APPENDICES FOR THE PAPER:

‘Technological Change and Transition: Relative Contributions to Worldwide Growth During the 1990’s’

Appendix A Results for the K&R Sample, 1992–2000

TABLE A.1
Estimation results for the change in productivity from its sources for the K&R sample, 1992–2000

Country	TE_b	TE_c	$PROD-1$ $\times 100$	$EFF-1$ $\times 100$	$TECH-1$ $\times 100$	$KACCUM-1$ $\times 100$
Argentina	0.58	0.54	9.57	−6.52	16.08	0.98
Australia	0.79	0.79	22.74	0.79	22.19	−0.34
Austria	0.82	0.78	16.14	−5.43	22.49	0.26
Belgium	0.92	0.87	16.63	−5.22	22.64	0.34
Bolivia	0.57	0.62	9.22	8.07	−4.09	5.37
Canada	0.81	0.81	23.72	−0.81	23.37	1.10
Chile	0.65	0.70	31.71	8.39	1.62	19.57
Colombia	0.81	0.74	−6.55	−9.56	−5.22	9.01
Denmark	0.74	0.78	28.29	5.47	21.69	−0.04
Dominican Republic	0.75	0.97	55.25	29.13	−5.07	26.65
Ecuador	0.47	0.43	−13.46	−7.76	−8.95	3.04
Finland	0.68	0.75	34.30	9.70	22.35	0.06
France	0.82	0.75	12.38	−8.27	22.07	0.36
Germany	0.79	0.71	11.07	−9.29	22.29	0.13
Greece	0.64	0.54	13.25	−15.68	29.41	3.78
Guatemala	0.97	1.00	5.76	3.00	−3.40	6.30
Honduras	0.74	0.58	−10.35	−21.39	−4.15	18.98
Hong Kong	1.00	0.80	28.98	−20.00	22.26	31.87
Iceland	0.70	0.69	21.86	−1.39	22.99	0.48
India	0.74	0.88	42.00	18.42	−5.84	27.34
Ireland	0.91	1.00	71.44	10.00	27.34	22.39
Israel	0.80	0.67	16.25	−16.11	28.56	7.79
Italy	0.92	0.83	10.68	−9.17	21.61	0.19
Jamaica	0.34	0.31	−5.64	−8.64	−8.12	12.42
Japan	0.75	0.60	6.98	−20.24	27.88	4.88
Kenya	0.54	0.56	−5.06	3.37	−8.20	0.05
Korea, Republic of	0.77	0.65	36.56	−15.58	17.49	37.68
Madagascar	0.58	0.68	−3.51	16.33	−11.54	−6.23
Malawi	0.37	0.55	33.83	47.25	−10.17	1.18
Mauritius	0.83	1.00	55.90	20.00	−3.82	35.08
Mexico	0.68	0.64	12.80	−5.13	6.20	11.96
Morocco	0.65	0.65	3.30	0.00	−5.68	9.53
Netherlands	0.85	0.80	15.21	−5.60	22.29	−0.20
New Zealand	0.63	0.61	18.19	−4.24	22.82	0.50

(*continued on next page*)

TABLE A.1 (*Continued*)

Country	TE_b	TE_c	$PROD-1 \times 100$	$EFF-1 \times 100$	$TECH-1 \times 100$	$KACCUM-1 \times 100$
Nigeria	0.65	0.46	−28.70	−29.49	−11.23	13.92
Norway	0.80	0.83	27.04	4.17	22.02	−0.05
Panama	0.57	0.51	5.14	−10.71	−4.19	22.91
Paraguay	1.00	0.78	−34.43	−22.48	−4.01	−11.88
Peru	0.32	0.36	4.47	13.00	−2.42	−5.25
Philippines	0.55	0.57	11.72	5.17	−3.84	10.47
Portugal	0.76	0.61	20.13	−20.12	19.91	25.42
Sierra Leone	1.00	1.00	−4.83	0.00	−17.81	15.80
Spain	0.78	0.68	13.81	−12.24	25.78	3.11
Sri Lanka	0.83	0.81	18.03	−2.42	−5.20	27.59
Sweden	0.71	0.70	20.00	−1.40	21.75	−0.04
Switzerland	0.85	0.73	4.32	−14.60	22.27	−0.09
Syria	0.79	0.95	15.52	20.95	−5.46	1.02
Taiwan	1.00	0.99	45.28	−0.99	1.06	45.20
Thailand	0.53	0.46	22.83	−14.16	−5.79	51.88
Turkey	0.77	0.67	11.65	−12.75	−7.38	38.16
United Kingdom	0.78	0.69	23.41	−11.03	27.63	8.69
USA	1.00	0.99	21.08	−0.99	21.84	0.36
Zambia	0.26	0.27	−10.16	2.41	−4.01	−8.61
Zimbabwe	0.36	0.36	−5.33	0.36	−3.90	−1.84
Average			13.16	−3.20	7.30	8.95

TABLE A.2

Mean percentage changes of the tripartite decomposition indices (country groupings)

Country Group	*Productivity change*	$EFF-1$ $\times 100$	$TECH-1$ $\times 100$	$KACCUM-1$ $\times 100$
OECD*	19.64	−5.60	22.57	3.40
Asian Tigers†	28.63	−14.54	16.73	28.95
Latin America	2.76	−2.52	−2.92	8.58
Africa	1.46	4.91	−8.60	5.81
Non OECD	5.92	−0.11	−4.36	10.87
All countries	13.16	−3.20	7.30	8.95

* OECD countries by UNESCO classification as of 2004; excluding Czech Republic, Hungary, Korea, Poland, Slovak Republic, *and* Luxembourg.

† Hong Kong, Japan, Singapore, South Korea and Taiwan.

TABLE A.3

Growth regressions of the percentage change in output per worker and the three decomposition indices on output per worker in base (1992) period

	Regression (A)	*Regression (B)*	*Regression (C)*	*Regression (D)*
	$PROD-1$ $\times$ 100	$EFF-1$ $\times$ 100	$TECH-1$ $\times$ 100	$KACCUM-1$ $\times$ 100
Constant	4.66	3.63	−12.31	14.47
	(0.357)	(0.400)	(0.000)	(0.000)
Slope	0.00042	−0.00025	0.00085	−0.00019
	(0.006)	(0.049)	(0.000)	(0.062)

Notes: p-values in parentheses, based on robust standard errors (see footnote **??**).

TABLE A.4

Testing for changes in the distribution of labor productivity due to different sources (comparison year, 2000)

H_0 : *Distributions are equal* H_1 : *Distributions are not equal*	*Value of statistic*	*Bootstrap p-value*	*Conclusion of testing* H_0
$g(y2000)$ vs. $f(y1992)$	1.6375	0.0444	reject
$g(y2000)$ vs. $f(y1992 \times EFF)$	2.2413	0.0208	reject
$g(y2000)$ vs. $f(y1992 \times TECH)$	0.0552	0.9420	fail to reject
$g(y2000)$ vs. $f(y1992 \times KACCUM)$	1.3262	0.0628	reject
$g(y2000)$ vs. $f(y1992 \times EFF \times TECH)$	0.0175	0.9840	fail to reject
$g(y2000)$ vs. $f(y1992 \times EFF \times KACCUM)$	2.1617	0.0268	reject
$g(y2000)$ vs. $f(y1992 \times TECH \times KACCUM)$	0.2632	0.7244	fail to reject

Notes: We used the bootstrapped Li (1996) tests with 5,000 bootstrap replications and the Silverman's (1986) rule-of-thumb bandwidth.

TABLE A.5

Testing for changes in the distribution of labor productivity due to different sources (comparison year, 1992)

H_0 : *Distributions are equal* H_1 : *Distributions are not equal*	*Value of statistic*	*Bootstrap p-value*	*Conclusion of testing* H_0
$g(y1992)$ vs. $f(y2000)$	1.6375	0.0458	reject
$g(y1992)$ vs. $f(y1992 \times EFF)$	0.0904	0.9050	fail to reject
$g(y1992)$ vs. $f(y1992 \times TECH)$	2.7934	0.0118	reject
$g(y1992)$ vs. $f(y1992 \times KACCUM)$	0.0694	0.9324	fail to reject
$g(y1992)$ vs. $f(y1992 \times EFF \times TECH)$	1.5435	0.0438	reject
$g(y1992)$ vs. $f(y1992 \times EFF \times KACCUM)$	–0.0571	0.9392	fail to reject
$g(y1992)$ vs. $f(y1992 \times TECH \times KACCUM)$	3.5719	0.0054	reject

Notes: We used the bootstrapped Li (1996) tests with 5,000 bootstrap replications and the Silverman's (1986) rule-of-thumb bandwidth.

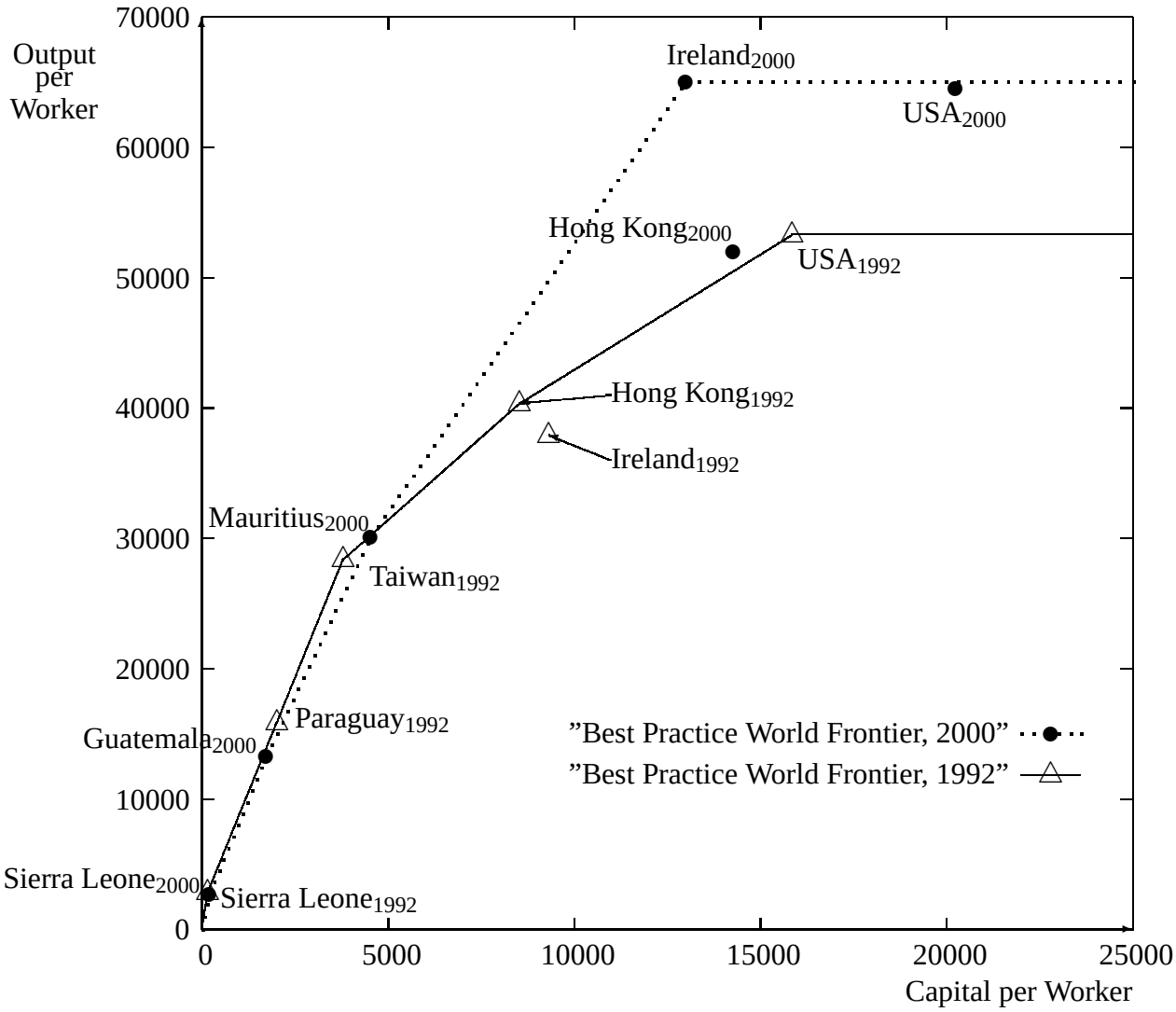

Figure A.1. Estimated best-practice world production frontiers in 1992 and in 2000

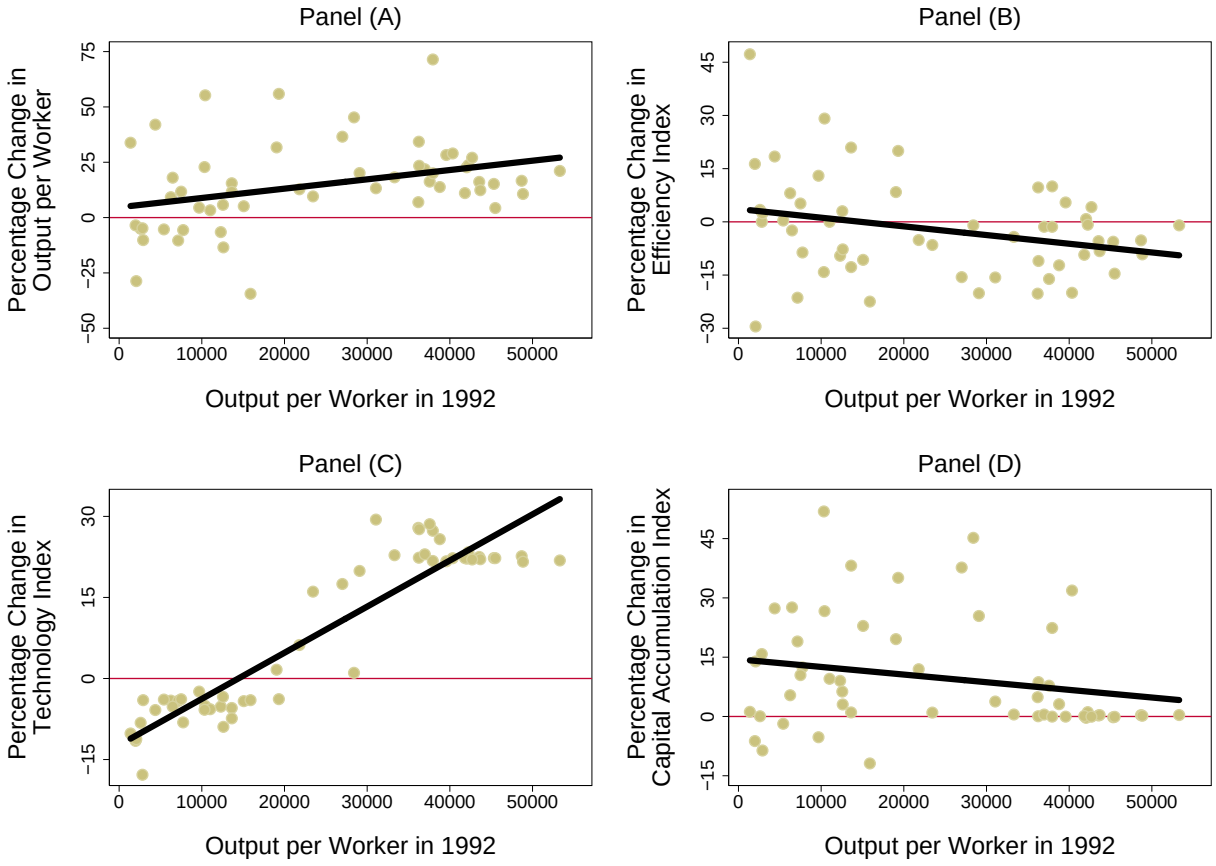

Figure A.2. Percentage change in output per worker and three decomposition indexes, plotted against output per worker in 1992

Note: Each panel contains a GLS regression line.

