests with 5000 bootstrap replications and the Sheather and Jones (1991) bandwidth.

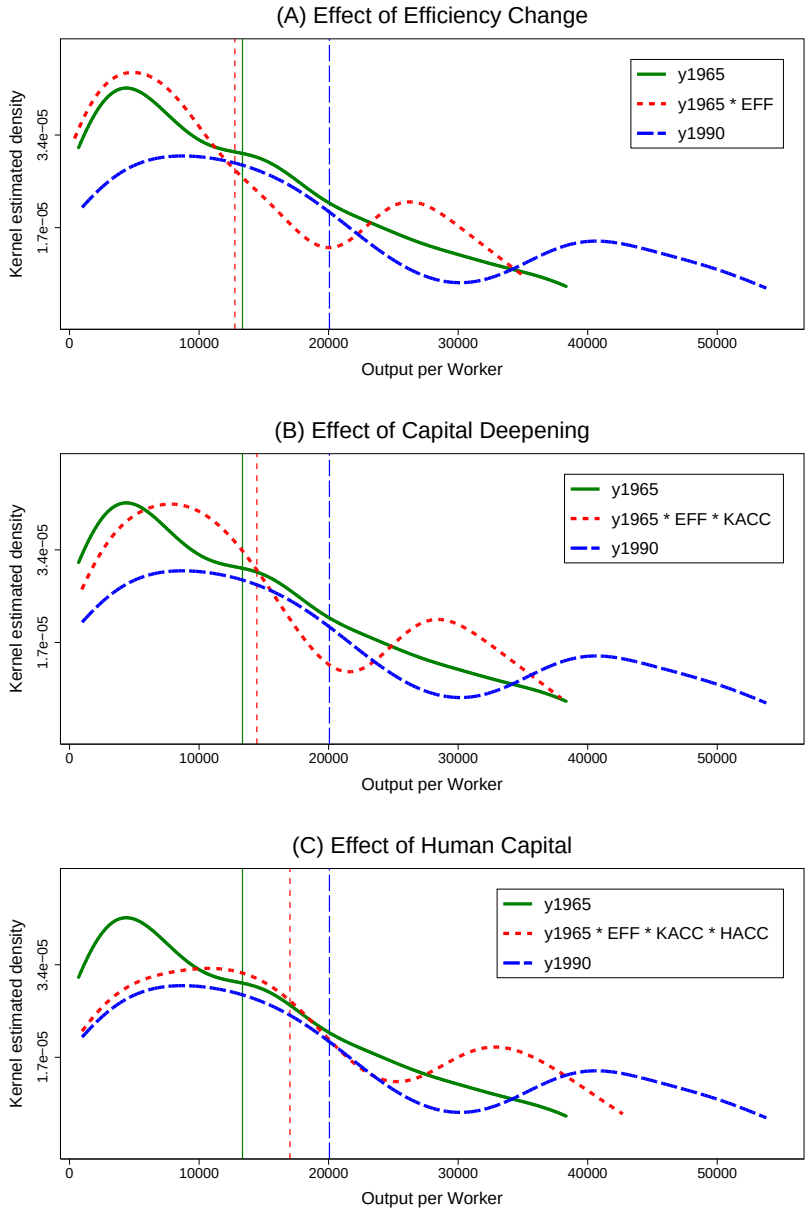

Figure B.5: Counterfactual Distributions of Output per Worker. Sequence of introducing effects of decomposition: EFF, KACC, and HACC

In each panel, the solid curve is the estimated 1965 distribution and the solid vertical line represents the 1965 mean value. The dashed curve is the estimated 1990 distribution and the dashed vertical line represents the 1990 mean value. The dotted curves in each panel are the counterfactual distributions isolating, sequentially, the effects of efficiency change, capital deepening, and human capital accumulation on the 1965 distribution, and the dotted vertical line represents the respective counterfactual mean.

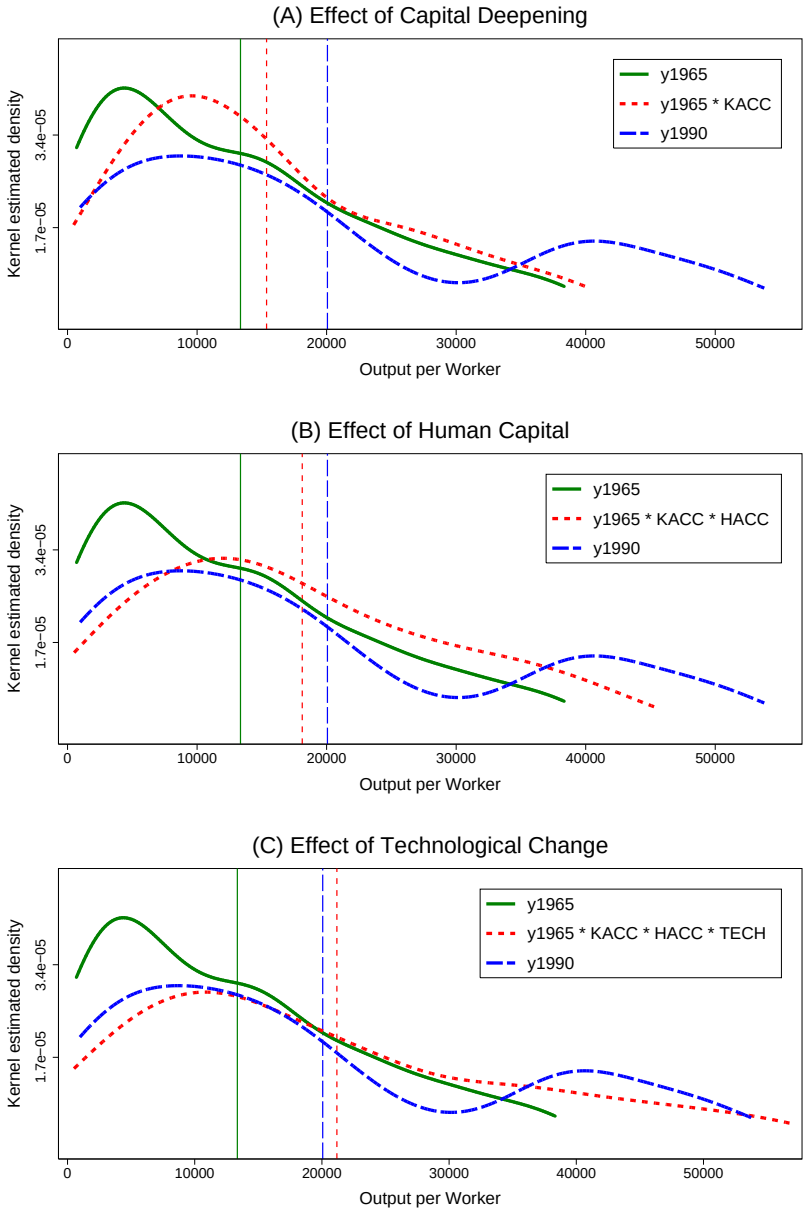

Figure B.6: Counterfactual Distributions of Output per Worker. Sequence of introducing effects of decomposition: KACC, HACC, and TECH

In each panel, the solid curve is the estimated 1965 distribution and the solid vertical line represents the 1965 mean value. The dashed curve is the estimated 1990 distribution and the dashed vertical line represents the 1990 mean value. The dotted curves in each panel are the counterfactual distributions isolating, sequentially, the effects of capital deepening, human capital accumulation, and technological change on the 1965 distribution, and the dotted vertical line represents the respective counterfactual mean.

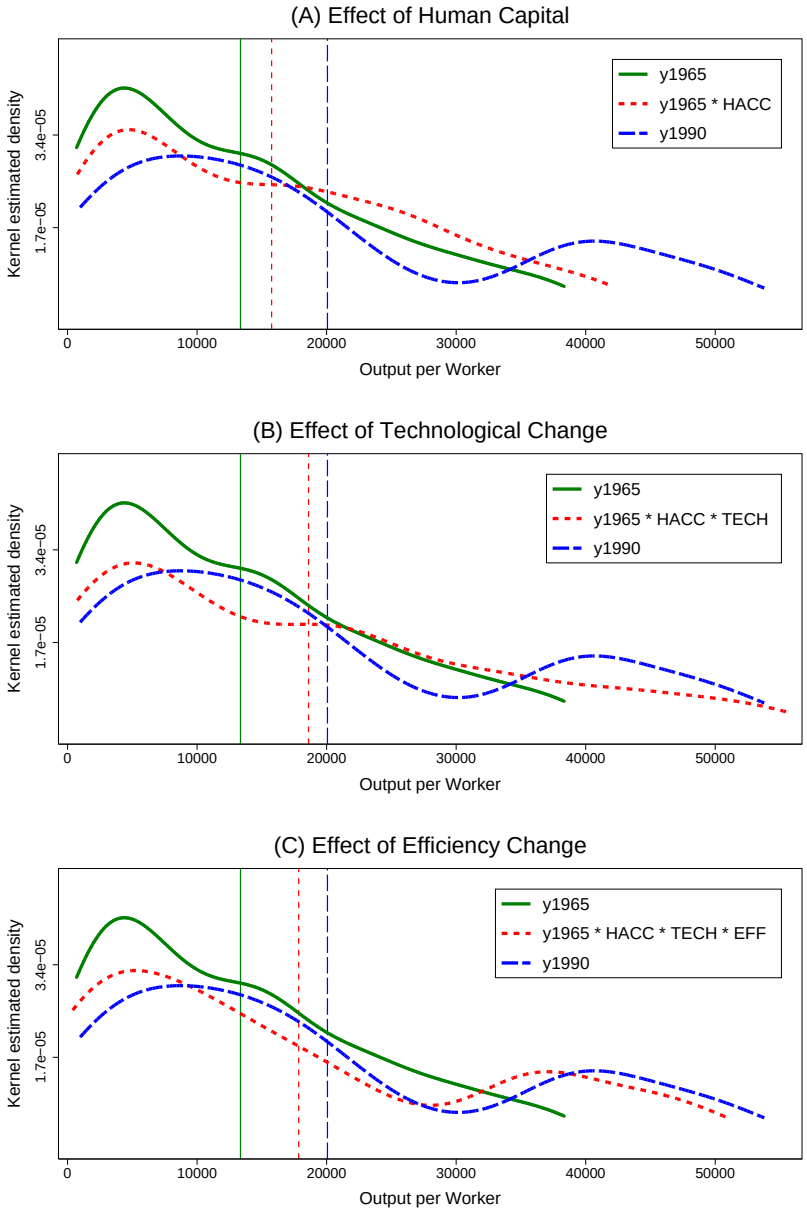

Figure B.7: Counterfactual Distributions of Output per Worker. Sequence of introducing effects of decomposition: HACC, TECH, and EFF

In each panel, the solid curve is the estimated 1965 distribution and the solid vertical line represents the 1965 mean value. The dashed curve is the estimated 1990 distribution and the dashed vertical line represents the 1990 mean value. The dotted curves in each panel are the counterfactual distributions isolating, sequentially, the effects of human capital deepening, technological change, and efficiency change on the 1965 distribution, and the dotted vertical line represents the respective counterfactual mean.