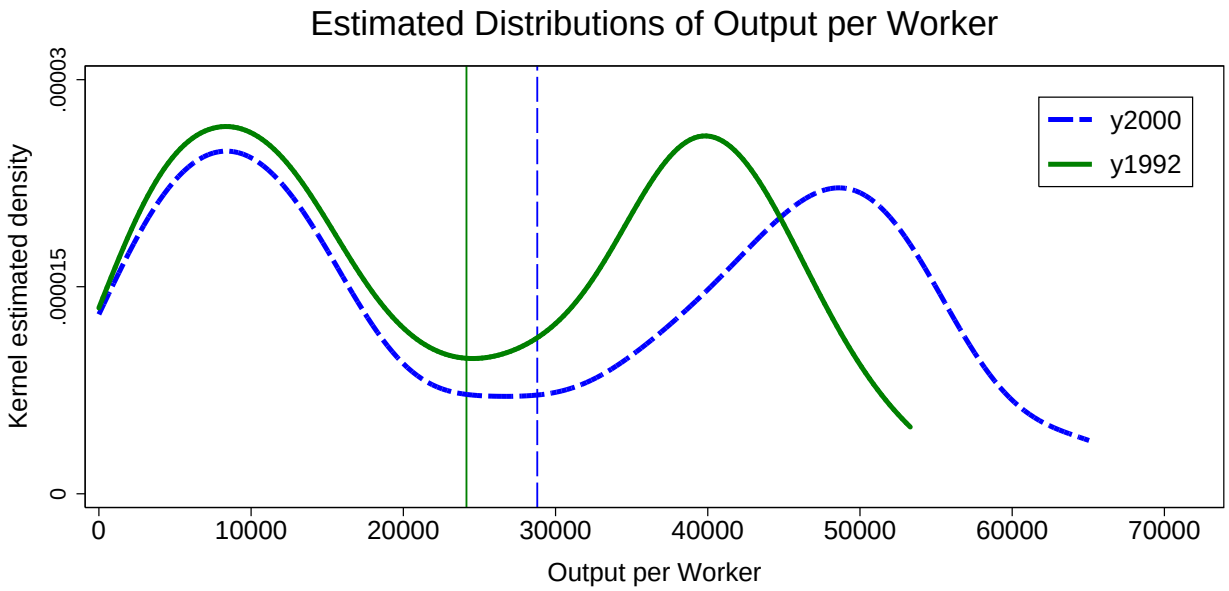

Figure A.3. Estimated 1992 and 2000 output per worker distributions

Notes: In the panel, the solid curve is the estimated 1992 distribution and the solid vertical line represents the 1992 mean value. The dashed curve is the estimated 2000 distribution and the dashed vertical line represents the 2000 mean value.

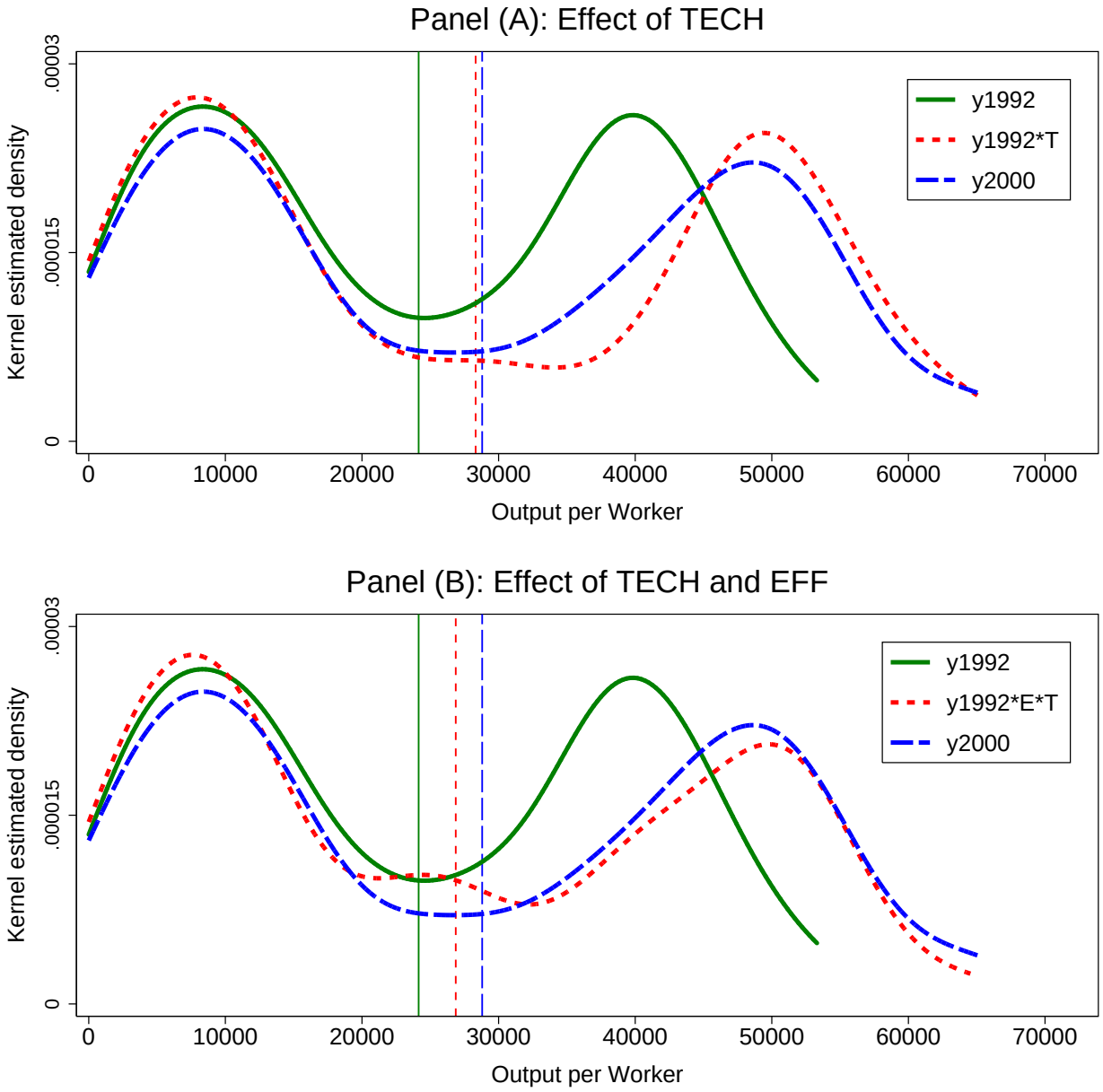

Figure A.4. Counterfactual distributions of output per worker. Sequence of introducing effects of decomposition: TECH, EFF

Notes: In each panel, the solid curve is the estimated 1992 distribution and the solid vertical line represents the 1992 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 and efficiency change on the 1992 distribution, and the dotted vertical line represents the respective counterfactual mean.

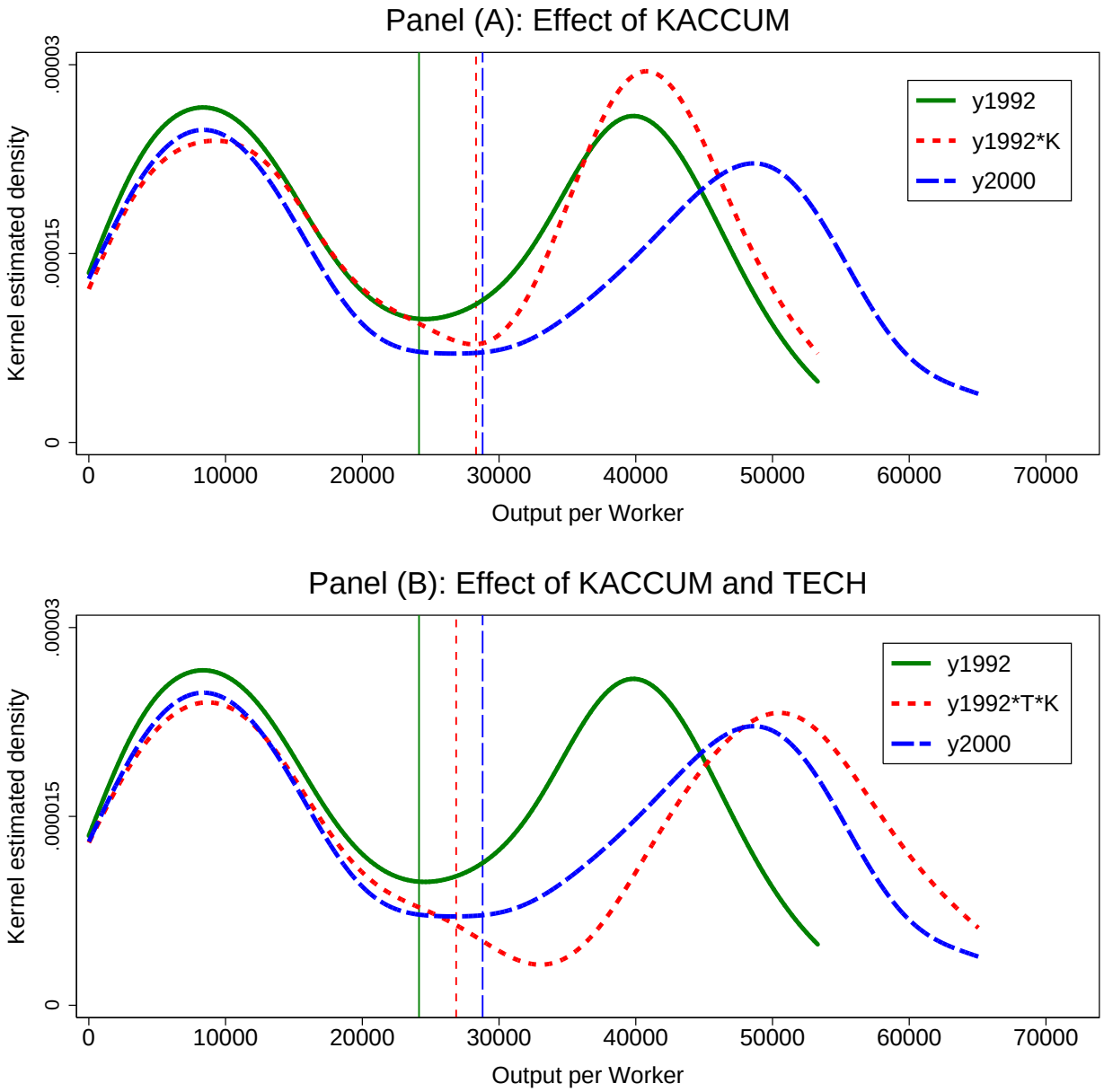

Figure A.5. Counterfactual distributions of output per worker. Sequence of introducing effects of decomposition: KACCUM, TECH

Notes: In each panel, the solid curve is the estimated 1992 distribution and the solid vertical line represents the 1992 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 accumulation and technological change on the 1992 distribution, and the dotted vertical line represents the respective counterfactual mean.

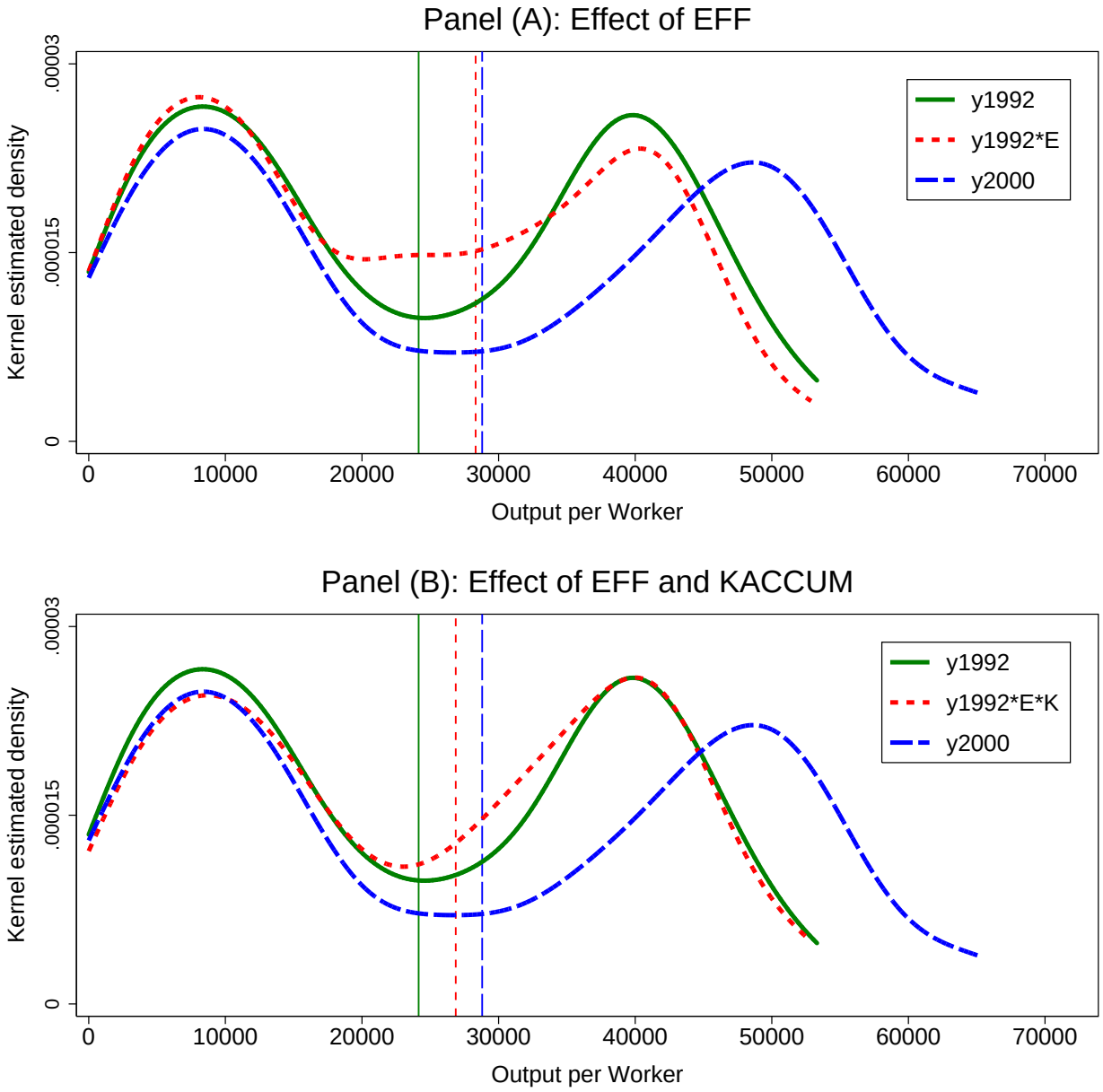

Figure A.6. Counterfactual distributions of output per worker. Sequence of introducing effects of decomposition: EFF, KACCUM

Notes: In each panel, the solid curve is the estimated 1992 distribution and the solid vertical line represents the 1992 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 and capital accumulation on the 1992 distribution, and the dotted vertical line represents the respective counterfactual mean.

Appendix B Results for the K&R Sample, 1965-2000

TABLE B.1
Estimation results for the change in productivity from its sources for the K&R sample, 1965–2000

Country	TE_b	TE_c	$PROD-1$ $\times 100$	$EFF-1$ $\times 100$	$TECH-1$ $\times 100$	$KACCUM-1$ $\times 100$
Argentina	0.94	0.54	21.82	−42.35	24.49	69.76
Australia	0.81	0.79	73.69	−1.83	52.09	16.33
Austria	0.75	0.78	158.68	3.69	44.37	72.80
Belgium	0.72	0.87	120.23	20.80	43.98	26.63
Bolivia	0.75	0.62	−14.79	−17.42	−8.78	13.12
Canada	0.90	0.80	63.53	−11.04	41.62	29.80
Chile	0.64	0.70	96.65	9.84	17.25	52.69
Colombia	0.80	0.73	26.88	−7.71	−0.38	38.01
Denmark	0.83	0.78	72.74	−5.67	42.74	28.29
Dominican Republic	0.75	0.97	163.63	29.76	−16.55	143.44
Ecuador	0.50	0.43	65.66	−14.31	10.22	75.40
Finland	0.70	0.75	146.65	7.59	43.34	59.94
France	0.82	0.75	114.36	−7.93	43.52	62.23
Germany	0.46	0.71	168.81	55.75	72.61	−0.01
Greece	0.80	0.54	127.99	−32.01	41.47	137.05
Guatemala	0.90	1.00	59.64	11.22	−12.04	63.19
Honduras	0.67	0.58	10.55	−14.12	−19.22	59.36
Hong Kong	0.68	0.80	451.81	18.19	34.62	246.82
Iceland	0.76	0.69	74.87	−8.56	41.38	35.27
India	0.45	0.88	181.03	96.67	−33.27	114.13
Ireland	0.93	1.00	319.09	7.08	38.58	182.43
Israel	0.63	0.67	116.42	7.27	41.91	42.16
Italy	0.69	0.83	155.55	20.86	42.42	48.47
Jamaica	0.57	0.31	−10.98	−45.73	11.60	46.96
Japan	0.85	0.60	246.81	−30.31	32.97	274.24
Kenya	0.26	0.56	30.18	115.29	−40.65	1.88
Korea, Republic of	0.57	0.65	608.96	14.12	5.89	486.66
Madagascar	0.41	0.68	−14.95	65.77	−41.38	−12.48
Malawi	0.30	0.55	87.45	80.52	−58.03	147.40
Mauritius	0.75	1.00	241.81	33.58	7.83	137.29
Mexico	1.00	0.64	50.16	−35.92	13.50	106.46
Morocco	0.66	0.65	59.57	−0.47	−1.01	61.97
Netherlands	0.84	0.80	70.43	−4.87	48.78	20.42
New Zealand	0.96	0.61	11.27	−36.90	52.99	15.26

(*continued on next page*)

TABLE B.1 (*Continued*)

Country	TE_b	TE_c	$PROD-1 \times 100$	$EFF-1 \times 100$	$TECH-1 \times 100$	$KACCUM-1 \times 100$
Nigeria	0.78	0.46	−41.35	−40.68	−57.82	134.43
Norway	0.65	0.83	123.19	27.96	55.69	12.03
Panama	0.77	0.51	76.34	−33.95	6.98	149.55
Paraguay	1.00	0.78	32.49	−22.26	−21.94	118.34
Peru	0.51	0.36	−23.40	−29.74	20.82	−9.76
Philippines	0.65	0.58	41.66	−11.78	−12.03	82.52
Portugal	0.83	0.61	198.28	−26.71	26.52	221.67
Sierra Leone	1.00	1.00	−9.00	0.00	−65.08	160.62
Spain	0.93	0.68	133.03	−27.07	42.27	124.60
Sri Lanka	0.68	0.80	129.08	18.77	−28.04	168.02
Sweden	0.79	0.70	61.69	−10.96	45.08	25.16
Switzerland	1.00	0.73	25.96	−27.04	58.29	9.07
Syria	0.72	0.95	106.32	32.10	−2.73	60.58
Taiwan	0.80	0.99	690.47	24.05	−16.81	665.97
Thailand	0.37	0.46	366.60	24.07	−15.45	344.77
Turkey	0.76	0.67	142.36	−12.26	−13.60	219.69
United Kingdom	0.98	0.69	89.68	−29.54	44.79	85.93
USA	1.00	0.99	82.76	−0.79	41.01	30.64
Zambia	0.37	0.27	−36.42	−28.24	−9.97	−1.59
Zimbabwe	0.25	0.36	53.93	42.68	3.27	4.47
Average			87.09	−2.23	7.19	78.52

TABLE B.2

Mean percentage changes of the tripartite decomposition indices (country groupings)

Country Group	*Productivity change*	$EFF-1$ $\times 100$	$TECH-1$ $\times 100$	$KACCUM-1$ $\times 100$
OECD*	106.92	−9.27	43.49	58.95
Asian Tigers†	472.26	−0.93	14.77	403.30
Latin America	34.03	−17.01	−1.16	63.42
Africa	21.83	20.11	−34.78	55.53
Non OECD	50.08	1.83	−15.53	74.49
All countries	87.09	−2.23	7.19	78.52

* OECD countries by UNESCO classification as of 2004; excluding Czech Republic, Hungary, Korea, Poland, Slovak Republic, *and* Luxembourg.

† Hong Kong, Japan, Singapore, South Korea and Taiwan.

TABLE B.3

Growth regressions of the percentage change in output per worker and the three decomposition indices on output per worker in base (1965) period

	Regression (A)	*Regression (B)*	*Regression (C)*	*Regression (D)*
	$PROD-1$ $\times$ 100	$EFF-1$ $\times$ 100	$TECH-1$ $\times$ 100	$KACCUM-1$ $\times$ 100
Constant	148.06	18.80	−25.49	166.27
	(0.001)	(0.051)	(0.000)	(0.000)
Slope	−0.002	−0.001	0.003	−0.005
	(0.198)	(0.010)	(0.000)	(0.001)

Notes: p-values in parentheses, based on robust standard errors (see footnote **??**).

TABLE B.4

Testing for changes in the distribution of labor productivity due to different sources (comparison year, 2000)

H_0 : *Distributions are equal* H_1 : *Distributions are not equal*	*Value of statistic*	*Bootstrap p-value*	*Conclusion of testing* H_0
$g(y2000)$ vs. $f(y1965)$	6.6647	0.0000	reject
$g(y2000)$ vs. $f(y1965 \times EFF)$	7.4651	0.0000	reject
$g(y2000)$ vs. $f(y1965 \times TECH)$	2.4844	0.0085	reject
$g(y2000)$ vs. $f(y1965 \times KACCUM)$	3.8293	0.0035	reject
$g(y2000)$ vs. $f(y1965 \times EFF \times TECH)$	2.7170	0.0080	reject
$g(y2000)$ vs. $f(y1965 \times EFF \times KACCUM)$	5.1355	0.0005	reject
$g(y2000)$ vs. $f(y1965 \times TECH \times KACCUM)$	0.0496	0.9505	fail to reject

Notes: We used the bootstrapped Li (1996) tests with 5,000 bootstrap replications and the Silverman's (1986) rule-of-thumb bandwidth.

TABLE B.5

Testing for changes in the distribution of labor productivity due to different sources (comparison year, 1965)

H_0 : *Distributions are equal* H_1 : *Distributions are not equal*	*Value of statistic*	*Bootstrap p-value*	*Conclusion of testing* H_0
$g(y1965)$ vs. $f(y2000)$	6.6647	0.0000	reject
$g(y1965)$ vs. $f(y1965 \times EFF)$	0.0496	0.9370	fail to reject
$g(y1965)$ vs. $f(y1965 \times TECH)$	1.1256	0.0570	reject
$g(y1965)$ vs. $f(y1965 \times KACCUM)$	5.1511	0.0005	reject
$g(y1965)$ vs. $f(y1965 \times EFF \times TECH)$	1.4831	0.0325	reject
$g(y1965)$ vs. $f(y1965 \times EFF \times KACCUM)$	3.1951	0.0050	reject
$g(y1965)$ vs. $f(y1965 \times TECH \times KACCUM)$	7.0380	0.0000	reject

Notes: We used the bootstrapped Li (1996) tests with 5,000 bootstrap replications and the Silverman's (1986) rule-of-thumb bandwidth.

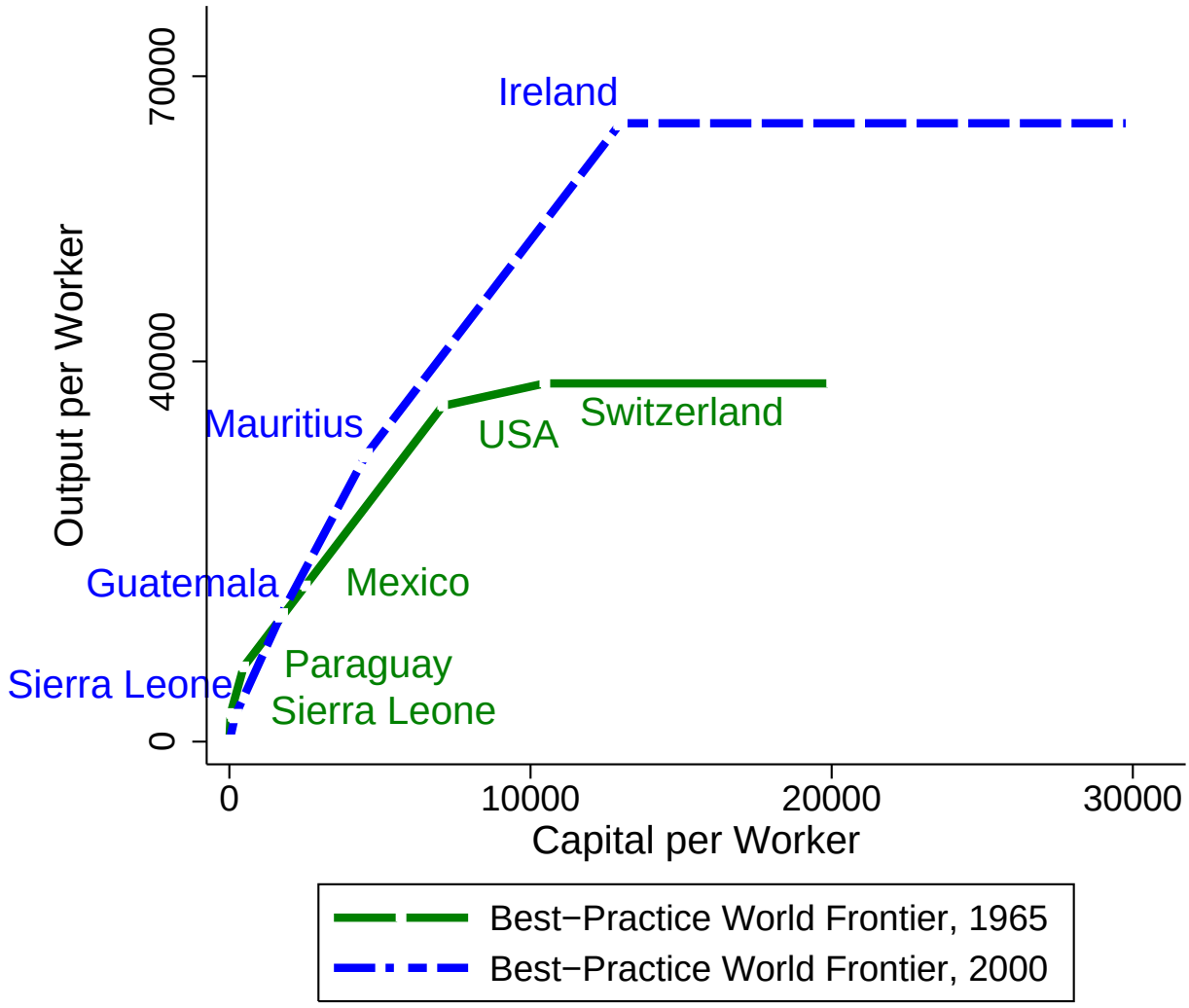

Figure B.1. Estimated best-practice world production frontiers in 1965 and in 2000

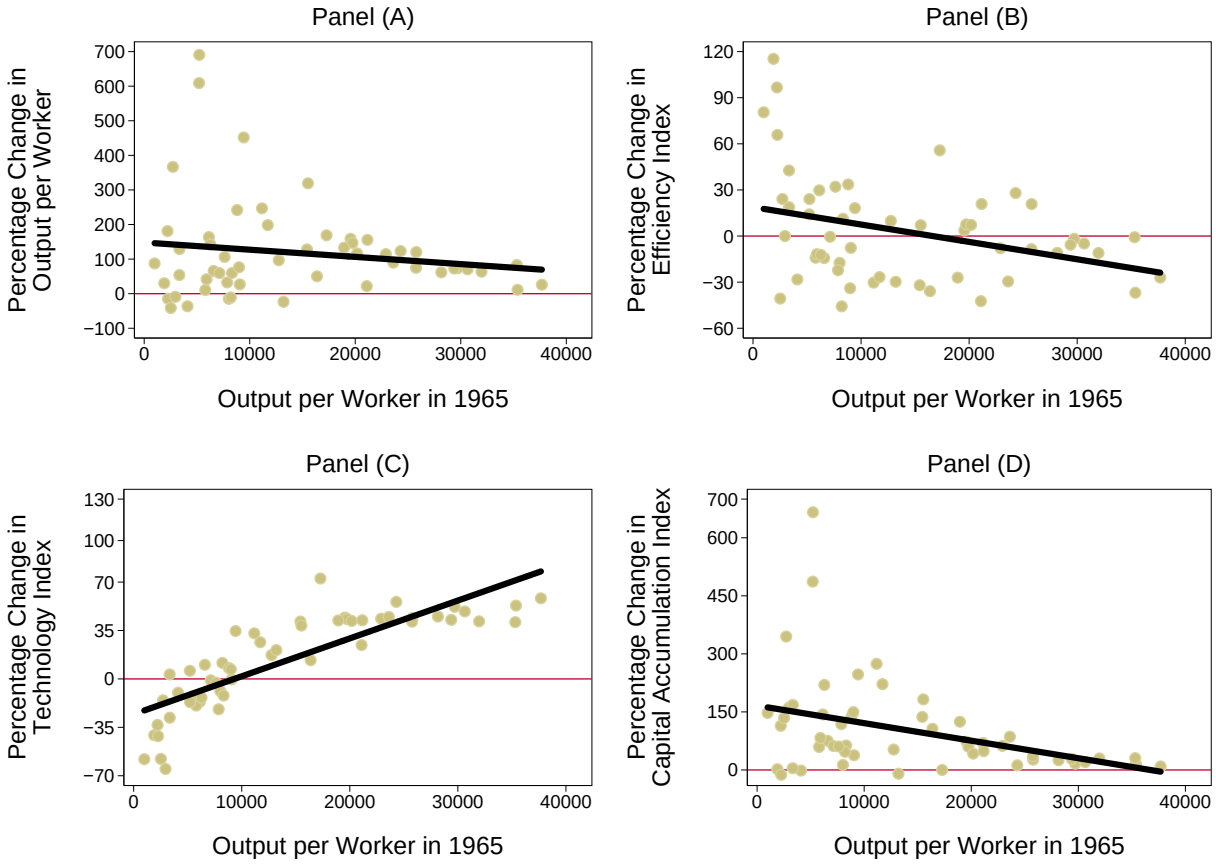

Figure B.2. Percentage change in output per worker and three decomposition indexes, plotted against output per worker in 1965

Note: Each panel contains a GLS regression line.

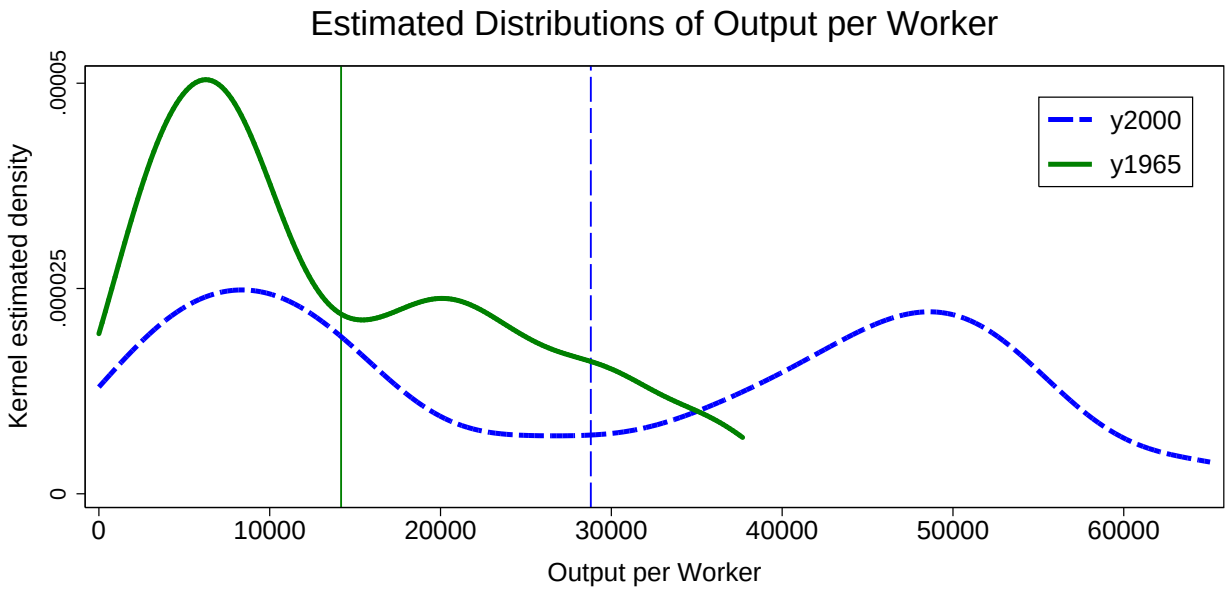

Figure B.3. Estimated 1965 and 2000 output per worker distributions

Notes: In the 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.

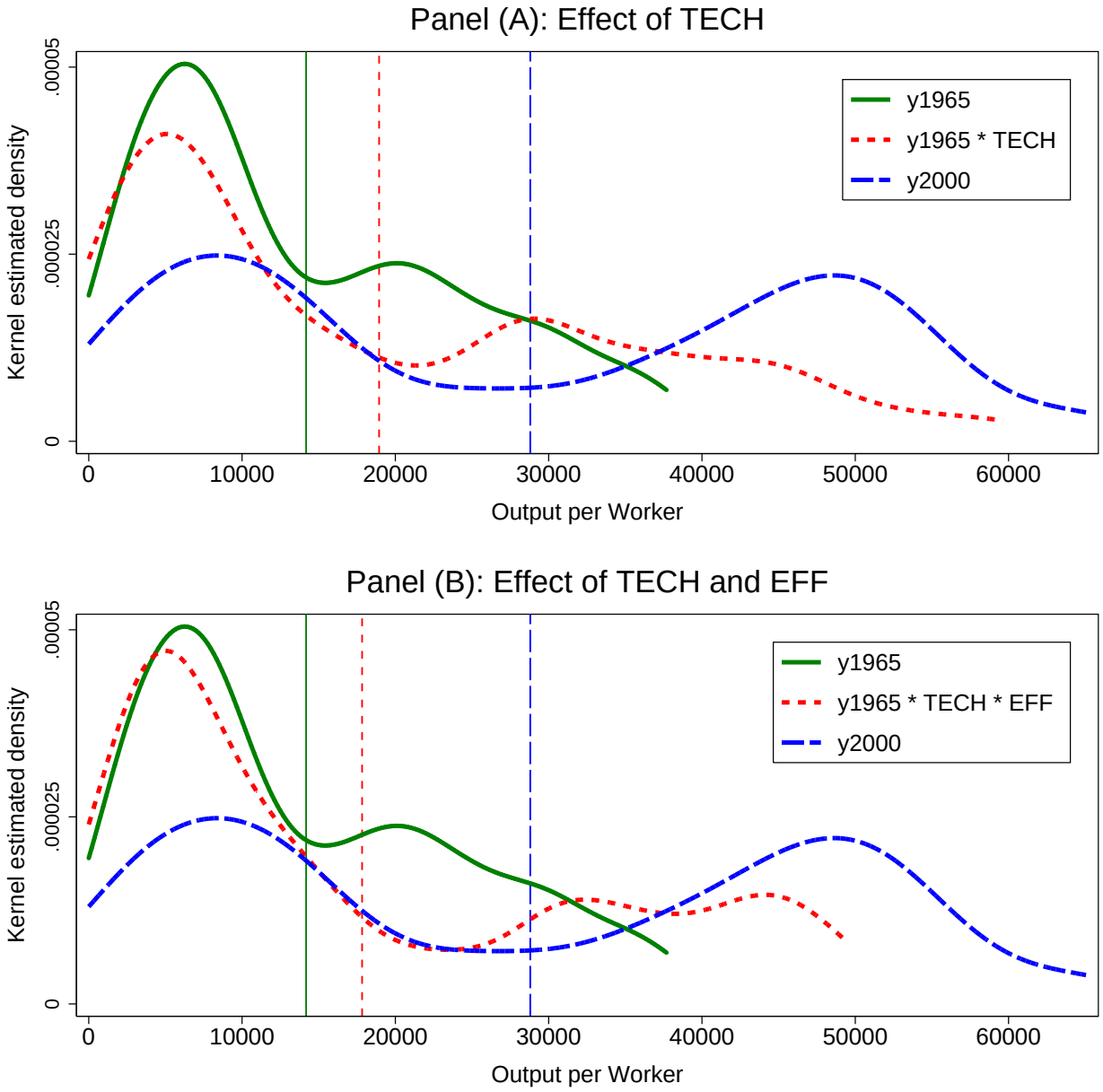

Figure B.4. Counterfactual distributions of output per worker. Sequence of introducing effects of decomposition: TECH, EFF

Notes: 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 and efficiency change on the 1965 distribution, and the dotted vertical line represents the respective counterfactual mean.