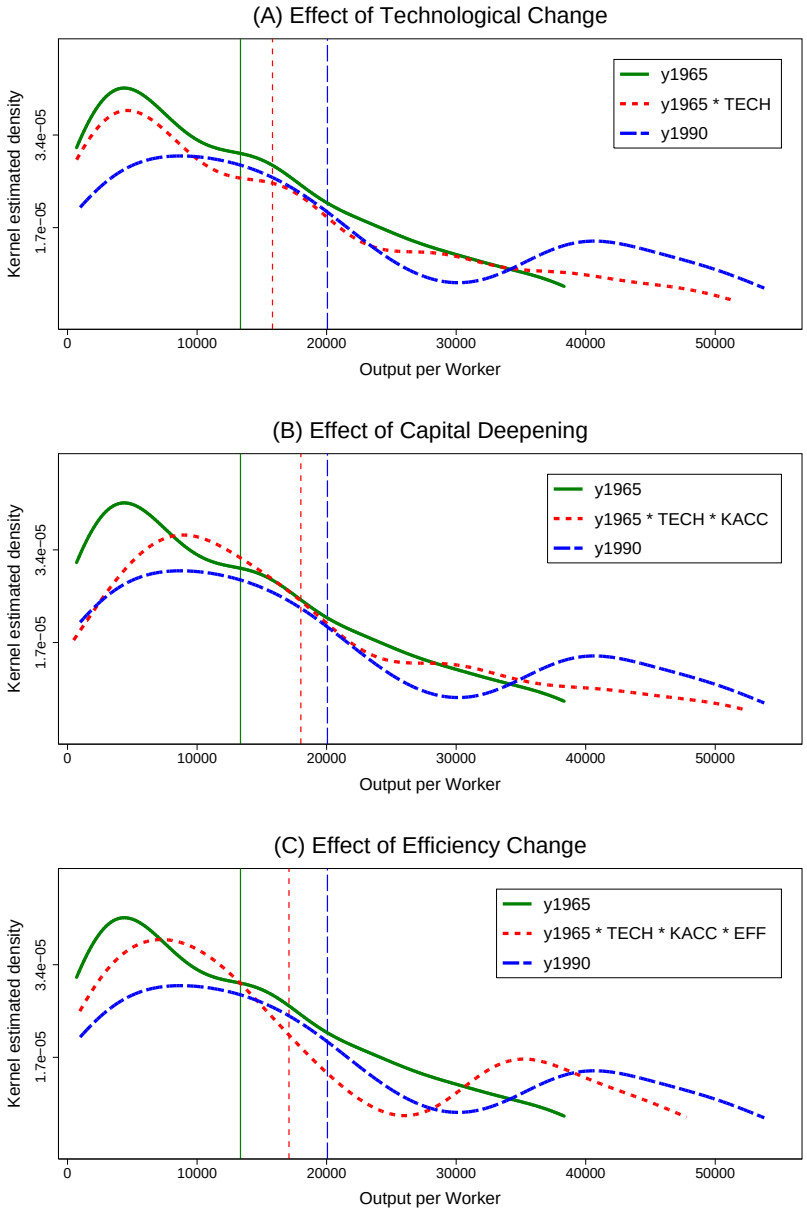

Figure B.8: Counterfactual Distributions of Output per Worker. Sequence of introducing effects of decomposition: TECH, KACC, and EFF

In each panel, the solid curve is the estimated 1965 distribution and the solid vertical line represents the 1965 mean value. The dashed curve is the estimated 1990 distribution and the dashed vertical line represents the 1990 mean value. The dotted curves in each panel are the counterfactual distributions isolating, sequentially, the effects of technological change, capital deepening, and efficiency change on the 1965 distribution, and the dotted vertical line represents the respective counterfactual mean.

Appendix C Barro and Lee (2001) schooling data set

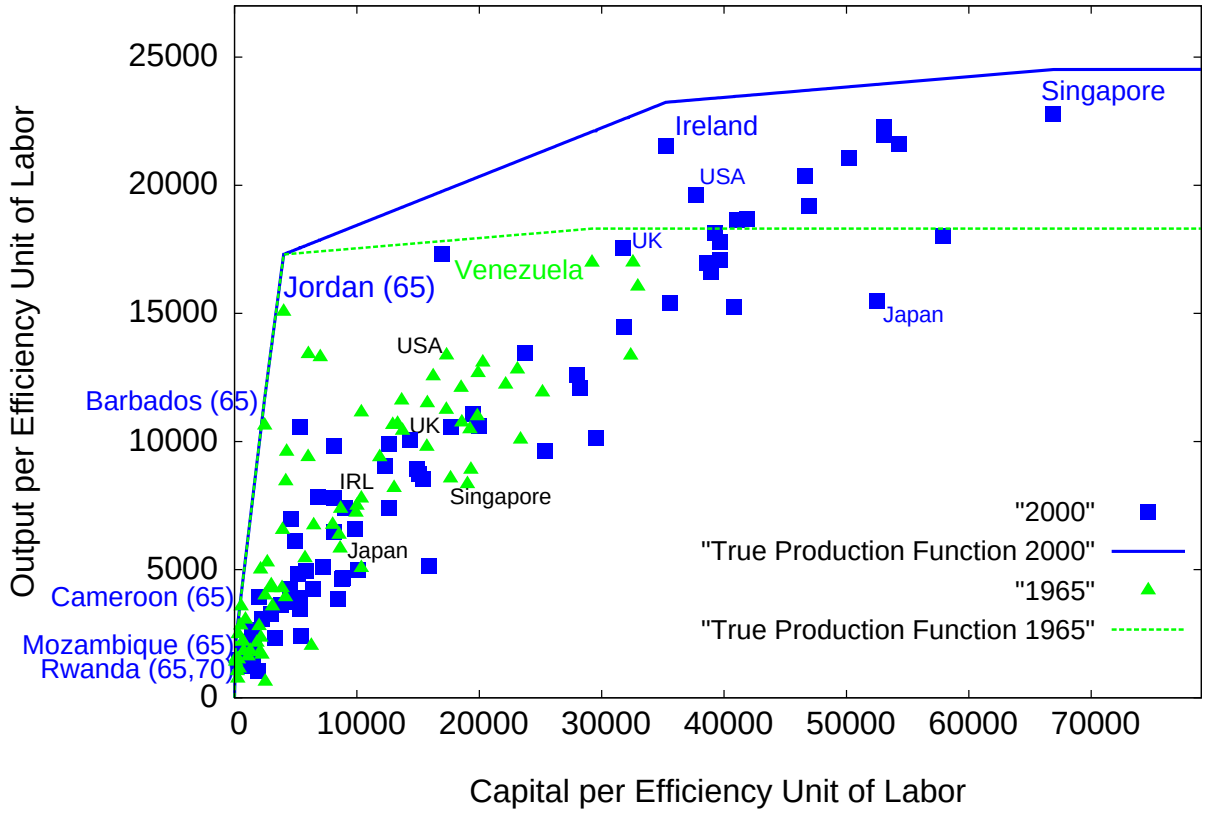

Figure C.1: Estimated "true" best-practice world production frontiers and scatterplots of the data for 1965 and 2000

Table C.1: Efficiency scores, 1965−2000, BL data set

#	Country	eff_b	eff_b^{bc}	eff_b^{true}	eff_c	eff_c^{bc}	eff_c^{true}
1	Algeria	0.869	0.809	0.760	0.621	0.585	0.479
2	Argentina	0.734	0.702	0.654	0.605	0.554	0.531
3	Australia	0.646	0.616	0.584	0.765	0.722	0.711
4	Austria	0.614	0.587	0.550	0.970	0.916	0.902
5	Barbados	1.000	0.906	0.906	1.000	0.908	0.600
6	Belgium	0.664	0.634	0.599	1.000	0.946	0.931
7	Benin	0.418	0.380	0.374	0.574	0.542	0.259
8	Bolivia	0.291	0.254	0.253	0.463	0.432	0.217
9	Brazil	0.413	0.389	0.363	0.522	0.484	0.439
10	Cameroon	1.000	0.892	0.892	0.896	0.846	0.405
11	Canada	0.779	0.741	0.705	0.715	0.665	0.664
12	Chile	0.548	0.522	0.495	0.618	0.571	0.546
13	Colombia	0.441	0.408	0.385	0.584	0.554	0.406
14	Costa Rica	0.636	0.559	0.552	0.806	0.763	0.542
15	Denmark	0.699	0.668	0.628	0.787	0.744	0.732
16	Dominican Republic	0.471	0.426	0.423	0.639	0.605	0.430
17	Ecuador	0.326	0.310	0.287	0.375	0.355	0.270
18	El Salvador	0.560	0.491	0.486	0.617	0.567	0.349
19	Finland	0.609	0.575	0.556	0.701	0.664	0.652
20	France	0.748	0.714	0.675	0.951	0.901	0.885
21	Ghana	0.058	0.052	0.052	0.644	0.591	0.288
22	Greece	0.520	0.497	0.462	0.607	0.569	0.553
23	Guatemala	0.443	0.386	0.384	0.754	0.698	0.400
24	Honduras	0.345	0.310	0.305	0.327	0.298	0.197
25	Hong Kong	0.478	0.451	0.420	0.819	0.774	0.761
26	Iceland	0.776	0.732	0.708	0.783	0.738	0.727
27	India	0.292	0.268	0.263	0.517	0.486	0.239
28	Indonesia	0.545	0.494	0.488	0.379	0.353	0.238
29	Iran	0.716	0.681	0.632	0.500	0.468	0.451
30	Ireland	0.483	0.459	0.426	1.000	0.929	0.929
31	Israel	0.675	0.643	0.611	0.856	0.810	0.796
32	Italy	0.715	0.670	0.655	0.987	0.934	0.919
33	Jamaica	0.465	0.442	0.410	0.371	0.352	0.257
34	Japan	0.378	0.357	0.332	0.697	0.659	0.648
35	Jordan	1.000	0.867	0.867	0.436	0.410	0.284
36	Kenya	0.258	0.238	0.233	0.408	0.385	0.184
37	Korea, Republic of	0.312	0.287	0.283	0.500	0.469	0.457
38	Lesotho	0.495	0.424	0.409	0.226	0.206	0.137
39	Malawi	0.325	0.284	0.274	0.540	0.488	0.241
40	Malaysia	0.361	0.325	0.321	0.590	0.546	0.522

(*continued on next page*)

Table C.1 (*Continued*)