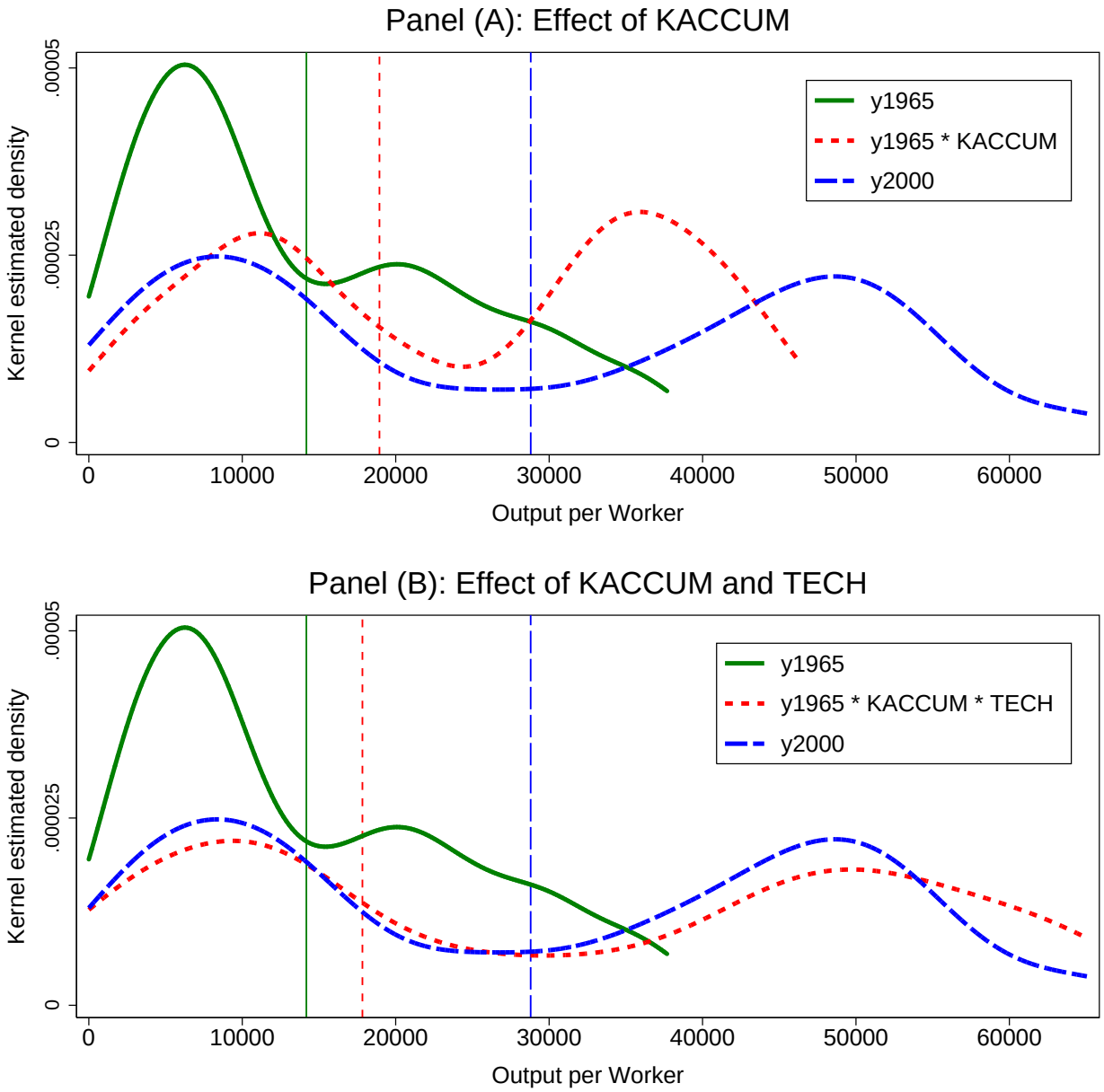

Figure B.5. Counterfactual distributions of output per worker. Sequence of introducing effects of decomposition: KACCUM, TECH

Notes: 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 accumulation and technological change on the 1965 distribution, and the dotted vertical line represents the respective counterfactual mean.

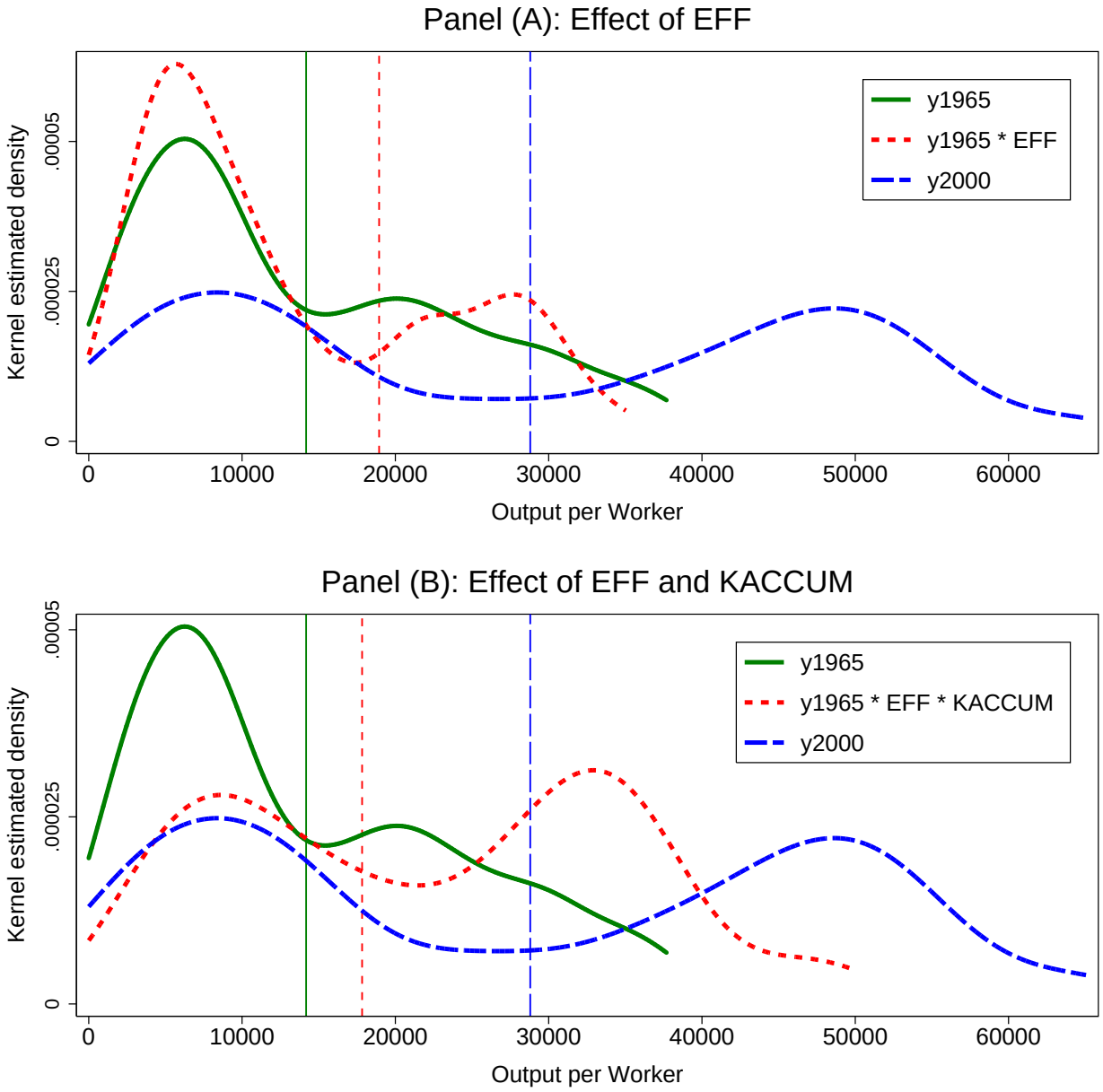

Figure B.6. Counterfactual distributions of output per worker. Sequence of introducing effects of decomposition: EFF, KACCUM

Notes: 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 and capital accumulation on the 1965 distribution, and the dotted vertical line represents the respective counterfactual mean.

Appendix C Different Assumptions on Returns to Scale

DEA technical efficiency scores can be estimated using different returns to scale assumptions. To facilitate discussion, let $\mathcal{T}_t$ denote the Data Generating Process (DGP) in period t characterized in terms of the technology set and the distribution of inputs, output and inefficiency across countries in each period (see Kneip, Simar, and Wilson, 2003). Neither the technology, nor any of the distributions are known, and all that is observed is the random sample $\langle Y_{it}, K_{it}, L_{it}\rangle_{i=1}^{n}$ generated by $\mathcal{T}_t$. The key object of estimation is the Farrell-type technical efficiency score defined in equation (**??**). Under assumption of constant returns to scale (CRS), the DEA-estimator of $\mathcal{T}_t$ would be

$$\widehat{\mathcal{T}_t} = \{\langle Y, L, K\rangle \in \Re_+^3 \mid Y \leq \sum_i z_{it} Y_{it},\ L \geq \sum_i z_i L_{it},$$
$$K \geq \sum_i z_i K_{it},\ z_i \geq 0\ \forall\ i\}.$$

Under assumption of non-increasing returns to scale (NIRS), the DEA-estimator of $\mathcal{T}_t$ would be

$$\widehat{\mathcal{T}_t} = \{\langle Y, L, K\rangle \in \Re_+^3 \mid Y \leq \sum_i z_{it} Y_{it},\ L \geq \sum_i z_i L_{it},$$
$$K \geq \sum_i z_i K_{it},\ \sum_i z_i \leq 1,\ z_i \geq 0\ \forall\ i\}.$$

Under assumption of variable returns to scale (VRS), the DEA-estimator of $\mathcal{T}_t$ would be

$$\widehat{\mathcal{T}_t} = \{\langle Y, L, K\rangle \in \Re_+^3 \mid Y \leq \sum_i z_{it} Y_{it},\ L \geq \sum_i z_i L_{it},$$
$$K \geq \sum_i z_i K_{it},\ \sum_i z_i = 1,\ z_i \geq 0\ \forall\ i\}.$$

Now, using these estimates of the $\mathcal{T}_t$, we can obtain the DEA-estimate of the technical efficiency at any fixed point $\langle Y_{it}, K_{it}, L_{it}\rangle$, as

$$\widehat{\mathrm{TE}}_{it} = \min\left\{\lambda \mid \langle Y_{it}/\lambda, L_{it}, K_{it}\rangle \in \widehat{\mathcal{T}_t}\right\}.$$

By the construction, the relationship between three technical efficiency scores is the following:

$$\widehat{\mathrm{TE}}_{it}\left(\langle Y_{it},K_{it},L_{it}\rangle|\widehat{\mathcal{T}}_t^{CRS}\right)\leq\widehat{\mathrm{TE}}_{it}\left(\langle Y_{it},K_{it},L_{it}\rangle|\widehat{\mathcal{T}}_t^{NIRS}\right)\leq\widehat{\mathrm{TE}}_{it}\left(\langle Y_{it},K_{it},L_{it}\rangle|\widehat{\mathcal{T}}_t^{VRS}\right).$$

TABLE C.1
Technical Efficiency Scores in Base (1992) and Current (2000) Years Under Different Assumptions on Returns to Scale: Constant, Non-increasing, and Variable

Country	TE_b^{CRS}	TE_c^{CRS}	TE_b^{NIRS}	TE_c^{NIRS}	TE_b^{VRS}	TE_c^{VRS}
Albania	0.62	0.75	0.62	0.75	0.63	0.78
Argentina	0.58	0.54	0.61	0.66	0.61	0.66
Armenia	0.23	0.29	0.23	0.30	0.23	0.30
Australia	0.79	0.79	0.79	0.80	0.79	0.80
Austria	0.82	0.78	0.82	0.78	0.83	0.78
Azerbaijan	0.31	0.30	0.31	0.32	0.31	0.32
Belarus	0.28	0.25	0.28	0.27	0.28	0.27
Belgium	0.91	0.87	0.91	0.88	0.92	0.88
Bolivia	0.57	0.62	0.58	0.63	0.58	0.63
Brazil	0.53	0.55	0.80	0.85	0.80	0.85
Bulgaria	0.68	0.57	0.68	0.60	0.68	0.60
Canada	0.81	0.80	0.81	0.82	0.81	0.82
Chile	0.64	0.70	0.64	0.73	0.65	0.73
China	0.67	0.74	1.00	1.00	1.00	1.00
Colombia	0.82	0.73	0.83	0.86	0.83	0.86
Costa Rica	0.67	0.70	0.67	0.72	0.70	0.72
Croatia	0.43	0.41	0.43	0.41	0.44	0.41
Czech Republic	0.42	0.37	0.42	0.37	0.42	0.37
Denmark	0.74	0.78	0.74	0.78	0.75	0.78
Dominican Republic	0.75	0.97	0.75	0.99	0.75	0.99
Ecuador	0.47	0.43	0.47	0.47	0.47	0.47
Estonia	0.33	0.38	0.33	0.38	0.36	0.38
Finland	0.68	0.75	0.68	0.75	0.69	0.75
France	0.82	0.75	0.82	0.76	0.82	0.76
Germany	0.78	0.71	0.78	0.72	0.79	0.72
Greece	0.64	0.54	0.64	0.59	0.65	0.59
Guatemala	0.97	1.00	0.98	1.00	0.98	1.00
Honduras	0.73	0.58	0.73	0.58	0.73	0.59
Hong Kong	1.00	0.80	1.00	0.88	1.00	0.88
Hungary	0.45	0.40	0.45	0.46	0.45	0.46
Iceland	0.71	0.69	0.71	0.69	1.00	1.00
India	0.74	0.88	1.00	1.00	1.00	1.00
Indonesia	0.96	0.74	1.00	0.91	1.00	0.91
Ireland	0.91	1.00	0.91	1.00	0.93	1.00
Israel	0.80	0.67	0.80	0.68	0.82	0.68
Italy	0.92	0.83	0.92	0.84	0.92	0.84

(*continued on next page*)

TABLE C.1 (*Continued*)

Country	TE_b^{CRS}	TE_c^{CRS}	TE_b^{NIRS}	TE_c^{NIRS}	TE_b^{VRS}	TE_c^{VRS}
Jamaica	0.34	0.31	0.34	0.32	0.36	0.32
Japan	0.75	0.60	0.79	0.65	0.79	0.65
Kazakhstan	0.32	0.32	0.33	0.34	0.33	0.34
Kenya	0.54	0.56	0.65	0.71	0.65	0.71
Korea, Republic of	0.77	0.65	0.90	0.84	0.90	0.84
Kyrgyzstan	0.83	0.81	0.84	0.81	0.84	0.82
Latvia	0.24	0.23	0.24	0.23	0.24	0.23
Lithuania	0.38	0.37	0.38	0.37	0.40	0.37
Macedonia	0.34	0.37	0.34	0.38	0.39	0.38
Madagascar	0.58	0.68	0.76	1.00	0.76	1.00
Malawi	0.37	0.55	0.44	0.69	0.44	0.69
Malaysia	0.74	0.76	0.74	0.80	0.74	0.80
Mauritius	0.83	1.00	0.83	1.00	1.00	1.00
Mexico	0.68	0.64	0.91	0.90	0.91	0.90
Moldova	0.36	0.28	0.36	0.28	0.36	0.29
Morocco	0.65	0.65	0.66	0.74	0.66	0.74
Netherlands	0.85	0.80	0.85	0.81	0.86	0.81
New Zealand	0.63	0.61	0.63	0.61	0.65	0.61
Nigeria	0.65	0.46	1.00	0.73	1.00	0.73
Norway	0.80	0.83	0.80	0.84	0.82	0.84
Panama	0.57	0.51	0.57	0.53	0.64	0.53
Paraguay	1.00	0.78	1.00	0.78	1.00	0.79
Peru	0.32	0.36	0.32	0.41	0.32	0.41
Philippines	0.55	0.58	0.56	0.68	0.56	0.68
Poland	0.27	0.31	0.27	0.35	0.27	0.35
Portugal	0.76	0.61	0.77	0.68	0.77	0.68
Romania	0.28	0.28	0.31	0.32	0.31	0.32
Russia	0.33	0.25	0.33	0.29	0.33	0.29
Sierra Leone	1.00	1.00	1.00	1.00	1.00	1.00
Singapore	0.76	0.82	0.76	0.82	0.77	0.82
Slovak Republic	0.36	0.36	0.36	0.36	0.37	0.36
Slovenia	0.46	0.51	0.46	0.51	0.48	0.52
Spain	0.78	0.68	0.78	0.74	0.78	0.74
Sri Lanka	0.83	0.80	0.86	0.85	0.86	0.85
Sweden	0.71	0.70	0.71	0.70	0.72	0.70
Switzerland	0.85	0.73	0.85	0.73	0.86	0.73
Syria	0.79	0.95	0.79	1.00	0.79	1.00
Taiwan	1.00	0.99	1.00	1.00	1.00	1.00

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TABLE C.1 (*Continued*)

Country	TE_b^{CRS}	TE_c^{CRS}	TE_b^{NIRS}	TE_c^{NIRS}	TE_b^{VRS}	TE_c^{VRS}
Tajikistan	0.28	0.36	0.28	0.36	0.28	0.36
Thailand	0.53	0.46	0.68	0.62	0.68	0.62
Turkey	0.77	0.67	0.89	0.83	0.89	0.83
Ukraine	0.30	0.14	0.30	0.14	0.30	0.14
United Kingdom	0.77	0.69	0.80	0.82	0.80	0.82
Uruguay	0.58	0.58	0.58	0.58	0.61	0.58
USA	1.00	0.99	1.00	1.00	1.00	1.00
Venezuela	0.58	0.44	0.60	0.45	0.60	0.45
Zambia	0.26	0.27	0.26	0.27	0.26	0.27
Zimbabwe	0.36	0.36	0.36	0.39	0.36	0.39
Average	0.63	0.61	0.66	0.66	0.67	0.67

Appendix D Results with the Assumption that the Technology Cannot Implode

TABLE D.1
Estimation results for the change in productivity from its sources, 1992–2000

Country	TE_b	TE_c	$PROD-1$ $\times 100$	$EFF-1$ $\times 100$	$TECH-1$ $\times 100$	$KACCUM-1$ $\times 100$
Albania	0.62	0.72	46.06	16.68	0.00	25.18
Argentina	0.58	0.54	9.57	−7.39	17.47	0.71
Armenia	0.23	0.27	32.89	16.02	0.00	14.53
Australia	0.79	0.79	22.74	0.58	22.04	0.00
Austria	0.82	0.78	16.14	−4.82	22.03	0.00
Azerbaijan	0.31	0.28	−0.31	−9.89	0.00	10.63
Belarus	0.28	0.25	17.39	−13.42	28.59	5.43
Belgium	0.91	0.87	16.63	−4.43	22.04	0.00
Bolivia	0.57	0.60	9.22	3.97	0.00	5.05
Brazil	0.53	0.54	16.34	0.94	6.73	7.99
Bulgaria	0.68	0.52	−12.21	−23.13	0.00	14.20
Canada	0.81	0.80	23.72	−1.06	23.53	1.22
Chile	0.64	0.68	31.71	5.82	5.65	17.80
China	0.67	0.70	69.40	5.71	0.00	60.25
Colombia	0.82	0.70	−6.55	−14.56	0.00	9.37
Costa Rica	0.67	0.64	8.23	−3.57	0.00	12.23
Croatia	0.43	0.40	13.81	−4.89	14.43	4.57
Czech Republic	0.42	0.37	9.48	−10.30	22.04	0.00
Denmark	0.74	0.78	28.29	5.12	22.04	0.00
Dominican Republic	0.75	0.91	55.25	20.98	0.00	28.33
Ecuador	0.47	0.39	−13.46	−15.91	0.00	2.91
Estonia	0.33	0.37	57.92	12.98	12.03	24.75
Finland	0.68	0.75	34.30	10.04	22.04	0.00
France	0.82	0.75	12.38	−7.91	22.03	0.00
Germany	0.78	0.71	11.07	−8.99	22.04	0.00
Greece	0.64	0.54	13.25	−15.86	29.47	3.96
Guatemala	0.97	0.97	5.76	−0.57	0.00	6.37
Honduras	0.73	0.56	−10.35	−24.26	0.00	18.37
Hong Kong	1.00	0.80	28.98	−20.01	22.83	31.27
Hungary	0.45	0.40	37.39	−11.11	27.11	21.60
Iceland	0.71	0.69	21.87	−1.87	23.11	0.88
India	0.74	0.83	42.00	12.35	0.00	26.40

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TABLE D.1 (*Continued*)

Country	TE_b	TE_c	$PROD-1$ $\times 100$	$EFF-1$ $\times 100$	$TECH-1$ $\times 100$	$KACCUM-1$ $\times 100$
Indonesia	0.96	0.72	9.87	−25.14	0.00	46.78
Ireland	0.91	1.00	71.44	10.05	27.66	22.04
Israel	0.80	0.67	16.25	−16.29	28.62	7.97
Italy	0.92	0.83	10.68	−9.31	22.04	0.00
Jamaica	0.34	0.28	−5.64	−16.39	−0.01	12.87
Japan	0.75	0.60	6.98	−20.16	27.88	4.78
Kazakhstan	0.32	0.31	26.89	−2.22	16.04	11.83
Kenya	0.54	0.51	−5.06	−5.39	0.00	0.35
Korea, Republic of	0.77	0.65	36.56	−15.97	19.04	36.51
Kyrgyzstan	0.83	0.77	13.36	−6.88	0.00	21.73
Latvia	0.24	0.23	44.23	−3.96	25.21	19.95
Lithuania	0.38	0.36	16.49	−5.80	8.10	14.40
Macedonia	0.34	0.36	13.79	6.26	4.35	2.62
Madagascar	0.58	0.60	−3.51	2.62	0.00	−5.97
Malawi	0.37	0.49	33.83	32.46	0.00	1.03
Malaysia	0.74	0.74	33.92	0.11	4.53	27.98
Mauritius	0.83	0.96	55.90	15.64	1.73	32.52
Mexico	0.68	0.63	12.80	−7.42	9.04	11.73
Moldova	0.36	0.27	−16.85	−23.42	0.00	8.58
Morocco	0.65	0.61	3.30	−6.40	0.01	10.36
Netherlands	0.85	0.80	15.21	−5.60	22.04	0.00
New Zealand	0.63	0.61	18.19	−4.65	22.99	0.78
Nigeria	0.65	0.41	−28.70	−36.88	0.00	12.95
Norway	0.80	0.83	27.04	4.11	22.04	0.00
Panama	0.57	0.49	5.14	−13.94	2.22	19.53
Paraguay	1.00	0.75	−34.43	−24.86	0.00	−12.74
Peru	0.32	0.34	4.47	6.01	2.72	−4.06
Philippines	0.55	0.55	11.72	0.47	0.00	11.19
Poland	0.27	0.31	53.35	16.92	26.51	3.67
Portugal	0.76	0.61	20.13	−20.57	21.20	24.78
Romania	0.28	0.27	4.56	−3.67	2.33	6.08
Russia	0.33	0.25	−9.26	−26.47	22.72	0.56
Sierra Leone	1.00	0.88	−4.83	−12.42	0.00	8.66
Singapore	0.76	0.82	49.94	8.16	27.11	9.07
Slovak Republic	0.36	0.36	22.70	0.56	22.03	−0.01
Slovenia	0.46	0.51	39.57	11.70	23.49	1.19
Spain	0.78	0.68	13.81	−12.55	26.03	3.27

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TABLE D.1 (*Continued*)

Country	TE_b	TE_c	$PROD-1$ $\times 100$	$EFF-1$ $\times 100$	$TECH-1$ $\times 100$	$KACCUM-1$ $\times 100$
Sri Lanka	0.83	0.77	18.03	−6.99	0.00	26.91
Sweden	0.71	0.70	20.00	−1.67	22.04	0.00
Switzerland	0.85	0.73	4.32	−14.52	22.04	0.00
Syria	0.79	0.90	15.52	13.57	0.00	1.71
Taiwan	1.00	0.98	45.28	−2.41	6.62	39.62
Tajikistan	0.28	0.34	27.09	23.10	0.00	3.24
Thailand	0.53	0.43	22.83	−19.83	0.85	51.91
Turkey	0.77	0.61	11.65	−20.24	0.00	39.98
Ukraine	0.30	0.14	−41.99	−52.49	22.07	0.02
United Kingdom	0.77	0.69	23.41	−11.05	27.83	8.54
Uruguay	0.58	0.56	10.78	−2.85	8.86	4.75
USA	1.00	0.99	21.08	−0.79	22.04	0.00
Venezuela	0.58	0.44	−17.13	−25.39	12.79	−1.53
Zambia	0.26	0.26	−10.16	−1.80	0.00	−8.52
Zimbabwe	0.36	0.35	−5.33	−3.44	0.01	−1.97
Average			14.34	−6.20	10.99	9.82

TABLE D.2

Mean percentage changes of the tripartite decomposition indices (country groupings)

Country Group	*Productivity change*	$EFF-1$ $\times 100$	$TECH-1$ $\times 100$	$KACCUM-1$ $\times 100$
OECD*	20.25	−5.00	22.55	3.29
Non OECD	12.17	−6.38	6.86	12.36
Asian Tigers†	32.63	−10.75	20.44	23.38
Latin America	2.98	−7.39	3.20	7.75
Africa	1.46	−3.44	0.19	4.87
Transition (all)‡	16.52	−5.56	11.51	11.28
Non-Transition	13.29	−3.38	6.94	9.65
Baltic Countries§	38.44	0.73	14.89	19.63
Central and Eastern Europe¶	21.23	−0.89	13.71	7.58
Republics of Former USSR$	0.99	−13.49	9.35	8.31
All countries	14.56	−6.20	11.00	9.82

* OECD countries by UNESCO classification as of 2004; excluding Czech Republic, Hungary, Korea, Poland, Slovak Republic, *and* Luxembourg.

† Hong Kong, Japan, Singapore, South Korea and Taiwan.

‡ Albania, Armenia, Azerbaijan, Belarus, Bulgaria, China, Croatia, Czech Republic, Estonia, Hungary, Kazakhstan, Kyrgyzstan, Latvia, Lithuania, Macedonia, Moldova, Poland, Romania, Russia, Slovak Republic, Slovenia, Tajikistan, Ukraine.

§ Estonia, Latvia, Lithuania.

¶ Albania, Bulgaria, Croatia, Czech Republic, Hungary, Macedonia, Poland, Romania, Slovak Republic, Slovenia.

$ Excluding Baltic Countries.

TABLE D.3

Growth regressions of the percentage change in output per worker and the three decomposition indices on output per worker in base (1992) period

	Regression (A)	*Regression (B)*	*Regression (C)*	*Regression (D)*
	$PROD-1$ $\times 100$	$EFF-1$ $\times 100$	$TECH-1$ $\times 100$	$KACCUM-1$ $\times 100$
Constant	10.85 (0.015)	−3.68 (0.219)	−0.75 (0.521)	15.72 (0.000)
Slope	0.0003 (0.054)	−0.0001 (0.448)	0.0006 (0.000)	−0.0002 (0.006)

Notes: p-values in parentheses, based on robust standard errors (see footnote **??**).

TABLE D.4

Testing for changes in the distribution of labor productivity due to different sources (comparison year, 2000)

H_0 : *Distributions are equal* H_1 : *Distributions are not equal*	*Value of statistic*	*Bootstrap p-value*	*Conclusion of testing* H_0
$g(y2000)$ vs. $f(y1992)$	1.0792	0.0795	reject
$g(y2000)$ vs. $f(y1992 \times EFF)$	1.3717	0.0480	reject
$g(y2000)$ vs. $f(y1992 \times TECH)$	-0.0442	0.9485	fail to reject
$g(y2000)$ vs. $f(y1992 \times KACCUM)$	1.0178	0.0880	reject
$g(y2000)$ vs. $f(y1992 \times EFF \times TECH)$	0.0346	0.9705	fail to reject
$g(y2000)$ vs. $f(y1992 \times EFF \times KACCUM)$	1.2814	0.0570	reject
$g(y2000)$ vs. $f(y1992 \times TECH \times KACCUM)$	0.1890	0.7810	fail to reject

Notes: We used the bootstrapped Li (1996) tests with 5,000 bootstrap replications and the Silverman's (1986) rule-of-thumb bandwidth.

TABLE D.5

Testing for changes in the distribution of labor productivity due to different sources (comparison year, 1992)

H_0 : *Distributions are equal* H_1 : *Distributions are not equal*	*Value of statistic*	*Bootstrap p-value*	*Conclusion of testing* H_0
$g(y1992)$ vs. $f(y2000)$	1.0792	0.0823	reject
$g(y1992)$ vs. $f(y1992 \times EFF)$	0.0310	0.9620	fail to reject
$g(y1992)$ vs. $f(y1992 \times TECH)$	1.6892	0.0305	reject
$g(y1992)$ vs. $f(y1992 \times KACCUM)$	0.1144	0.8760	fail to reject
$g(y1992)$ vs. $f(y1992 \times EFF \times TECH)$	1.0602	0.0790	reject
$g(y1992)$ vs. $f(y1992 \times EFF \times KACCUM)$	-0.0916	0.8985	fail to reject
$g(y1992)$ vs. $f(y1992 \times TECH \times KACCUM)$	2.3645	0.0105	reject

Notes: We used the bootstrapped Li (1996) tests with 5,000 bootstrap replications and the Silverman's (1986) rule-of-thumb bandwidth.

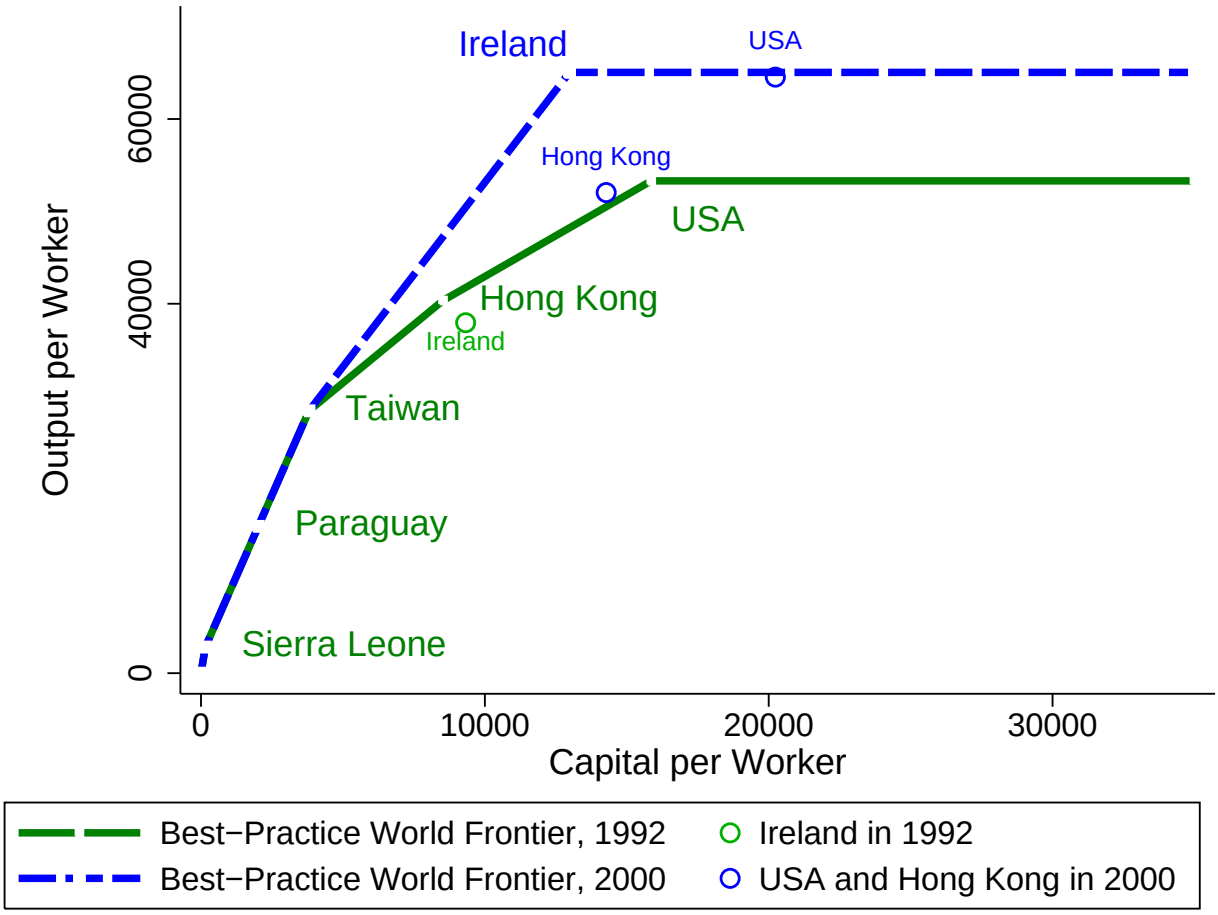

Figure D.1. Estimated best-practice world production frontiers in 1992 and in 2000