#	Country	eff_b	eff_b^{bc}	eff_b^{true}	eff_c	eff_c^{bc}	eff_c^{true}
41	Mali	0.397	0.354	0.346	0.582	0.547	0.262
42	Mauritius	0.659	0.630	0.587	1.000	0.913	0.875
43	Mexico	0.676	0.646	0.601	0.537	0.499	0.448
44	Mozambique	1.000	0.766	0.766	0.848	0.753	0.376
45	Nepal	0.608	0.536	0.518	0.335	0.314	0.156
46	Netherlands	1.000	0.927	0.927	0.925	0.877	0.861
47	New Zealand	0.802	0.763	0.727	0.634	0.595	0.577
48	Nicaragua	0.881	0.810	0.769	0.453	0.418	0.279
49	Niger	1.000	0.883	0.854	0.515	0.481	0.231
50	Norway	0.786	0.729	0.728	0.872	0.827	0.811
51	Pakistan	0.248	0.227	0.224	0.465	0.424	0.275
52	Panama	0.358	0.327	0.312	0.501	0.472	0.391
53	Paraguay	0.534	0.490	0.483	0.530	0.502	0.356
54	Peru	0.514	0.491	0.465	0.369	0.350	0.254
55	Philippines	0.286	0.257	0.254	0.387	0.356	0.214
56	Portugal	0.599	0.572	0.531	0.836	0.790	0.777
57	Romania	0.287	0.263	0.258	0.311	0.295	0.211
58	Rwanda	1.000	0.761	0.761	0.858	0.718	0.377
59	Senegal	0.833	0.743	0.738	0.758	0.714	0.341
60	Singapore	0.531	0.508	0.478	1.000	0.930	0.930
61	South Africa	0.617	0.567	0.538	0.683	0.640	0.437
62	Spain	0.720	0.689	0.645	0.857	0.812	0.797
63	Sri Lanka	0.195	0.179	0.177	0.465	0.431	0.243
64	Sweden	0.743	0.703	0.676	0.697	0.652	0.641
65	Switzerland	0.944	0.876	0.875	0.804	0.756	0.748
66	Syria	0.627	0.574	0.563	0.632	0.596	0.286
67	Thailand	0.172	0.157	0.155	0.308	0.284	0.263
68	Togo	0.539	0.489	0.482	0.373	0.352	0.168
69	Trinidad & Tobago	0.784	0.750	0.703	0.712	0.664	0.638
70	Tunisia	0.439	0.412	0.385	0.669	0.630	0.522
71	Turkey	0.373	0.338	0.338	0.499	0.474	0.357
72	Uganda	0.630	0.554	0.534	1.000	0.791	0.437
73	United Kingdom	0.678	0.648	0.603	0.846	0.791	0.778
74	United States	0.831	0.794	0.747	0.907	0.852	0.843
75	Uruguay	0.500	0.476	0.441	0.636	0.593	0.521
76	Venezuela	1.000	0.926	0.926	0.552	0.513	0.459
77	Zambia	0.133	0.123	0.116	0.242	0.229	0.110
78	Zimbabwe	0.260	0.228	0.226	0.369	0.336	0.222
	Average	0.676	0.641	0.608	0.744	0.699	0.650

Table C.2: Efficiency scores and percentage change of tripartite decomposition indexes, 1965−2000

#	Country	productivity change	EFF−1 × 100	TECH−1 × 100	KACC−1 × 100	HACC−1 × 100
1	Algeria	14.9	−36.9	4.7	5.8	64.5
2	Argentina	24.9	−18.8	9.7	5.0	33.6
3	Australia	72.8	21.9	19.7	9.4	8.2
4	Austria	160.6	64.2	19.8	13.6	16.6
5	Barbados	40.3	−33.7	0.6	72.3	22.2
6	Belgium	125.2	55.3	20.9	11.1	7.9
7	Benin	46.8	−30.8	0.3	96.5	7.7
8	Bolivia	0.5	−14.3	0.0	8.3	8.3
9	Brazil	67.6	21.1	6.6	5.5	23.0
10	Cameroon	42.8	−54.6	0.3	187.7	8.9
11	Canada	52.9	−5.7	19.7	10.0	23.3
12	Chile	70.4	10.2	12.7	3.4	32.7
13	Colombia	43.7	5.3	3.2	2.7	28.8
14	Costa Rica	28.5	−1.8	1.8	10.3	16.5
15	Denmark	65.5	16.4	19.0	10.6	8.0
16	Dominican Republic	109.7	1.7	1.7	65.3	22.6
17	Ecuador	45.8	−5.9	5.2	2.1	44.2
18	El Salvador	2.6	−28.3	0.5	14.3	24.5
19	Finland	119.4	17.2	21.7	9.9	40.0
20	France	121.7	31.2	20.6	12.2	24.9
21	Ghana	303.8	450.2	0.1	−33.5	10.2
22	Greece	108.3	19.7	13.4	11.1	38.1
23	Guatemala	33.8	3.9	0.3	12.6	14.1
24	Honduras	11.9	−35.6	0.6	42.8	20.9
25	Hong Kong	264.6	81.1	15.1	17.5	48.9
26	Iceland	72.6	2.8	21.3	8.9	27.1
27	India	170.3	−9.2	0.1	155.8	16.3
28	Indonesia	196.1	−51.1	1.2	340.2	35.9
29	Iran	41.2	−28.7	11.2	11.7	59.3
30	Ireland	260.5	118.2	15.3	15.5	24.1
31	Israel	109.2	30.2	20.2	10.4	21.1
32	Italy	131.1	40.2	23.7	8.8	22.4
33	Jamaica	−10.6	−37.4	4.6	1.1	35.2
34	Japan	223.5	95.3	16.4	17.9	20.7
35	Jordan	−35.3	−67.3	1.4	33.8	45.9
36	Kenya	−2.4	−21.3	0.1	14.2	8.5
37	Korea, Republic of	513.6	61.7	9.9	149.4	38.4
38	Lesotho	175.0	−66.6	4.5	583.7	15.3
39	Malawi	86.7	−12.1	3.3	93.3	6.3

(*continued on next page*)

Table C.2 (*Continued*)

#	Country	productivity change	EFF−1 × 100	TECH−1 × 100	KACC−1 × 100	HACC−1 × 100
40	Malaysia	328.2	62.9	6.4	77.4	39.2
41	Mali	83.7	−24.3	1.7	131.4	3.2
42	Mauritius	125.7	49.1	9.4	4.4	32.4
43	Mexico	31.4	−25.4	8.3	4.8	55.0
44	Mozambique	31.4	−50.9	0.2	155.3	4.6
45	Nepal	98.7	−69.9	2.7	468.0	13.3
46	Netherlands	66.5	−7.1	26.4	6.2	33.6
47	New Zealand	11.1	−20.6	16.4	5.8	13.8
48	Nicaragua	−51.6	−63.7	1.7	0.9	30.1
49	Niger	−31.0	−72.9	2.7	138.9	3.9
50	Norway	124.8	11.4	26.3	7.5	48.6
51	Pakistan	152.9	22.5	0.5	82.1	12.8
52	Panama	99.1	25.3	4.3	6.8	42.7
53	Paraguay	68.9	−26.3	1.7	92.1	17.2
54	Peru	−12.0	−45.3	8.2	−2.2	51.9
55	Philippines	50.3	−15.7	0.4	43.7	23.6
56	Portugal	168.4	46.3	16.5	15.3	36.5
57	Romania	235.8	−18.0	2.0	221.1	25.1
58	Rwanda	20.2	−50.4	0.7	132.5	3.6
59	Senegal	4.6	−53.8	0.6	115.9	4.2
60	Singapore	341.8	94.5	21.9	16.1	60.5
61	South Africa	27.2	−18.8	2.0	2.8	49.3
62	Spain	133.6	23.5	18.5	13.7	40.3
63	Sri Lanka	211.3	37.8	0.2	92.5	17.1
64	Sweden	54.0	−5.2	18.9	7.5	27.0
65	Switzerland	41.7	−14.5	27.8	5.9	22.4
66	Syria	72.0	−49.2	0.2	188.5	17.1
67	Thailand	324.0	69.3	4.8	97.9	20.7
68	Togo	−15.7	−65.2	0.3	116.9	11.2
69	Trinidad & Tobago	49.7	−9.2	13.1	7.3	35.8
70	Tunisia	133.1	35.7	5.3	5.3	54.9
71	Turkey	132.4	5.7	2.4	76.2	21.9
72	Uganda	24.4	−18.2	4.7	26.6	14.7
73	United Kingdom	95.7	29.0	15.1	11.7	17.9
74	United States	80.2	12.8	18.9	11.3	20.8
75	Uruguay	66.0	18.0	7.0	4.1	26.3
76	Venezuela	−24.2	−50.4	14.6	−3.2	37.9
77	Zambia	−20.0	−5.7	1.0	−34.8	28.8
78	Zimbabwe	47.5	−1.7	0.6	16.9	27.5
	Average	93.5	4.5	8.5	56.7	25.9

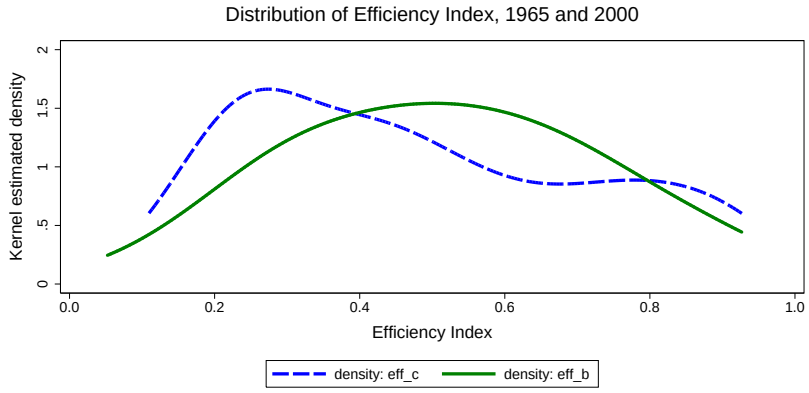

Figure C.2: Distributions of efficiency indices, 1965 and 2000

Table C.3: Growth Regressions of the Percentage Change in Output per Worker and the Four Decomposition Indices on Output per Worker in Base Period

	Regression (A)	Regression (B)	Regression (C)	Regression (D)	Regression (E)
	$PROD-1$ $\times$ 100	$EFF-1$ $\times$ 100	$TECH-1$ $\times$ 100	$KACCUM-1$ $\times$ 100	$HACCUM-1$ $\times$ 100
Constant	112.34	1.20	-0.34	116.38	22.00
	0.000	0.943	0.553	0.000	0.000
Slope	-1.4E-03	2.5E-04	6.7E-04	-4.5E-03	3.0E-04
	0.103	0.749	0.000	0.000	0.047

Notes: *p*-values under estimates, based on 'heteroskedasticity-consistent' estimators for the variance (Huber (1981) and White (1980)).