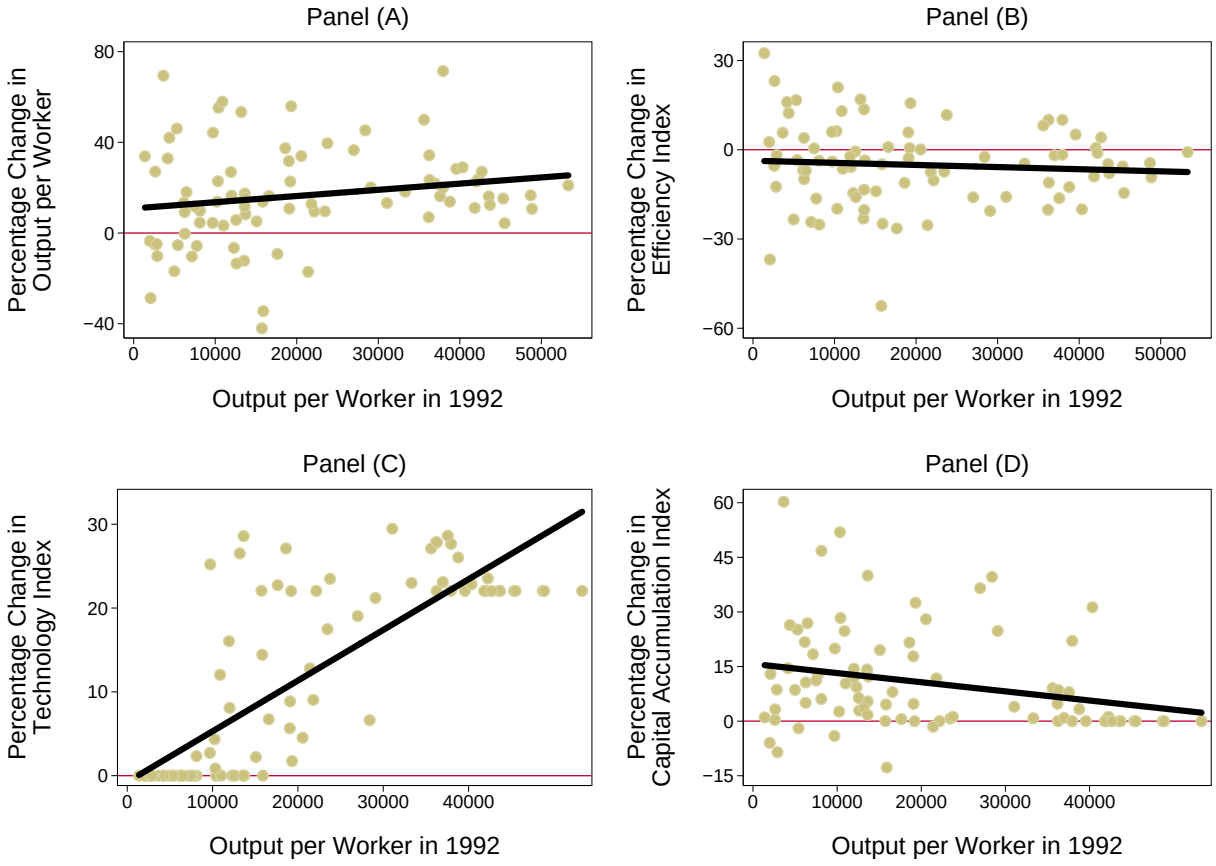

Figure D.2. Percentage change in output per worker and three decomposition indexes, plotted against output per worker in 1992

Note: Each panel contains a GLS regression line.

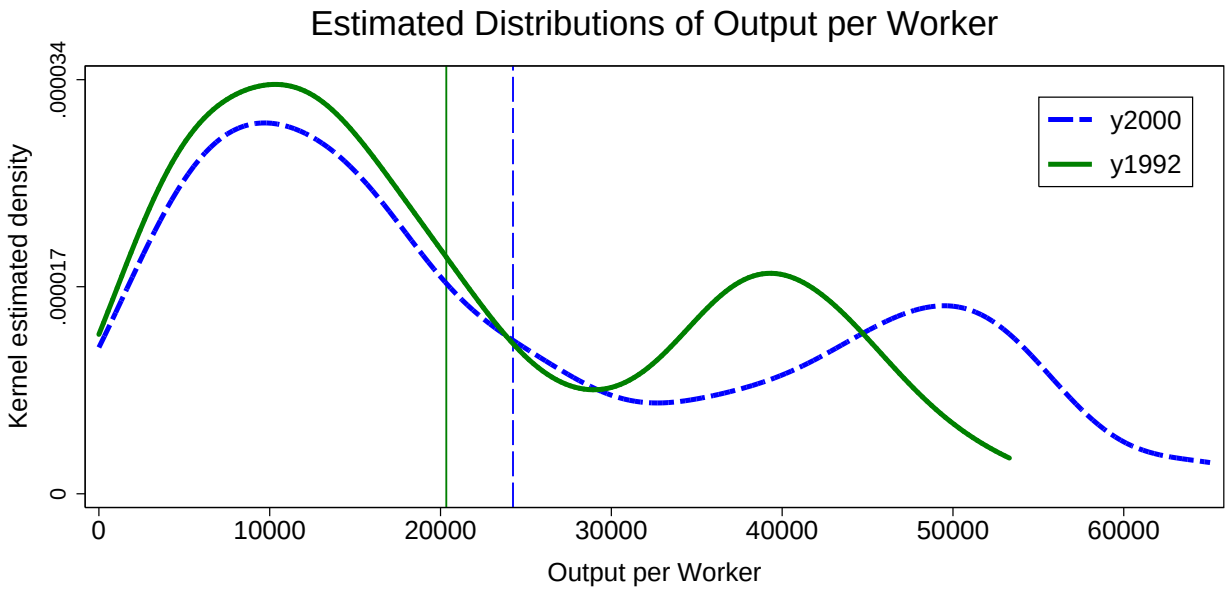

Figure D.3. Estimated 1992 and 2000 output per worker distributions

Notes: In the panel, the solid curve is the estimated 1992 distribution and the solid vertical line represents the 1992 mean value. The dashed curve is the estimated 2000 distribution and the dashed vertical line represents the 2000 mean value.

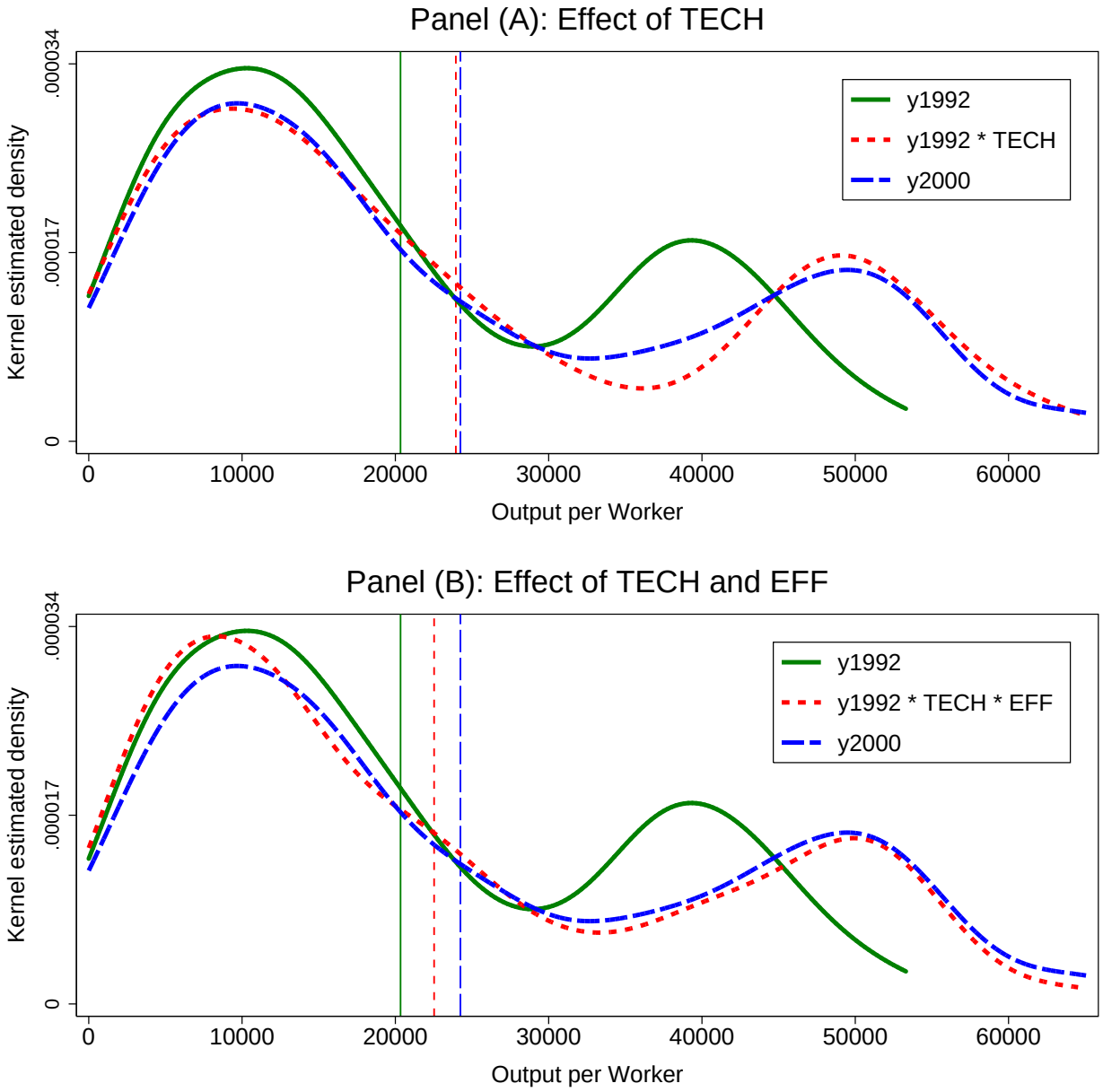

Figure D.4. Counterfactual distributions of output per worker. Sequence of introducing effects of decomposition: TECH, EFF

Notes: In each panel, the solid curve is the estimated 1992 distribution and the solid vertical line represents the 1992 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 and efficiency change on the 1992 distribution, and the dotted vertical line represents the respective counterfactual mean.

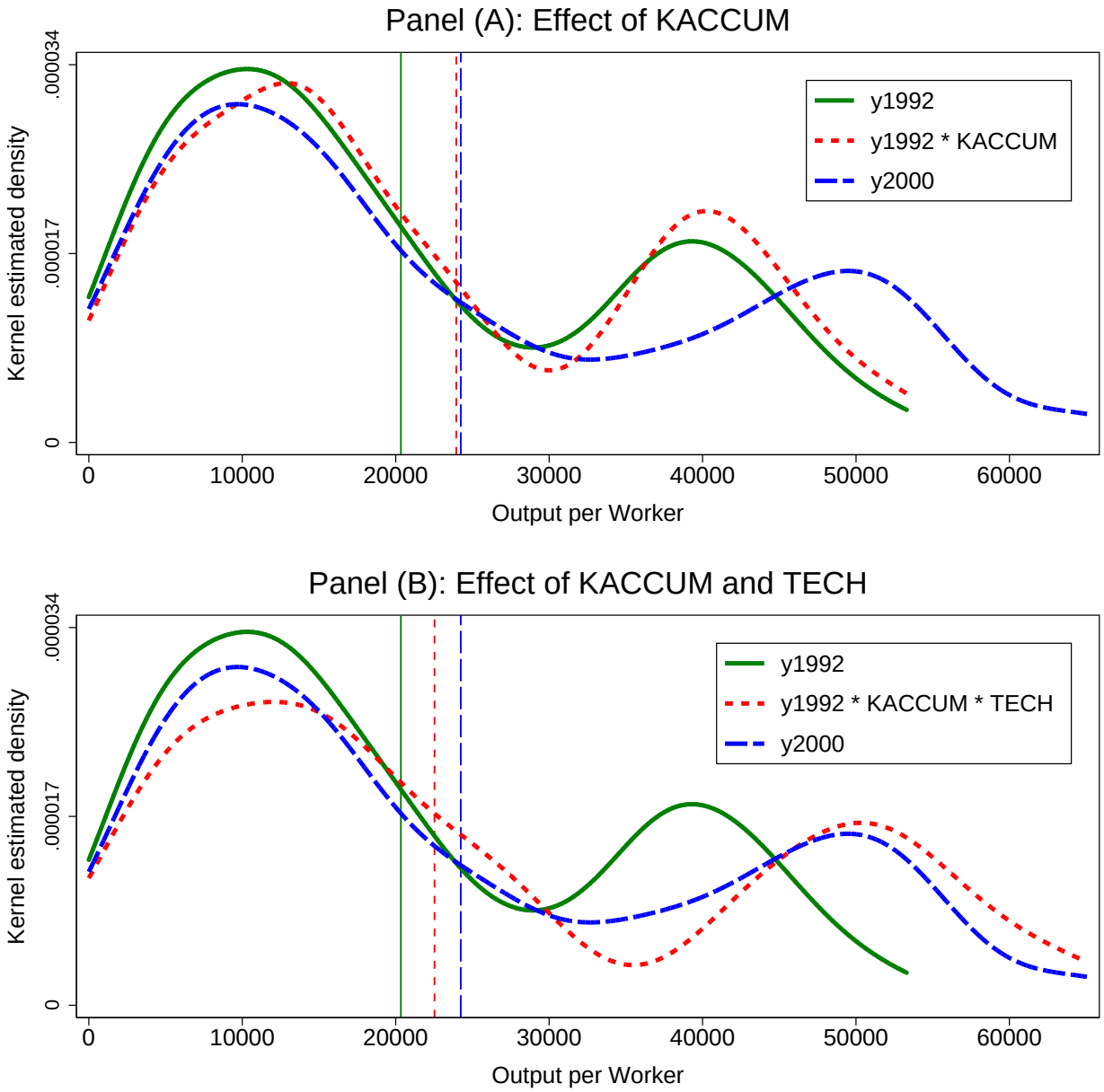

Figure D.5. Counterfactual distributions of output per worker. Sequence of introducing effects of decomposition: KACCUM, TECH

Notes: In each panel, the solid curve is the estimated 1992 distribution and the solid vertical line represents the 1992 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 accumulation and technological change on the 1992 distribution, and the dotted vertical line represents the respective counterfactual mean.

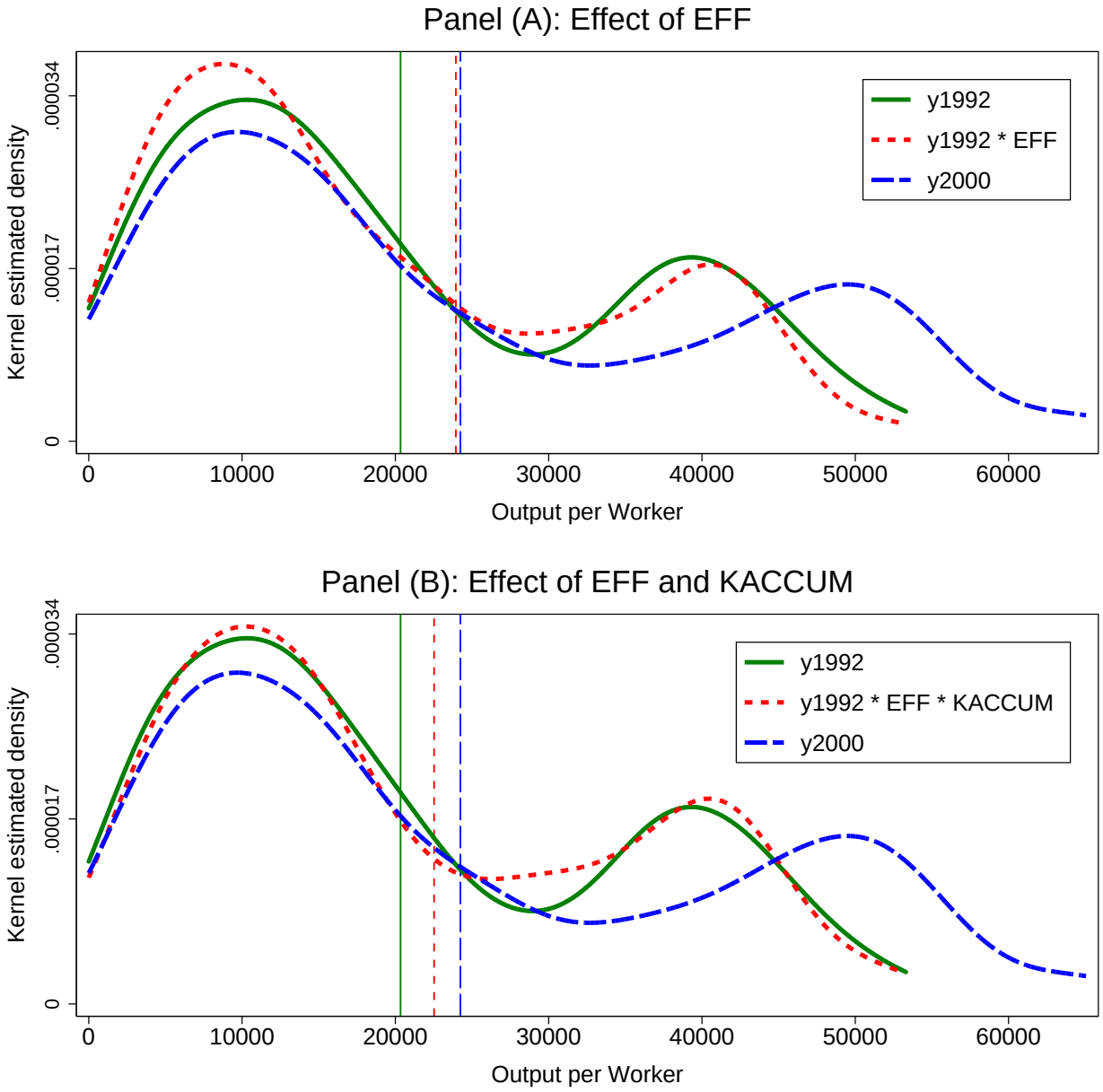

Figure D.6. Counterfactual distributions of output per worker. Sequence of introducing effects of decomposition: EFF, KACCUM

Notes: In each panel, the solid curve is the estimated 1992 distribution and the solid vertical line represents the 1992 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 and capital accumulation on the 1992 distribution, and the dotted vertical line represents the respective counterfactual mean.

Appendix E Correction for Bias in Technical Efficiency Scores

Here we briefly outline the estimation and bootstrap details for individual DEA-based estimates. The DEA estimator at any fixed point $\langle Y_{it}, K_{it}, L_{it} \rangle$,

$$\widehat{\mathrm{TE}}_{it}\left(\langle Y_{it}, K_{it}, L_{it} \rangle | \widehat{\mathcal{T}_t}\right) = \min\left\{\lambda \mid \langle Y_{it}/\lambda, L_{it}, K_{it} \rangle \in \widehat{\mathcal{T}_t}\right\},$$

is consistent and has some sampling distribution which can be estimated via a consistent bootstrap analog as was shown in Kneip, Simar, and Wilson (2003). Specifically, using the original data set $\langle Y_{it}, K_{it}, L_{it} \rangle_{i=1}^{n}$ and $\widehat{\mathcal{T}_t}$ we can obtain a bootstrap sample $\langle \langle Y_{it}, K_{it}, L_{it} \rangle_{i=1}^{n} \rangle^{*}$ and use the DEA estimator to get the analog of the output set, $\widehat{\mathcal{T}_t}^{*}$. Further, from the perspective of $\langle \langle Y_{it}, K_{it}, L_{it} \rangle_{i=1}^{n} \rangle^{*}$ this is the true output set, and in our original setting was an estimate of $\mathcal{T}_t$. From here, we can calculate a consistent bootstrap estimate of technical efficiency at the same fixed point $\langle Y_{it}, K_{it}, L_{it} \rangle$ using

$$\widehat{\mathrm{TE}}_{it}^{*}\left(\langle Y_{it}, K_{it}, L_{it} \rangle | \widehat{\mathcal{T}_t}^{*}\right) = \min\left\{\lambda \mid \langle Y_{it}/\lambda, L_{it}, K_{it} \rangle \in \widehat{\mathcal{T}_t}^{*}\right\}.$$

Intuitively, the unknown distribution of the difference between the true and estimated efficiency score is approximated by the distribution of the difference between the estimated and the bootstrapped efficiency score, which, in principal, is known. This relationship allows for consistent estimation of the bias and of confidence intervals for $\widehat{\mathrm{TE}}_{it}\left(\langle Y_{it}, K_{it}, L_{it} \rangle | \widehat{\mathcal{T}_t}\right)$, at any fixed point $\langle Y_{it}, K_{it}, L_{it} \rangle$.

In practice, the bootstrap distribution can be approximated by generating B samples of $\langle \langle Y_{it}, K_{it}, L_{it} \rangle_{i=1}^{n} \rangle_{b}^{*}$ $(b = 1, 2, ..., B)$ drawn from $\widehat{\mathcal{T}_t}$. Then, technical efficiency is re-estimated B times, yielding $\widehat{\mathrm{TE}}_{it}^{*}\left(\langle Y_{it}, K_{it}, L_{it} \rangle | \widehat{\mathcal{T}_t}^{*}\right)$. The bootstrap bias estimate and confidence intervals for the DEA-estimate of $\widehat{\mathrm{TE}}_{it}\left(\langle Y_{it}, K_{it}, L_{it} \rangle | \widehat{\mathcal{T}_t}\right)$ can then be obtained from the distribution of $\widehat{\mathrm{TE}}_{it}^{*}\left(\langle Y_{it}, K_{it}, L_{it} \rangle | \widehat{\mathcal{T}_t}^{*}\right)$. Specifically, two types of sampling procedures can be used: (i) sub-sampling from $\langle Y_{it}, K_{it}, L_{it} \rangle_{i=1}^{n}$ and (ii) sampling from the smooth kernel-based density estimate of $\widehat{\mathrm{TE}}_{it}\left(\langle Y_{it}, K_{it}, L_{it} \rangle | \widehat{\mathcal{T}_t}\right)$. Kneip,

Simar, and Wilson (2003) show that the first procedure is consistent, while the second one, as was suggested and outlined in Simar and Wilson (1998), is an approximation of the first procedure. Given the small sample, we use the second approach. The number of bootstrap iterations is 5,000. For these tests, we use the Gaussian kernel and Silverman (1986) adaptive bandwidth estimator, $h = 0.9An^{-1/5}$ (where $A = \min(\sqrt{var(u)}, iqr(u)/1.349)$ and $iqr(u)$ is the interquartile range of the random variable u, for which the density is estimated).

TABLE E.1

Technical efficiency and bias-corrected technical efficiency scores in the base (1992) and current (2000) years under constant returns to scale assumption

Country	TE_b	$TE_b^{corr.}$	St.D.	CI_b^{lower}	CI_b^{upper}	TE_c	$TE_c^{corr.}$	St.D.	CI_c^{lower}	CI_c^{upper}
Albania	0.62	0.59	0.02	0.55	0.61	0.75	0.70	0.03	0.65	0.74
Argentina	0.58	0.54	0.02	0.51	0.57	0.55	0.50	0.03	0.46	0.54
Armenia	0.23	0.22	0.01	0.21	0.23	0.29	0.27	0.01	0.26	0.29
Australia	0.79	0.73	0.03	0.69	0.78	0.79	0.76	0.03	0.71	0.79
Austria	0.82	0.76	0.04	0.71	0.81	0.78	0.75	0.03	0.70	0.78
Azerbaijan	0.31	0.29	0.01	0.27	0.30	0.30	0.28	0.01	0.26	0.30
Belarus	0.28	0.27	0.01	0.25	0.28	0.25	0.23	0.01	0.21	0.25
Belgium	0.91	0.87	0.04	0.81	0.91	0.87	0.84	0.03	0.79	0.87
Bolivia	0.57	0.55	0.02	0.52	0.57	0.62	0.58	0.03	0.54	0.62
Brazil	0.53	0.49	0.03	0.46	0.53	0.55	0.51	0.03	0.48	0.55
Bulgaria	0.68	0.64	0.03	0.60	0.68	0.57	0.53	0.02	0.50	0.56
Canada	0.81	0.75	0.04	0.71	0.81	0.80	0.76	0.03	0.71	0.80
Chile	0.64	0.58	0.04	0.54	0.64	0.70	0.65	0.03	0.60	0.70
China	0.67	0.61	0.04	0.57	0.66	0.74	0.69	0.03	0.64	0.73
Colombia	0.82	0.78	0.03	0.73	0.81	0.74	0.69	0.03	0.65	0.73
Costa Rica	0.67	0.63	0.03	0.58	0.66	0.70	0.65	0.03	0.61	0.69
Croatia	0.43	0.40	0.02	0.38	0.42	0.41	0.38	0.02	0.35	0.41
Czech Republic	0.42	0.39	0.02	0.36	0.41	0.37	0.36	0.01	0.33	0.37
Denmark	0.74	0.70	0.03	0.65	0.74	0.78	0.75	0.03	0.70	0.78
Dominican Republic	0.75	0.72	0.02	0.68	0.75	0.97	0.91	0.04	0.85	0.96
Ecuador	0.47	0.42	0.03	0.39	0.46	0.43	0.40	0.02	0.37	0.43
Estonia	0.33	0.31	0.01	0.29	0.33	0.38	0.35	0.02	0.32	0.38
Finland	0.68	0.64	0.03	0.60	0.68	0.75	0.72	0.03	0.67	0.75
France	0.82	0.77	0.04	0.72	0.82	0.76	0.73	0.03	0.68	0.75
Germany	0.79	0.75	0.03	0.69	0.78	0.71	0.69	0.02	0.64	0.71
Greece	0.64	0.61	0.02	0.57	0.64	0.54	0.49	0.03	0.46	0.54
Guatemala	0.97	0.93	0.03	0.88	0.97	1.00	0.92	0.04	0.87	0.99
Honduras	0.73	0.70	0.02	0.66	0.73	0.58	0.54	0.02	0.51	0.57
Hong Kong	1.00	0.93	0.04	0.88	0.99	0.80	0.71	0.05	0.66	0.79
Hungary	0.45	0.42	0.02	0.40	0.44	0.40	0.34	0.03	0.32	0.39
Iceland	0.71	0.65	0.03	0.61	0.70	0.69	0.66	0.03	0.61	0.69
India	0.74	0.69	0.04	0.64	0.74	0.88	0.81	0.04	0.76	0.87
Indonesia	0.96	0.91	0.03	0.86	0.95	0.74	0.69	0.03	0.65	0.73
Ireland	0.91	0.85	0.03	0.80	0.90	1.00	0.84	0.08	0.80	0.98
Israel	0.80	0.76	0.03	0.71	0.80	0.67	0.61	0.04	0.56	0.67
Italy	0.92	0.87	0.04	0.81	0.91	0.83	0.80	0.03	0.75	0.83
Jamaica	0.34	0.31	0.02	0.29	0.34	0.31	0.29	0.01	0.27	0.31
Japan	0.75	0.70	0.03	0.66	0.74	0.60	0.56	0.03	0.53	0.59

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TABLE E.1 (*Continued*)

Country	TE_b	$TE_b^{corr.}$	St.D.	CI_b^{lower}	CI_b^{upper}	TE_c	$TE_c^{corr.}$	St.D.	CI_c^{lower}	CI_c^{upper}
Kazakhstan	0.32	0.30	0.01	0.28	0.32	0.32	0.29	0.02	0.27	0.31
Kenya	0.54	0.49	0.04	0.45	0.54	0.56	0.49	0.05	0.45	0.55
Korea, Republic of	0.77	0.72	0.03	0.68	0.76	0.65	0.57	0.05	0.54	0.64
Kyrgyzstan	0.83	0.79	0.03	0.74	0.83	0.81	0.75	0.04	0.71	0.80
Latvia	0.24	0.22	0.01	0.21	0.24	0.23	0.20	0.02	0.19	0.23
Lithuania	0.38	0.35	0.02	0.33	0.38	0.37	0.34	0.02	0.32	0.37
Macedonia	0.34	0.31	0.02	0.29	0.33	0.37	0.34	0.02	0.32	0.37
Madagascar	0.59	0.47	0.09	0.43	0.58	0.68	0.49	0.13	0.48	0.67
Malawi	0.37	0.31	0.05	0.28	0.37	0.55	0.45	0.08	0.41	0.55
Malaysia	0.74	0.66	0.05	0.62	0.74	0.77	0.71	0.04	0.66	0.76
Mauritius	0.83	0.77	0.04	0.71	0.83	1.00	0.90	0.05	0.85	0.99
Mexico	0.68	0.63	0.03	0.59	0.67	0.64	0.60	0.03	0.55	0.64
Moldova	0.36	0.34	0.01	0.32	0.35	0.29	0.27	0.01	0.25	0.28
Morocco	0.66	0.62	0.02	0.58	0.65	0.65	0.61	0.03	0.58	0.65
Netherlands	0.85	0.80	0.04	0.75	0.85	0.80	0.77	0.03	0.72	0.80
New Zealand	0.64	0.59	0.03	0.55	0.63	0.61	0.57	0.03	0.53	0.60
Nigeria	0.65	0.49	0.12	0.46	0.64	0.46	0.37	0.07	0.34	0.45
Norway	0.80	0.76	0.03	0.71	0.80	0.83	0.80	0.03	0.75	0.83
Panama	0.57	0.51	0.04	0.48	0.57	0.51	0.46	0.03	0.44	0.51
Paraguay	1.00	0.95	0.04	0.90	1.00	0.78	0.72	0.03	0.68	0.77
Peru	0.32	0.29	0.02	0.27	0.32	0.36	0.33	0.02	0.31	0.36
Philippines	0.55	0.53	0.02	0.49	0.55	0.58	0.54	0.02	0.50	0.57
Poland	0.27	0.25	0.01	0.24	0.26	0.31	0.29	0.02	0.27	0.31
Portugal	0.77	0.71	0.03	0.68	0.76	0.61	0.54	0.04	0.50	0.60
Romania	0.28	0.25	0.02	0.23	0.28	0.28	0.25	0.01	0.24	0.28
Russia	0.33	0.31	0.02	0.29	0.33	0.25	0.23	0.01	0.21	0.25
Sierra Leone	1.00	0.59	0.25	0.67	0.98	1.00	0.67	0.21	0.69	0.97
Singapore	0.76	0.72	0.03	0.68	0.75	0.82	0.77	0.04	0.72	0.82
Slovak Republic	0.36	0.34	0.02	0.32	0.36	0.36	0.35	0.01	0.32	0.36
Slovenia	0.46	0.42	0.02	0.40	0.45	0.51	0.48	0.02	0.45	0.51
Spain	0.78	0.73	0.03	0.68	0.77	0.68	0.64	0.03	0.59	0.68
Sri Lanka	0.83	0.79	0.03	0.74	0.82	0.80	0.75	0.04	0.70	0.80
Sweden	0.71	0.67	0.03	0.62	0.71	0.70	0.67	0.03	0.63	0.70
Switzerland	0.85	0.81	0.03	0.76	0.85	0.73	0.70	0.03	0.66	0.73
Syria	0.79	0.75	0.03	0.70	0.79	0.95	0.89	0.04	0.84	0.94
Taiwan	1.00	0.87	0.07	0.83	0.98	1.00	0.92	0.05	0.85	0.99
Tajikistan	0.28	0.27	0.01	0.25	0.28	0.36	0.33	0.02	0.31	0.36
Thailand	0.53	0.50	0.02	0.47	0.53	0.46	0.42	0.02	0.39	0.45
Turkey	0.77	0.73	0.03	0.68	0.77	0.67	0.62	0.03	0.58	0.66
Ukraine	0.30	0.28	0.01	0.26	0.30	0.14	0.14	0.01	0.13	0.14
United Kingdom	0.77	0.73	0.03	0.69	0.77	0.69	0.63	0.04	0.58	0.68

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TABLE E.1 (*Continued*)

Country	TE_b	$TE_b^{corr.}$	St.D.	CI_b^{lower}	CI_b^{upper}	TE_c	$TE_c^{corr.}$	St.D.	CI_c^{lower}	CI_c^{upper}
Uruguay	0.58	0.54	0.03	0.51	0.58	0.58	0.54	0.03	0.50	0.57
USA	1.00	0.92	0.05	0.86	0.98	0.99	0.95	0.04	0.88	0.99
Venezuela	0.58	0.55	0.02	0.52	0.58	0.44	0.41	0.02	0.38	0.44
Zambia	0.26	0.25	0.01	0.24	0.26	0.27	0.25	0.01	0.23	0.27
Zimbabwe	0.36	0.35	0.01	0.32	0.36	0.36	0.34	0.02	0.32	0.36
Average	0.63	0.58				0.61	0.56			

Notes: TE_b (TE_c) and $TE_b^{corr.}$ ($TE_c^{corr.}$) stand for technical efficiency and bias-corrected technical efficiency scores in in base (current) period respectively;
St.D. is the bootstrap standard error;
CI_b^{lower} (CI_c^{lower}) and CI_b^{upper} (CI_c^{upper}) are the lower and upper bounds of the TE_b (TE_c) confidence intervals at the 95 percent level.