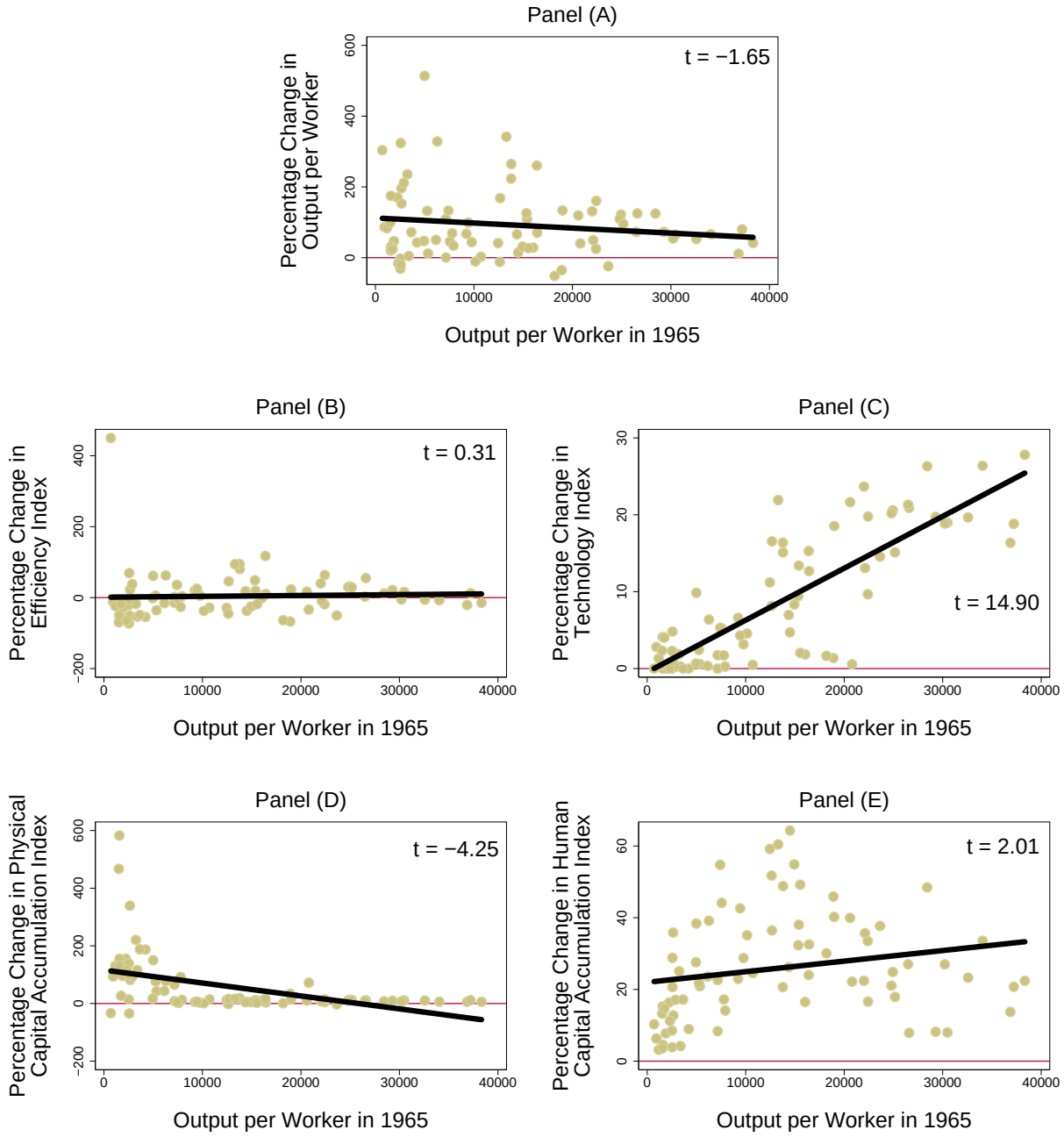

Figure C.3: Percentage change (from 1965 to 1990) in output per worker and four decomposition indexes, plotted against output per worker in 1965

Note: Each panel contains a GLS regression line.

Table C.4: Modality tests (*p-values*)

	Distribution	H_0: One Mode H_A: More Than One Mode
1	$f(y_{1965})$	0.562
2	$f(y_{2000})$	0.005
3	$f(y_{1965} \times EFF)$	0.012
4	$f(y_{1965} \times TECH)$	0.564
5	$f(y_{1965} \times KACC)$	0.571
6	$f(y_{1965} \times HACC)$	0.038
7	$f(y_{1965} \times EFF \times TECH)$	0.003
8	$f(y_{1965} \times EFF \times KACC)$	0.028
9	$f(y_{1965} \times EFF \times HACC)$	0.004
10	$f(y_{1965} \times TECH \times KACC)$	0.552
11	$f(y_{1965} \times TECH \times HACC)$	0.179
12	$f(y_{1965} \times KACC \times HACC)$	0.537
13	$f(y_{1965} \times EFF \times TECH \times KACC)$	0.005
14	$f(y_{1965} \times EFF \times TECH \times HACC)$	0.001
15	$f(y_{1965} \times EFF \times KACC \times HACC)$	0.010
16	$f(y_{1965} \times TECH \times KACC \times HACC)$	0.253

Notes: We used the bootstrapped calibrated Silverman tests for multimodality due to Hall and York (2001) with 1000 bootstrap replications.

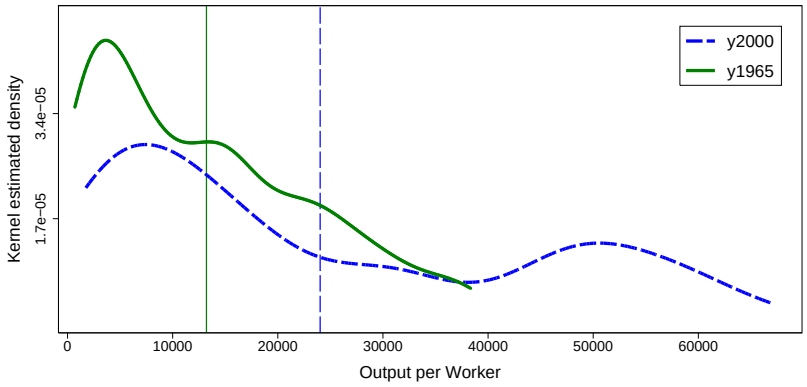

Figure C.4: Actual output per worker distributions

Table C.5: Distribution hypothesis tests (*p-values*)

	Distribution	Li Test
1	$g(y_{2000})$ vs. $f(y_{1965})$	0.000
2	$g(y_{2000})$ vs. $f(y_{1965} \times EFF)$	0.000
3	$g(y_{2000})$ vs. $f(y_{1965} \times TECH)$	0.000
4	$g(y_{2000})$ vs. $f(y_{1965} \times KACC)$	0.000
5	$g(y_{2000})$ vs. $f(y_{1965} \times HACC)$	0.000
6	$g(y_{2000})$ vs. $f(y_{1965} \times EFF \times TECH)$	0.000
7	$g(y_{2000})$ vs. $f(y_{1965} \times EFF \times KACC)$	0.000
8	$g(y_{2000})$ vs. $f(y_{1965} \times EFF \times HACC)$	0.005
9	$g(y_{2000})$ vs. $f(y_{1965} \times TECH \times KACC)$	0.000
10	$g(y_{2000})$ vs. $f(y_{1965} \times TECH \times HACC)$	0.009
11	$g(y_{2000})$ vs. $f(y_{1965} \times KACC \times HACC)$	0.000
12	$g(y_{2000})$ vs. $f(y_{1965} \times EFF \times TECH \times KACC)$	0.002
13	$g(y_{2000})$ vs. $f(y_{1965} \times EFF \times TECH \times HACC)$	0.705
14	$g(y_{2000})$ vs. $f(y_{1965} \times EFF \times KACC \times HACC)$	0.052
15	$g(y_{2000})$ vs. $f(y_{1965} \times TECH \times KACC \times HACC)$	0.019

Notes: We used the bootstrapped Li (1996) Tests with 5000 bootstrap replications and the Sheather and Jones (1991) bandwidth.

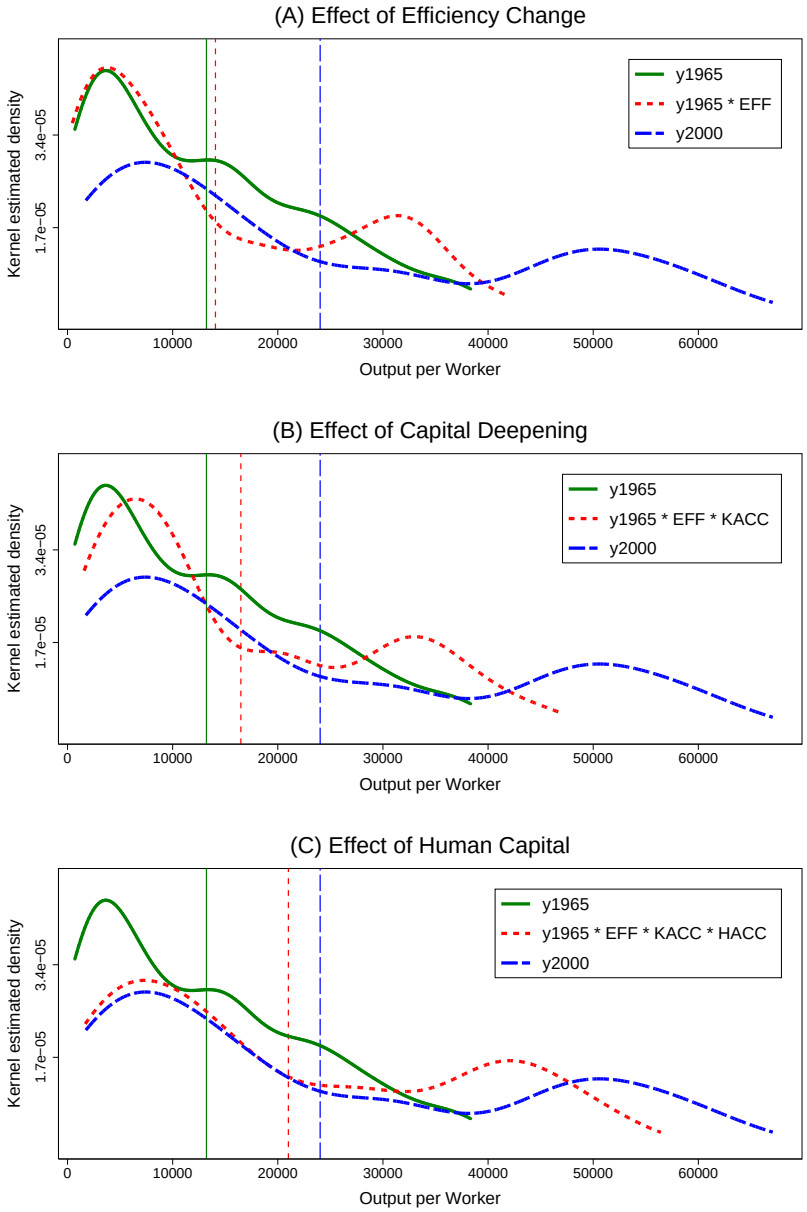

Figure C.5: Counterfactual Distributions of Output per Worker. Sequence of introducing effects of decomposition: EFF, KACC, and HACC

In each panel, the solid curve is the estimated 1965 distribution and the solid vertical line represents the 1965 mean value. The dashed curve is the estimated 1990 distribution and the dashed vertical line represents the 1990 mean value. The dotted curves in each panel are the counterfactual distributions isolating, sequentially, the effects of efficiency change, capital deepening, and human capital accumulation on the 1965 distribution, and the dotted vertical line represents the respective counterfactual mean.

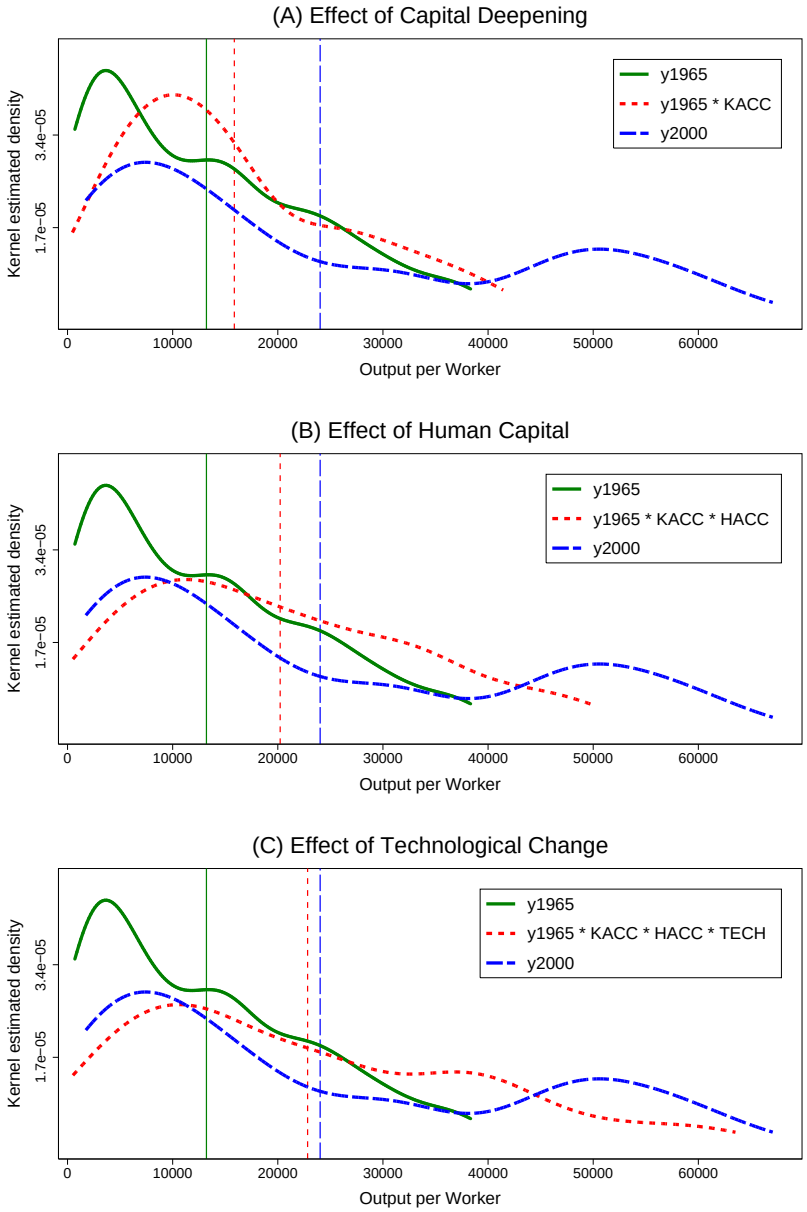

Figure C.6: Counterfactual Distributions of Output per Worker. Sequence of introducing effects of decomposition: KACC, HACC, and TECH

In each panel, the solid curve is the estimated 1965 distribution and the solid vertical line represents the 1965 mean value. The dashed curve is the estimated 1990 distribution and the dashed vertical line represents the 1990 mean value. The dotted curves in each panel are the counterfactual distributions isolating, sequentially, the effects of capital deepening, human capital accumulation, and technological change on the 1965 distribution, and the dotted vertical line represents the respective counterfactual mean.

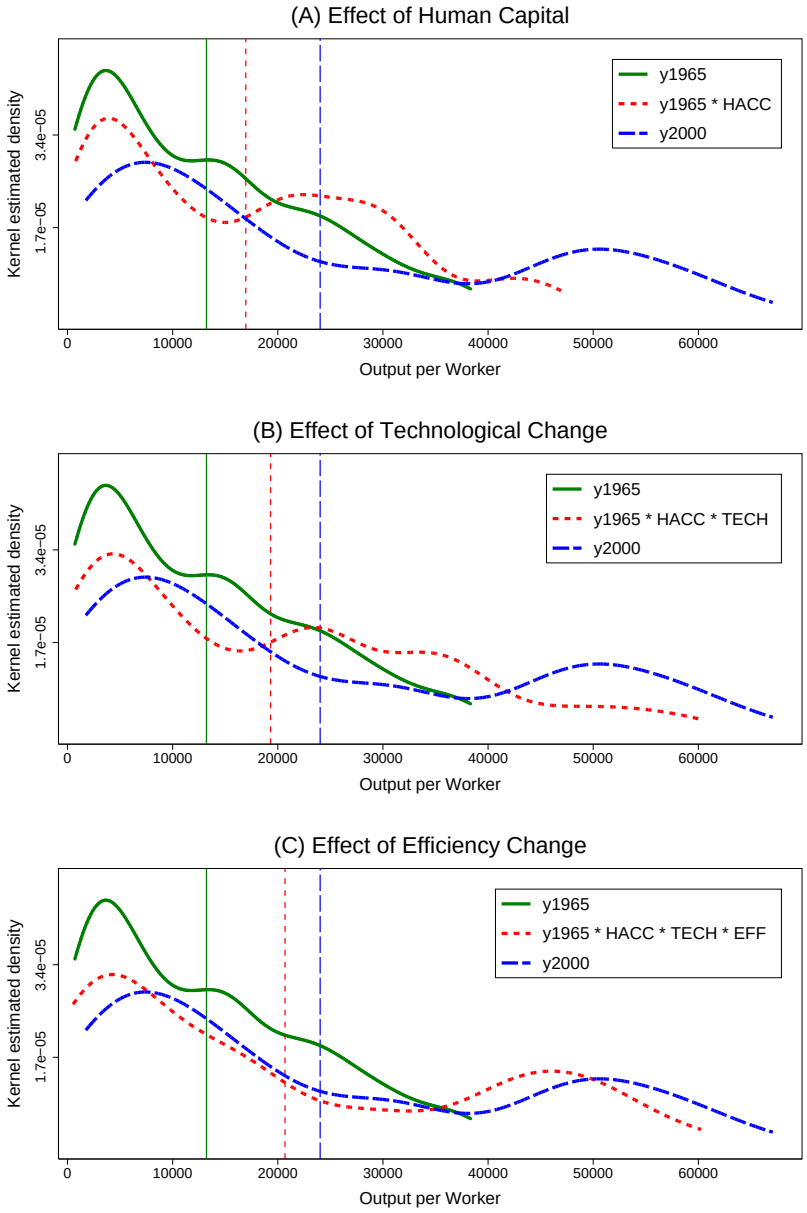

Figure C.7: Counterfactual Distributions of Output per Worker. Sequence of introducing effects of decomposition: HACC, TECH, and EFF

In each panel, the solid curve is the estimated 1965 distribution and the solid vertical line represents the 1965 mean value. The dashed curve is the estimated 1990 distribution and the dashed vertical line represents the 1990 mean value. The dotted curves in each panel are the counterfactual distributions isolating, sequentially, the effects of human capital deepening, technological change, and efficiency change on the 1965 distribution, and the dotted vertical line represents the respective counterfactual mean.

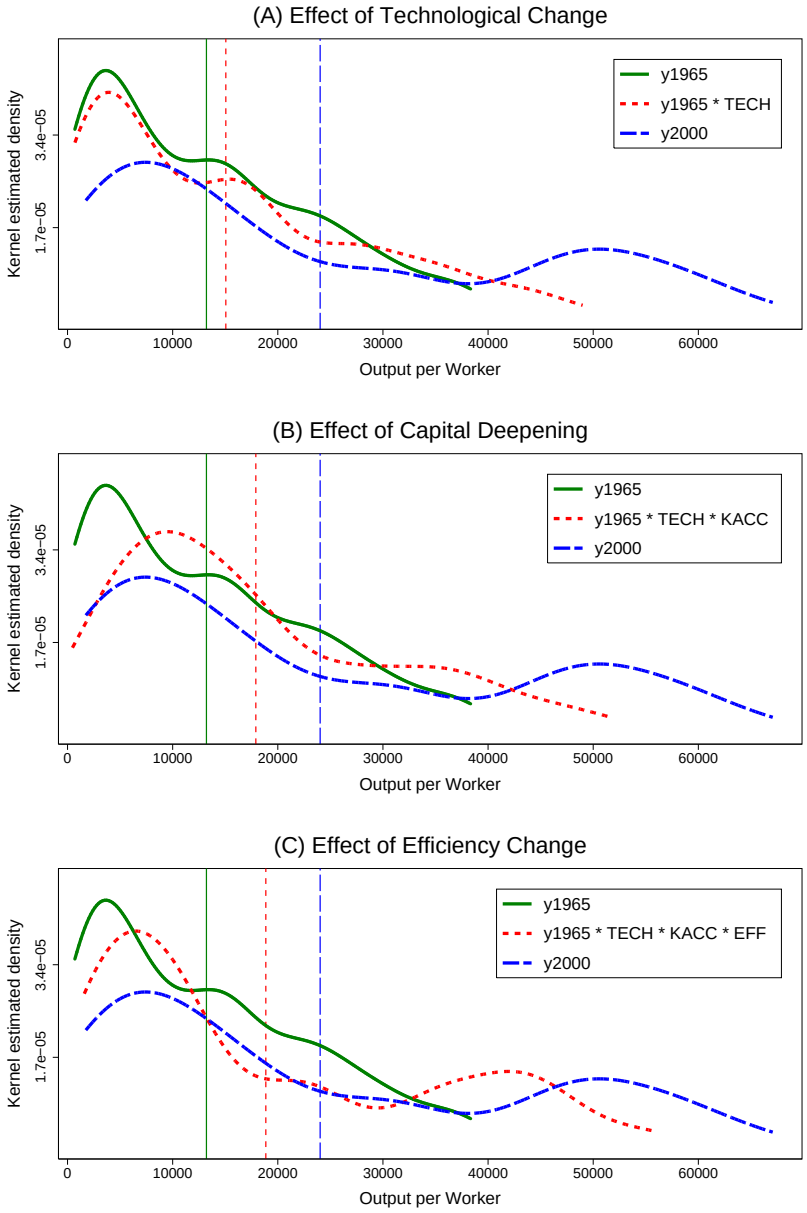

Figure C.8: Counterfactual Distributions of Output per Worker. Sequence of introducing effects of decomposition: TECH, KACC, and EFF

In each panel, the solid curve is the estimated 1965 distribution and the solid vertical line represents the 1965 mean value. The dashed curve is the estimated 1990 distribution and the dashed vertical line represents the 1990 mean value. The dotted curves in each panel are the counterfactual distributions isolating, sequentially, the effects of technological change, capital deepening, and efficiency change on the 1965 distribution, and the dotted vertical line represents the respective counterfactual mean.

Appendix D 1965−2000, simple DEA results

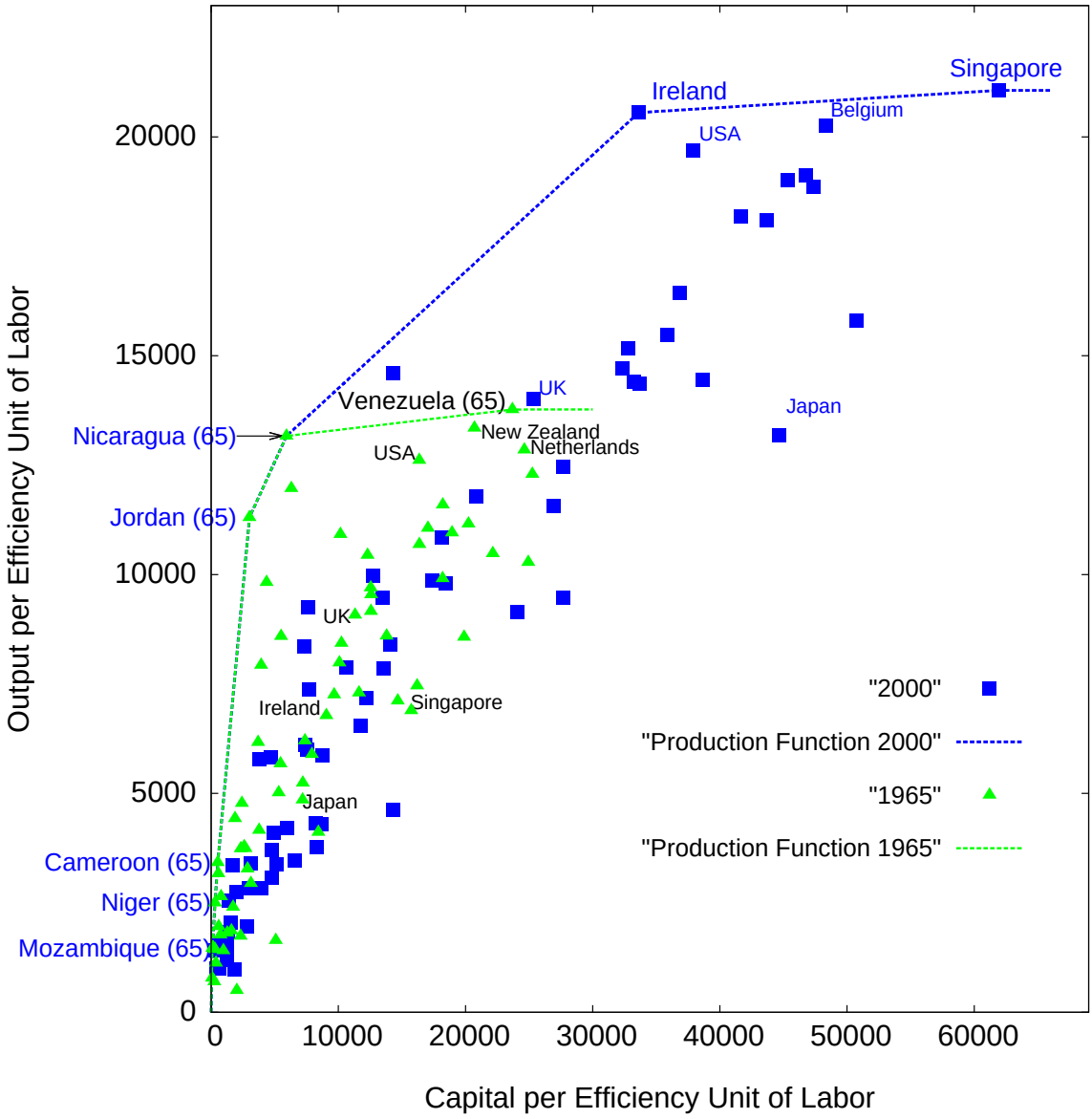

Figure D.1: Estimated best-practice world production frontiers and scatterplots of the data for 1965 and 2000

Table D.1: Efficiency scores and percentage change of tripartite decomposition indexes, 1965−2000

#	Country	eff_b	eff_c	prod. change	EFF−1 × 100	TECH−1 × 100	KACC−1 × 100	HACC−1 × 100
1	Algeria	0.91	0.55	14.9	−40.0	4.4	12.9	62.4
2	Argentina	0.78	0.66	24.9	−15.3	15.9	8.4	17.4
3	Australia	0.73	0.70	72.8	−4.3	34.4	15.4	16.4
4	Austria	0.64	0.91	160.6	41.7	31.0	20.5	16.5
5	Belgium	0.81	0.97	125.2	20.9	35.9	15.7	18.4
6	Benin	0.43	0.31	46.8	−28.0	0.0	87.4	8.8
7	Bolivia	0.35	0.25	0.5	−28.5	0.0	8.5	29.5
8	Brazil	0.45	0.45	67.6	−0.1	6.8	8.9	44.3
9	Cameroon	1.00	0.47	42.8	−52.6	0.0	168.4	12.1
10	Canada	0.85	0.70	52.9	−17.5	34.1	15.5	19.6
11	Chile	0.55	0.61	70.4	10.2	18.6	5.0	24.1
12	Colombia	0.44	0.45	43.7	1.9	1.3	8.2	28.7
13	Costa Rica	0.81	0.68	28.5	−16.0	1.5	14.3	31.8
14	Denmark	0.82	0.75	65.5	−8.0	33.5	16.5	15.7
15	Dominican Republic	0.51	0.54	109.7	6.7	1.6	61.4	19.9
16	Ecuador	0.31	0.31	45.8	−0.3	4.6	3.1	35.5
17	El Salvador	0.67	0.47	2.6	−29.5	0.0	13.4	28.3
18	Finland	0.63	0.70	119.4	11.4	36.2	15.4	25.3
19	France	0.79	0.92	121.7	15.8	33.4	18.4	21.3
20	Ghana	0.06	0.33	303.8	434.1	0.0	−31.0	9.6
21	Greece	0.55	0.62	108.3	12.7	22.4	17.8	28.1
22	Guatemala	0.53	0.49	33.8	−6.8	0.0	14.0	26.0
23	Honduras	0.36	0.25	11.9	−31.7	0.0	40.3	16.7
24	India	0.31	0.30	170.3	−4.4	0.0	129.7	23.1
25	Indonesia	0.54	0.27	196.1	−50.1	0.0	313.5	43.5
26	Iran	0.82	0.51	41.2	−38.1	18.5	18.9	62.0
27	Ireland	0.51	1.00	260.5	95.8	25.5	25.1	17.3
28	Italy	0.76	0.87	131.1	14.2	38.5	14.1	28.0
29	Jamaica	0.40	0.26	−10.6	−34.6	1.7	2.4	31.4
30	Japan	0.37	0.64	223.5	72.8	24.1	28.1	17.8
31	Jordan	1.00	0.32	−35.3	−68.1	0.1	46.3	38.4
32	Kenya	0.27	0.21	−2.4	−23.4	0.0	12.9	12.8
33	Korea	0.33	0.50	513.6	50.4	17.4	161.4	33.0
34	Malawi	0.32	0.26	86.7	−18.4	0.0	102.7	12.8
35	Malaysia	0.38	0.59	328.2	56.4	10.2	84.0	35.0
36	Mali	0.40	0.31	83.7	−21.9	0.0	125.7	4.2
37	Mauritius	0.71	0.95	125.7	33.1	13.0	6.6	40.7
38	Mexico	0.63	0.52	31.4	−18.5	10.4	7.3	36.2
39	Mozambique	1.00	0.41	31.4	−59.0	0.0	204.4	5.1

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Table D.1 (*Continued*)

#	Country	eff_b	eff_c	prod. change	EFF−1 × 100	TECH−1 × 100	KACC−1 × 100	HACC−1 × 100
40	Nepal	0.60	0.18	98.7	−69.3	0.0	420.8	24.2
41	Netherlands	0.93	0.88	66.5	−5.8	40.8	9.8	14.4
42	New Zealand	0.98	0.66	11.1	−32.7	31.3	8.5	15.9
43	Nicaragua	1.00	0.33	−51.6	−67.2	0.0	3.1	43.0
44	Niger	1.00	0.27	−31.0	−72.6	0.0	141.1	4.3
45	Norway	0.75	0.92	124.8	23.3	41.4	10.3	16.9
46	Panama	0.39	0.48	99.1	23.2	5.3	15.4	32.9
47	Paraguay	0.57	0.44	68.9	−23.0	1.4	88.9	14.5
48	Peru	0.51	0.31	−12.0	−38.5	10.3	−3.3	34.1
49	Philippines	0.30	0.30	50.3	−1.7	0.0	33.0	15.0
50	Portugal	0.60	0.75	168.4	24.3	25.9	24.9	37.4
51	Romania	0.29	0.27	235.8	−6.2	2.0	200.9	16.7
52	Senegal	0.89	0.41	4.6	−54.2	0.0	109.2	9.2
53	Singapore	0.53	1.00	341.8	89.3	32.7	23.1	42.9
54	South Africa	0.67	0.62	27.2	−7.3	1.2	7.5	26.2
55	Spain	0.68	0.80	133.6	16.6	29.2	22.3	26.7
56	Sweden	0.82	0.73	54.0	−11.0	35.1	12.2	14.1
57	Switzerland	0.89	0.76	41.7	−15.1	42.0	8.6	8.3
58	Syria	0.63	0.34	72.0	−45.5	0.0	161.2	20.7
59	Tanzania	0.71	0.34	54.6	−52.3	0.0	212.8	3.6
60	Thailand	0.19	0.30	324.0	57.5	7.0	90.7	32.0
61	Trinidad & Tobago	0.72	0.69	49.7	−5.0	18.2	11.0	20.1
62	Tunisia	0.47	0.67	133.1	41.9	7.1	10.4	38.9
63	Turkey	0.41	0.42	132.4	3.1	2.4	73.8	26.6
64	Uganda	0.62	0.52	24.4	−16.4	0.0	34.3	10.8
65	United Kingdom	0.68	0.76	95.7	12.3	20.7	16.4	24.0
66	United States	0.93	0.96	80.2	2.4	32.9	16.9	13.3
67	Uruguay	0.55	0.62	66.0	14.2	9.8	6.6	24.1
68	Venezuela	1.00	0.55	−24.2	−45.3	21.8	−4.8	19.5
69	Zambia	0.13	0.13	−20.0	1.1	0.0	−31.3	15.1
70	Zimbabwe	0.26	0.24	47.5	−7.5	0.0	29.0	23.5
	Average	0.73	0.71	90.2	−0.1	12.8	51.5	23.8

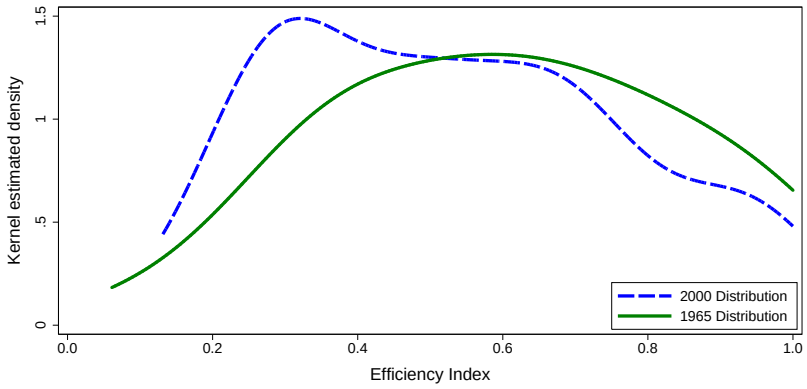

Figure D.2: Distributions of efficiency indices, 1965 and 2000

Table D.2: Mean percentage changes of the quadripartite decomposition indices (country groupings)

Country Group	Productivity Change	EFF−1 ×100	TECH−1 ×100	KACC−1 ×100	HACC−1 ×100
OECD [D.2a]	110.2	9.9	29.1	22.3	21.1
Non-OECD	52.0	−20.2	4.3	46.9	24.3
Asian Tigers [D.2b]	344.3	70.1	24.6	60.3	30.8
Latin America [D.2c]	26.6	−17.8	5.7	15.1	26.6
Africa [D.2d]	43.6	−21.0	1.5	53.5	16.7
EU 15 [D.2e]	118.4	16.1	31.3	17.5	21.9
Asia [D.2f]	114.8	−33.4	4.3	130.2	34.3

[D.2a] Australia, Austria, Belgium, Canada, Denmark, Finland, France, Greece, Ireland, Italy, Japan, Korea, Mexico, Netherlands, New Zealand, Norway, Portugal, Spain, Sweden, Switzerland, Turkey, United Kingdom, and United States.

[D.2b] Japan, Korea, and Singapore.

[D.2c] Argentina, Bolivia, Brazil, Chile, Colombia, Costa Rica, Dominican Republic, Ecuador, El Salvador, Guatemala, Honduras, Jamaica, Nicaragua, Panama, Paraguay, Peru, Philippines, Trinidad & Tobago, Uruguay, and Venezuela.

[D.2d] Algeria, Benin, Cameroon, Ghana, Kenya, Malawi, Mali, Mauritius, Mozambique, Niger, Senegal, South Africa, Tanzania, Tunisia, Uganda, Zambia, and Zimbabwe.

[D.2e] Austria, Belgium, Denmark, Finland, France, Greece, Ireland, Italy, Netherlands, Portugal, Spain, Sweden, and United Kingdom.

[D.2f] India, Indonesia, Iran, Jordan, Malaysia, Nepal, Syria, and Thailand.

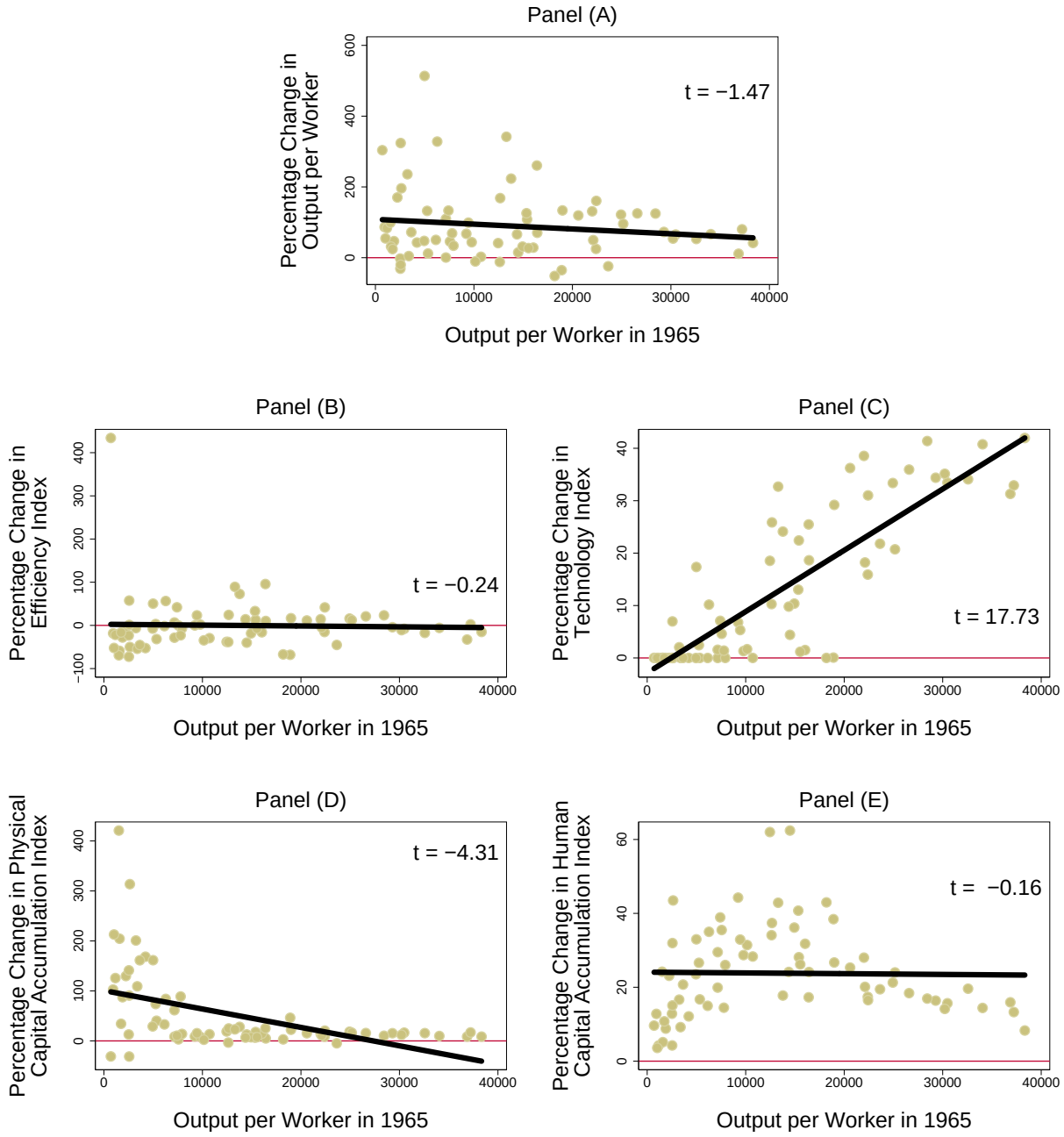

Figure D.3: Percentage change (from 1965 to 2000) in output per worker and four decomposition indexes, plotted against output per worker in 1965

Note: Each panel contains a GLS regression line.

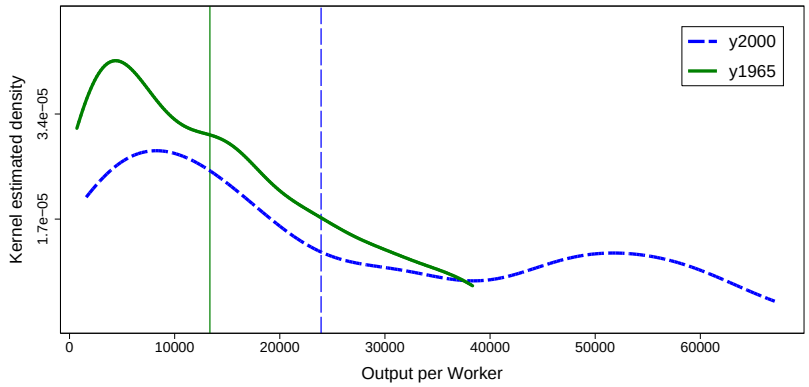

Figure D.4: Actual output per worker distributions

Table D.3: Modality tests (*p-values*)

	Distribution	H_0: One Mode H_A: More Than One Mode
1	$f(y_{1965})$	0.650
2	$f(y_{2000})$	0.009
3	$f(y_{1965} \times EFF)$	0.036
4	$f(y_{1965} \times TECH)$	0.583
5	$f(y_{1965} \times KACC)$	0.914
6	$f(y_{1965} \times HACC)$	0.180
7	$f(y_{1965} \times EFF \times TECH)$	0.015
8	$f(y_{1965} \times EFF \times KACC)$	0.041
9	$f(y_{1965} \times EFF \times HACC)$	0.030
10	$f(y_{1965} \times TECH \times KACC)$	0.406
11	$f(y_{1965} \times TECH \times HACC)$	0.385
12	$f(y_{1965} \times KACC \times HACC)$	0.610
13	$f(y_{1965} \times EFF \times TECH \times KACC)$	0.007
14	$f(y_{1965} \times EFF \times TECH \times HACC)$	0.007
15	$f(y_{1965} \times EFF \times KACC \times HACC)$	0.062
16	$f(y_{1965} \times TECH \times KACC \times HACC)$	0.771

Notes: We used the bootstrapped calibrated Silverman tests for multimodality due to Hall and York (2001) with 1000 bootstrap replications.

Table D.4: Distribution hypothesis tests (*p-values*)

	Distribution	Li Test
1	$g(y_{2000})$ vs. $f(y_{1965})$	0.000
2	$g(y_{2000})$ vs. $f(y_{1965} \times EFF)$	0.000
3	$g(y_{2000})$ vs. $f(y_{1965} \times TECH)$	0.001
4	$g(y_{2000})$ vs. $f(y_{1965} \times KACC)$	0.000
5	$g(y_{2000})$ vs. $f(y_{1965} \times HACC)$	0.000
6	$g(y_{2000})$ vs. $f(y_{1965} \times EFF \times TECH)$	0.001
7	$g(y_{2000})$ vs. $f(y_{1965} \times EFF \times KACC)$	0.000
8	$g(y_{2000})$ vs. $f(y_{1965} \times EFF \times HACC)$	0.001
9	$g(y_{2000})$ vs. $f(y_{1965} \times TECH \times KACC)$	0.006
10	$g(y_{2000})$ vs. $f(y_{1965} \times TECH \times HACC)$	0.135
11	$g(y_{2000})$ vs. $f(y_{1965} \times KACC \times HACC)$	0.000
12	$g(y_{2000})$ vs. $f(y_{1965} \times EFF \times TECH \times KACC)$	0.025
13	$g(y_{2000})$ vs. $f(y_{1965} \times EFF \times TECH \times HACC)$	0.521
14	$g(y_{2000})$ vs. $f(y_{1965} \times EFF \times KACC \times HACC)$	0.008
15	$g(y_{2000})$ vs. $f(y_{1965} \times TECH \times KACC \times HACC)$	0.652

Notes: We used the bootstrapped Li (1996) Tests with 5000 bootstrap replications and the Sheather and Jones (1991) bandwidth.

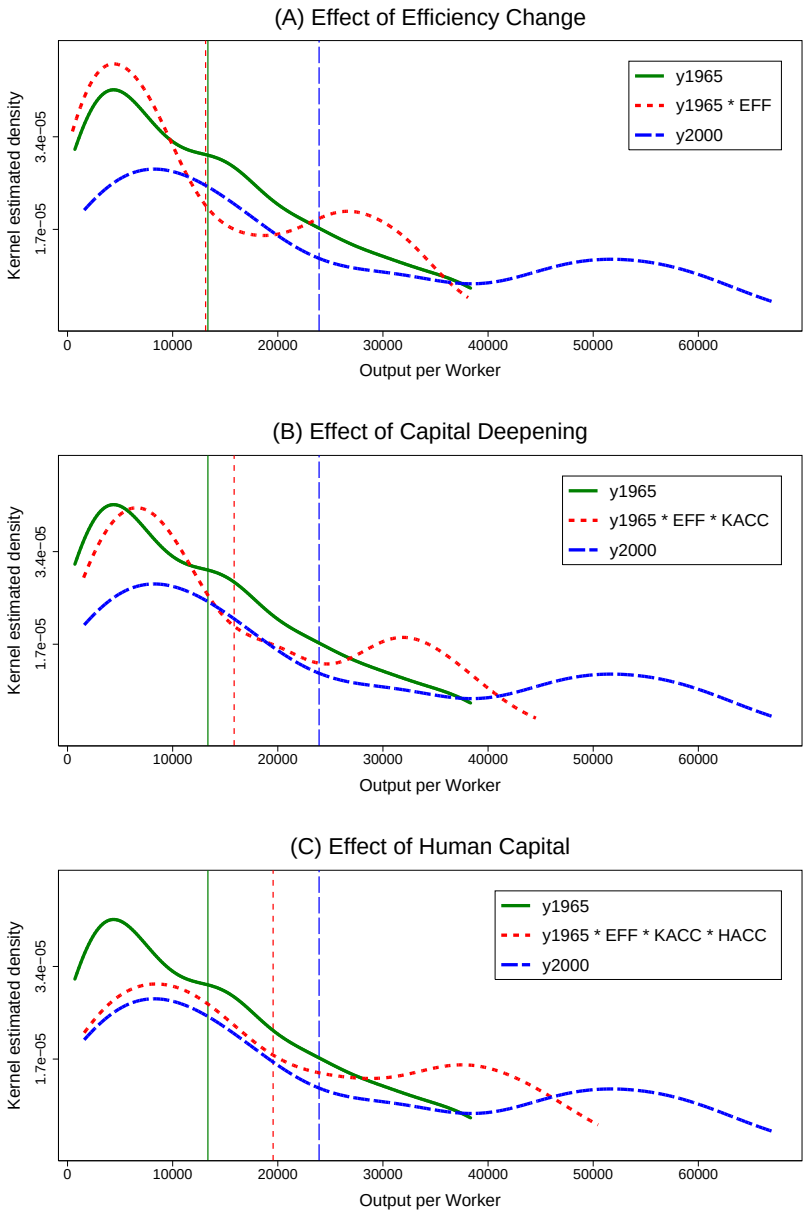

Figure D.5: Counterfactual Distributions of Output per Worker. Sequence of introducing effects of decomposition: EFF, KACC, and HACC

In each panel, the solid curve is the estimated 1965 distribution and the solid vertical line represents the 1965 mean value. The dashed curve is the estimated 2000 distribution and the dashed vertical line represents the 2000 mean value. The dotted curves in each panel are the counterfactual distributions isolating, sequentially, the effects of efficiency change, capital deepening, and human capital accumulation on the 1965 distribution, and the dotted vertical line represents the respective counterfactual mean.

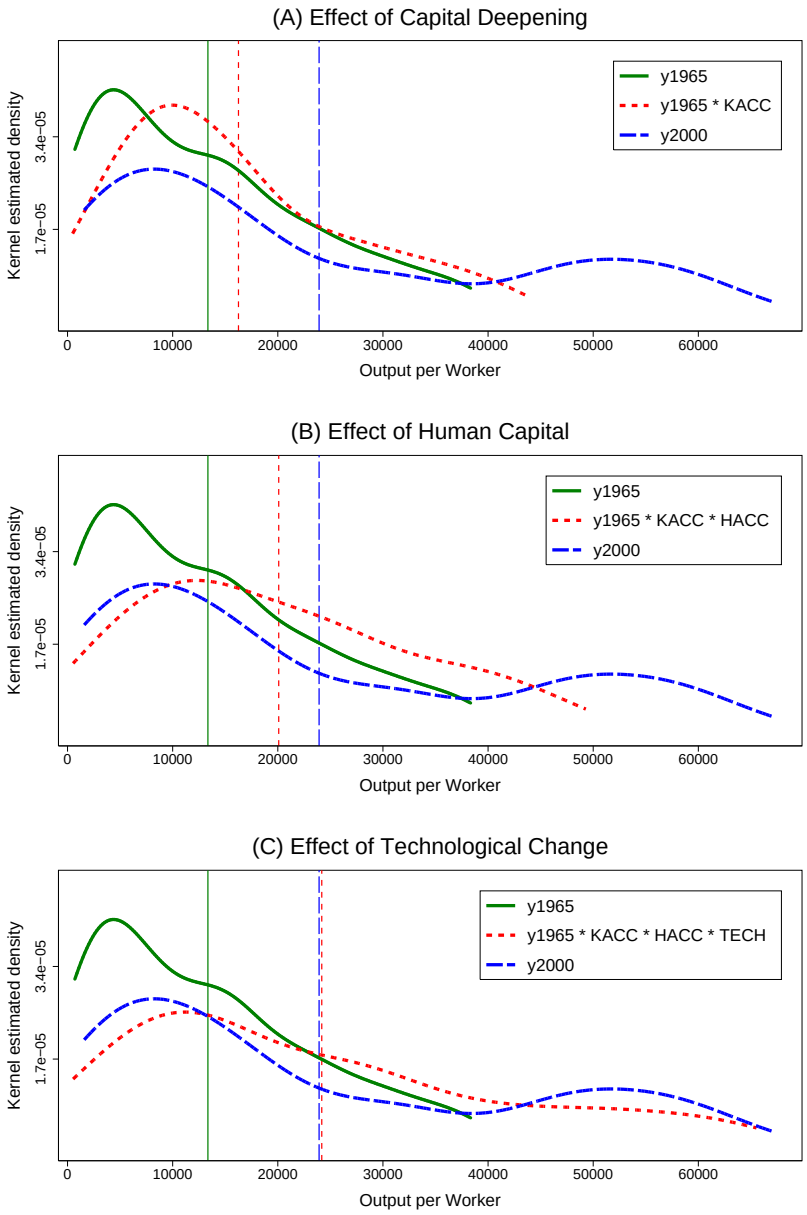

Figure D.6: Counterfactual Distributions of Output per Worker. Sequence of introducing effects of decomposition: KACC, HACC, and TECH

In each panel, the solid curve is the estimated 1965 distribution and the solid vertical line represents the 1965 mean value. The dashed curve is the estimated 2000 distribution and the dashed vertical line represents the 2000 mean value. The dotted curves in each panel are the counterfactual distributions isolating, sequentially, the effects of capital deepening, human capital accumulation, and technological change on the 1965 distribution, and the dotted vertical line represents the respective counterfactual mean.

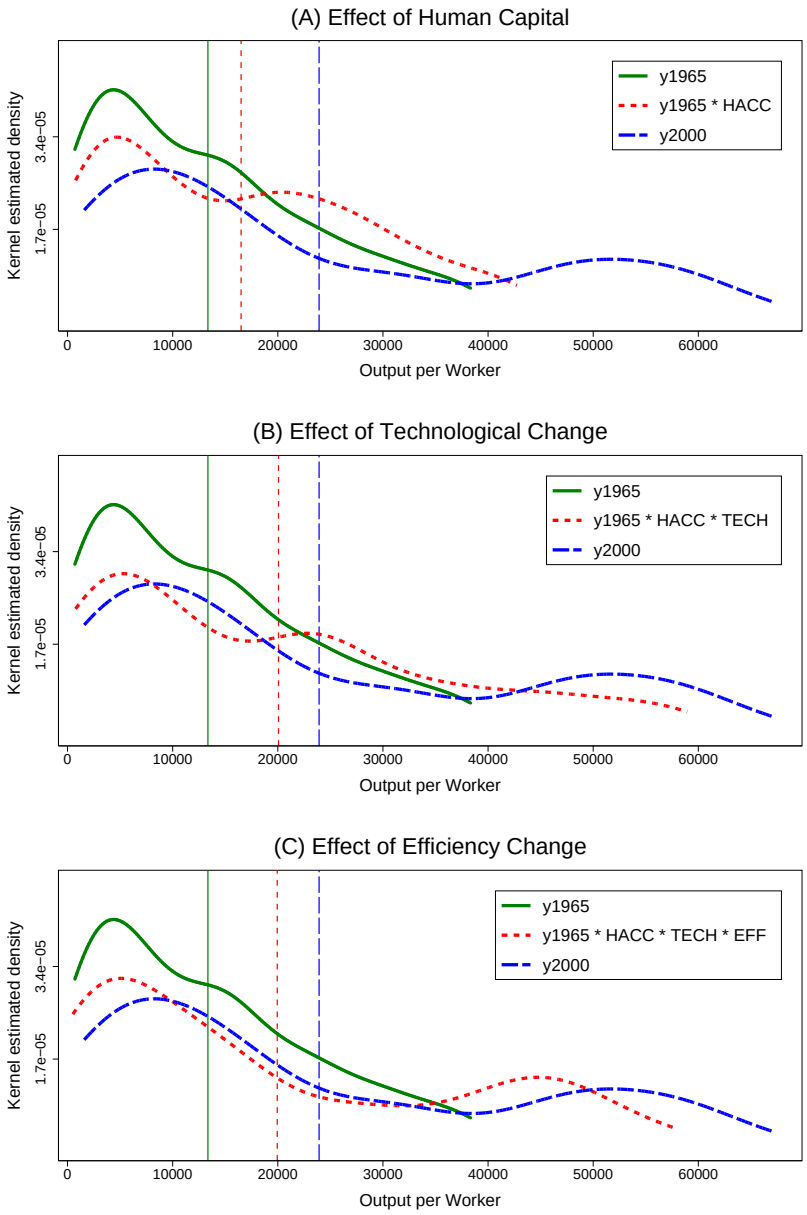

Figure D.7: Counterfactual Distributions of Output per Worker. Sequence of introducing effects of decomposition: HACC, TECH, and EFF

In each panel, the solid curve is the estimated 1965 distribution and the solid vertical line represents the 1965 mean value. The dashed curve is the estimated 2000 distribution and the dashed vertical line represents the 2000 mean value. The dotted curves in each panel are the counterfactual distributions isolating, sequentially, the effects of human capital deepening, technological change, and efficiency change on the 1965 distribution, and the dotted vertical line represents the respective counterfactual mean.

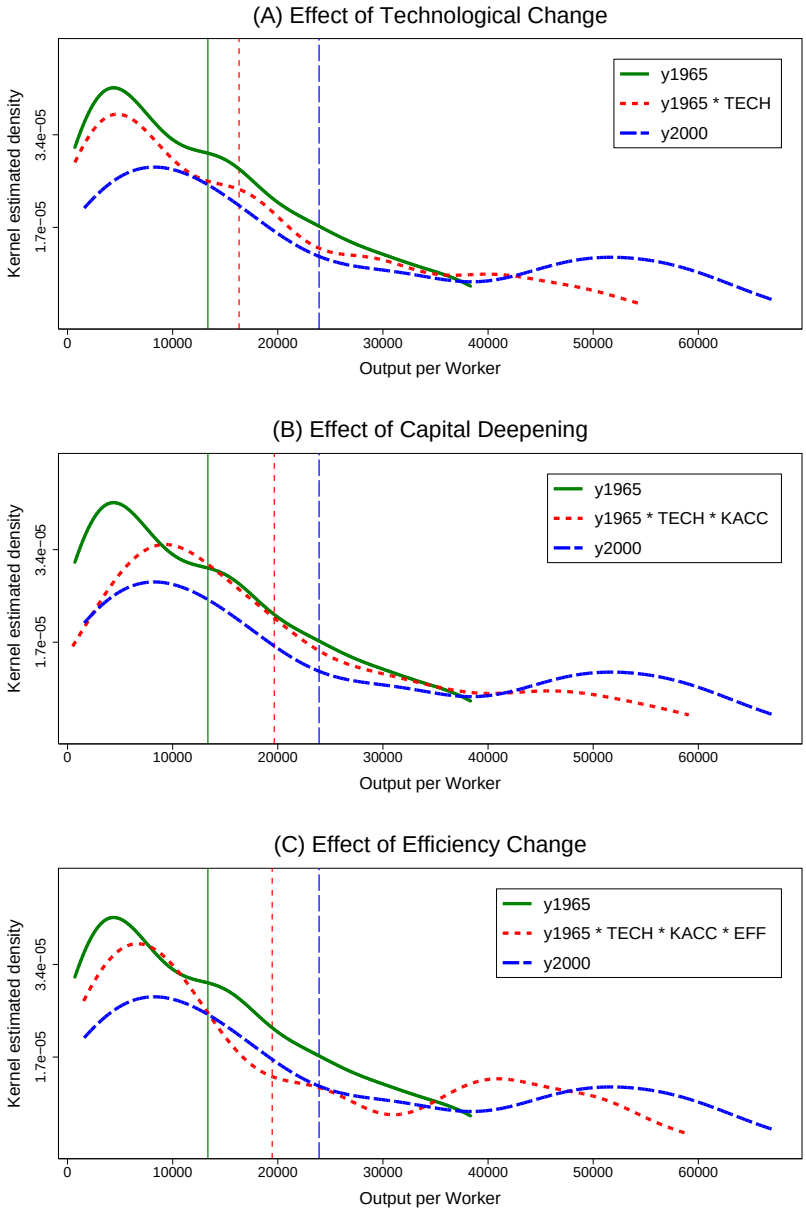

Figure D.8: Counterfactual Distributions of Output per Worker. Sequence of introducing effects of decomposition: TECH, KACC, and EFF

In each panel, the solid curve is the estimated 1965 distribution and the solid vertical line represents the 1965 mean value. The dashed curve is the estimated 2000 distribution and the dashed vertical line represents the 2000 mean value. The dotted curves in each panel are the counterfactual distributions isolating, sequentially, the effects of technological change, capital deepening, and efficiency change on the 1965 distribution, and the dotted vertical line represents the respective counterfactual mean.