TABLE E.2
Group-wise smoothing bootstrap for mean efficiencies, 1992

Country Group	*DEA*	*Bias-Corr.*	*St. E.*	*Lower Bound*	*Upper Bound*
OECD	0.7877	0.7389	0.0246	0.6819	0.7734
Non OECD	0.5700	0.5114	0.0222	0.4621	0.5467
Asian Tigers	0.8547	0.7994	0.0240	0.7425	0.8364
Latin America	0.6283	0.5865	0.0205	0.5376	0.6155
Africa	0.5847	0.4546	0.0738	0.2838	0.5617
Transition (all)	0.4128	0.3878	0.0090	0.3668	0.4018
Non-Transition	0.7164	0.6655	0.0167	0.6282	0.6932
Baltic Countries	0.3168	0.2929	0.0132	0.2612	0.3107
Central and Eastern Europe	0.4286	0.4001	0.0104	0.3767	0.4167
Republics of Former USSR	0.3597	0.3392	0.0082	0.3199	0.3517
All countries	0.6296	0.5827	0.0159	0.5471	0.6085

TABLE E.3
Group-wise smoothing bootstrap for mean efficiencies, 2000

Country Group	*DEA*	*Bias-Corr.*	*St. E.*	*Lower Bound*	*Upper Bound*
OECD	0.7472	0.7037	0.0255	0.6417	0.7383
Non OECD	0.5600	0.4976	0.0221	0.4473	0.5321
Asian Tigers	0.7720	0.7123	0.0301	0.6423	0.7576
Latin America	0.6107	0.5640	0.0204	0.5151	0.5939
Africa	0.6151	0.4928	0.0676	0.3470	0.5876
Transition (all)	0.4045	0.3738	0.0108	0.3495	0.3918
Non-Transition	0.6940	0.6402	0.0179	0.6001	0.6697
Baltic Countries	0.3253	0.2927	0.0168	0.2528	0.3177
Central and Eastern Europe	0.4332	0.3995	0.0122	0.3719	0.4191
Republics of Former USSR	0.3325	0.3082	0.0098	0.2852	0.3229
All countries	0.6113	0.5624	0.0166	0.5252	0.5892

Appendix F Results for the Entire 1992–2000 Sample with Luxembourg

TABLE F.1
Estimation results for the change in productivity from its sources, 1992–2000

Country	TE_b	TE_c	$PROD-1$ $\times 100$	$EFF-1$ $\times 100$	$TECH-1$ $\times 100$	$KACCUM-1$ $\times 100$
Albania	0.62	0.75	46.06	20.90	−3.96	25.80
Argentina	0.58	0.54	9.57	−6.52	16.08	0.98
Armenia	0.23	0.29	32.89	24.78	−6.45	13.83
Australia	0.77	0.65	22.74	−15.58	31.97	10.18
Austria	0.79	0.61	16.14	−23.03	31.62	14.65
Azerbaijan	0.31	0.30	−0.31	−2.39	−7.37	10.26
Belarus	0.28	0.23	17.39	−19.82	33.50	9.66
Belgium	0.81	0.64	16.63	−21.66	31.82	12.93
Bolivia	0.57	0.62	9.22	8.07	−4.09	5.37
Brazil	0.53	0.55	16.34	3.87	3.40	8.33
Bulgaria	0.68	0.57	−12.21	−16.48	−7.33	13.42
Canada	0.81	0.68	23.72	−16.33	32.29	11.77
Chile	0.65	0.70	31.71	8.39	1.62	19.57
China	0.67	0.74	69.40	11.11	−6.14	62.43
Colombia	0.81	0.74	−6.55	−9.56	−5.22	9.01
Costa Rica	0.67	0.70	8.23	4.90	−7.54	11.59
Croatia	0.43	0.41	13.81	−3.29	12.52	4.59
Czech Republic	0.40	0.31	9.48	−22.15	31.99	6.54
Denmark	0.70	0.59	28.29	−15.38	31.59	15.22
Dominican Republic	0.75	0.97	55.25	29.13	−5.07	26.65
Ecuador	0.47	0.43	−13.46	−7.76	−8.95	3.04
Estonia	0.33	0.38	57.91	14.77	9.58	25.56
Finland	0.65	0.60	34.30	−7.74	31.43	10.75
France	0.78	0.60	12.38	−23.81	31.64	12.05
Germany	0.63	0.49	11.07	−23.30	35.96	6.51
Greece	0.64	0.51	13.25	−21.21	34.20	7.11
Guatemala	0.97	1.00	5.76	3.00	−3.40	6.30
Honduras	0.74	0.58	−10.35	−21.39	−4.15	18.98
Hong Kong	1.00	0.77	28.98	−23.08	24.69	34.48
Hungary	0.45	0.40	37.39	−10.76	26.25	21.94
Iceland	0.70	0.60	21.86	−15.48	32.69	8.66
India	0.74	0.88	42.00	18.42	−5.84	27.34

(*continued on next page*)

TABLE F.1 (*Continued*)

Country	TE_b	TE_c	$PROD-1 \times 100$	$EFF-1 \times 100$	$TECH-1 \times 100$	$KACCUM-1 \times 100$
Indonesia	0.96	0.74	9.87	−22.96	−4.19	48.86
Ireland	0.91	1.00	71.44	10.00	27.34	22.39
Israel	0.80	0.63	16.25	−21.38	32.80	11.35
Italy	0.83	0.62	10.68	−25.47	31.69	12.75
Jamaica	0.34	0.31	−5.64	−8.64	−8.12	12.42
Japan	0.75	0.51	6.98	−31.63	33.75	16.99
Kazakhstan	0.32	0.32	11.45	−1.27	14.42	−1.35
Kenya	0.54	0.56	−5.06	3.37	−8.20	0.05
Korea, Republic of	0.77	0.65	36.56	−15.58	17.49	37.68
Kyrgyzstan	0.83	0.81	13.36	−2.44	−5.24	22.62
Latvia	0.24	0.23	44.23	−3.65	24.21	20.52
Lithuania	0.38	0.37	16.49	−3.69	5.11	15.08
Luxembourg	1.00	1.00	52.39	0.00	40.88	8.16
Macedonia	0.34	0.37	13.79	10.00	0.75	2.68
Madagascar	0.58	0.68	−3.51	16.33	−11.54	−6.23
Malawi	0.37	0.55	33.83	47.25	−10.17	1.18
Malaysia	0.75	0.76	33.92	2.29	−1.53	32.96
Mauritius	0.83	1.00	55.90	20.00	−3.82	35.08
Mexico	0.68	0.64	12.80	−5.13	6.20	11.96
Moldova	0.36	0.28	−16.85	−19.94	−3.96	8.15
Morocco	0.65	0.65	3.30	0.00	−5.68	9.53
Netherlands	0.79	0.64	15.21	−19.11	31.16	8.59
New Zealand	0.63	0.53	18.19	−15.96	32.65	6.02
Nigeria	0.65	0.46	−28.70	−29.49	−11.23	13.92
Norway	0.66	0.57	27.04	−14.20	35.88	8.98
Panama	0.57	0.51	5.14	−10.71	−4.19	22.91
Paraguay	1.00	0.78	−34.43	−22.48	−4.01	−11.88
Peru	0.32	0.36	4.47	13.00	−2.42	−5.25
Philippines	0.55	0.57	11.72	5.17	−3.84	10.47
Poland	0.27	0.28	53.35	7.12	33.38	7.33
Portugal	0.76	0.61	20.13	−20.12	19.91	25.42
Romania	0.28	0.28	4.56	0.00	−3.27	8.10
Russia	0.33	0.22	−9.26	−33.70	32.52	3.29
Sierra Leone	1.00	1.00	−4.83	0.00	−17.81	15.80
Singapore	0.76	0.71	49.94	−5.71	31.95	20.52
Slovak Republic	0.32	0.28	22.70	−10.26	31.60	3.89
Slovenia	0.46	0.44	39.58	−4.37	32.85	9.86

(*continued on next page*)

TABLE F.1 (*Continued*)

Country	TE_b	TE_c	$PROD-1 \times 100$	$EFF-1 \times 100$	$TECH-1 \times 100$	$KACCUM-1 \times 100$
Spain	0.78	0.60	13.81	−22.29	33.45	9.74
Sri Lanka	0.83	0.81	18.03	−2.42	−5.20	27.59
Sweden	0.68	0.57	20.00	−16.48	31.66	9.12
Switzerland	0.68	0.50	4.32	−26.87	35.97	4.91
Syria	0.79	0.95	15.52	20.95	−5.46	1.02
Taiwan	1.00	0.99	45.28	−0.99	1.06	45.20
Tajikistan	0.28	0.36	27.09	28.67	−4.29	3.20
Thailand	0.53	0.46	22.83	−14.16	−5.79	51.88
Turkey	0.77	0.67	11.65	−12.75	−7.38	38.16
Ukraine	0.25	0.11	−41.99	−58.21	31.04	5.92
United Kingdom	0.78	0.64	23.41	−17.31	32.38	12.74
Uruguay	0.58	0.58	10.78	0.00	5.70	4.81
USA	1.00	0.81	21.08	−18.70	32.63	12.29
Venezuela	0.58	0.44	−17.13	−23.56	10.38	−1.79
Zambia	0.26	0.27	−10.16	2.41	−4.01	−8.61
Zimbabwe	0.36	0.36	−5.33	0.36	−3.90	−1.84
Average			14.56	−8.04	10.29	12.94

TABLE F.2

Mean percentage changes of the tripartite decomposition indices (country groupings)

Country Group	*Productivity change*	$EFF-1$ $\times 100$	$TECH-1$ $\times 100$	$KACCUM-1$ $\times 100$
OECD*	21.50	−16.70	31.00	11.34
Non OECD	12.17	−4.08	3.04	13.49
Asian Tigers†	32.63	−16.15	21.17	30.54
Latin America	2.98	−2.98	−1.61	7.88
Africa	1.46	4.91	−8.60	5.81
Transition (all)‡	16.52	−6.41	10.62	12.55
Non-Transition	13.83	−8.63	10.17	13.09
Baltic Countries§	38.44	2.12	12.68	20.31
Central and Eastern Europe¶	21.23	−3.70	14.26	10.18
Republics of Former USSR$	0.99	−13.59	8.02	8.20
All countries	14.56	−8.04	10.29	12.94

* OECD countries by UNESCO classification as of 2004; excluding Czech Republic, Hungary, Korea, Poland, Slovak Republic, *and* Luxembourg.

† Hong Kong, Japan, Singapore, South Korea and Taiwan.

‡ Albania, Armenia, Azerbaijan, Belarus, Bulgaria, China, Croatia, Czech Republic, Estonia, Hungary, Kazakhstan, Kyrgyzstan, Latvia, Lithuania, Macedonia, Moldova, Poland, Romania, Russia, Slovak Republic, Slovenia, Tajikistan, Ukraine.

§ Estonia, Latvia, Lithuania.

¶ Albania, Bulgaria, Croatia, Czech Republic, Hungary, Macedonia, Poland, Romania, Slovak Republic, Slovenia.

$ Excluding Baltic Countries.

TABLE F.3

Growth regressions of the percentage change in output per worker and the three decomposition indices on output per worker in base (1992) period

	Regression (A)	*Regression (B)*	*Regression (C)*	*Regression (D)*
	$PROD-1$ $\times 100$	$EFF-1$ $\times 100$	$TECH-1$ $\times 100$	$KACCUM-1$ $\times 100$
Constant	9.64 (0.027)	4.53 (0.171)	−8.59 (0.000)	14.04 (0.000)
Slope	0.00033 (0.016)	−0.00053 (0.000)	0.00097 (0.000)	−0.00002 (0.820)

Notes: p-values in parentheses, based on robust standard errors (see footnote **??**).

TABLE F.4

Testing for changes in the distribution of labor productivity due to different sources (comparison year, 2000)

H_0 : *Distributions are equal* H_1 : *Distributions are not equal*	*Value of statistic*	*Bootstrap p-value*	*Conclusion of testing* H_0
$g(y2000)$ vs. $f(y1992)$	1.0518	0.0788	reject
$g(y2000)$ vs. $f(y1992 \times EFF)$	3.2646	0.0030	reject
$g(y2000)$ vs. $f(y1992 \times TECH)$	0.2773	0.6768	fail to reject
$g(y2000)$ vs. $f(y1992 \times KACCUM)$	0.2325	0.7482	fail to reject
$g(y2000)$ vs. $f(y1992 \times EFF \times TECH)$	0.3595	0.5886	fail to reject
$g(y2000)$ vs. $f(y1992 \times EFF \times KACCUM)$	2.2103	0.0142	reject
$g(y2000)$ vs. $f(y1992 \times TECH \times KACCUM)$	1.4155	0.0462	reject

Notes: We used the bootstrapped Li (1996) tests with 5,000 bootstrap replications and the Silverman's (1986) rule-of-thumb bandwidth.

TABLE F.5

Testing for changes in the distribution of labor productivity due to different sources (comparison year, 1992)

H_0 : *Distributions are equal* H_1 : *Distributions are not equal*	*Value of statistic*	*Bootstrap p-value*	*Conclusion of testing* H_0
$g(y1992)$ vs. $f(y2000)$	1.0518	0.0788	reject
$g(y1992)$ vs. $f(y1992 \times EFF)$	1.3763	0.0484	reject
$g(y1992)$ vs. $f(y1992 \times TECH)$	2.3486	0.0122	reject
$g(y1992)$ vs. $f(y1992 \times KACCUM)$	0.5133	0.4240	fail to reject
$g(y1992)$ vs. $f(y1992 \times EFF \times TECH)$	0.3157	0.6552	fail to reject
$g(y1992)$ vs. $f(y1992 \times EFF \times KACCUM)$	0.2140	0.7586	fail to reject
$g(y1992)$ vs. $f(y1992 \times TECH \times KACCUM)$	3.3722	0.0032	reject

Notes: We used the bootstrapped Li (1996) tests with 5,000 bootstrap replications and the Silverman's (1986) rule-of-thumb bandwidth.

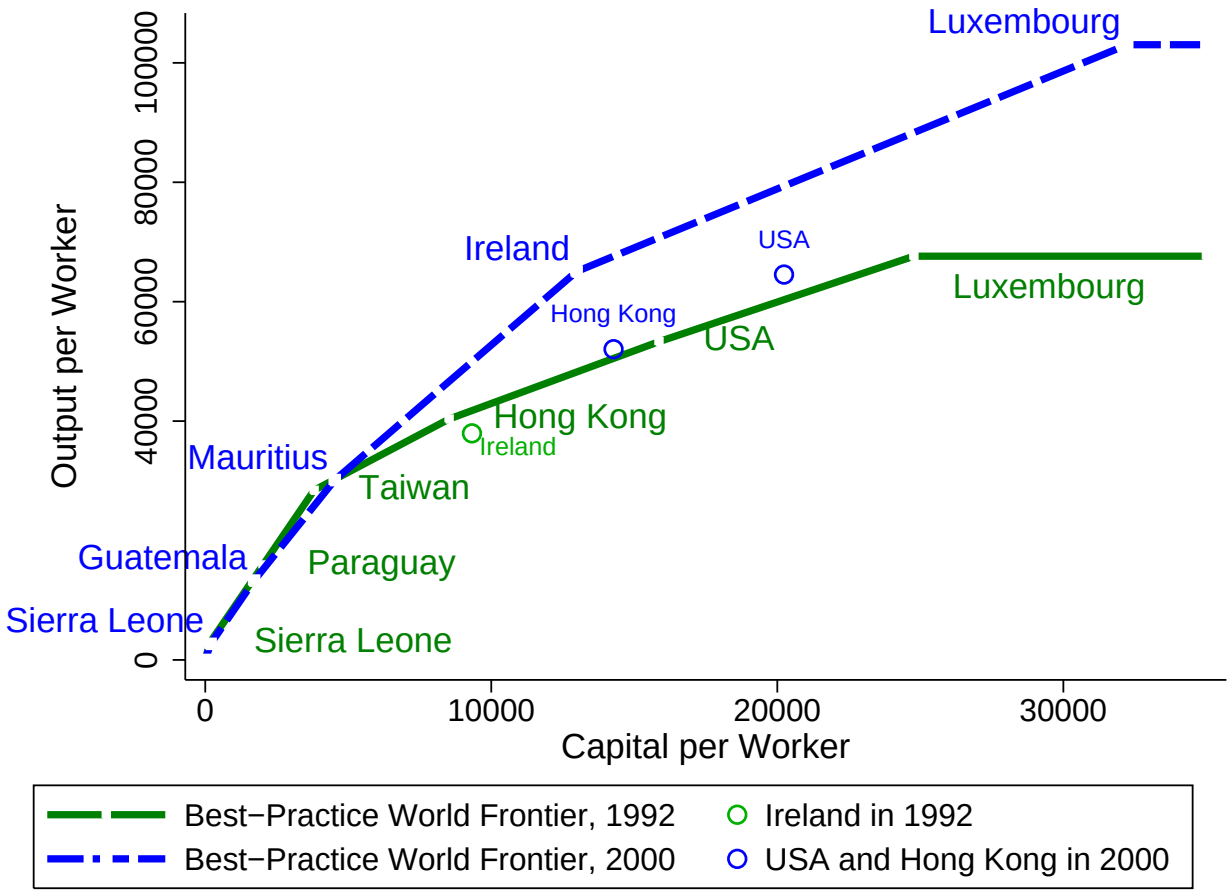

Figure F.1. Estimated best-practice world production frontiers in 1992 and in 2000

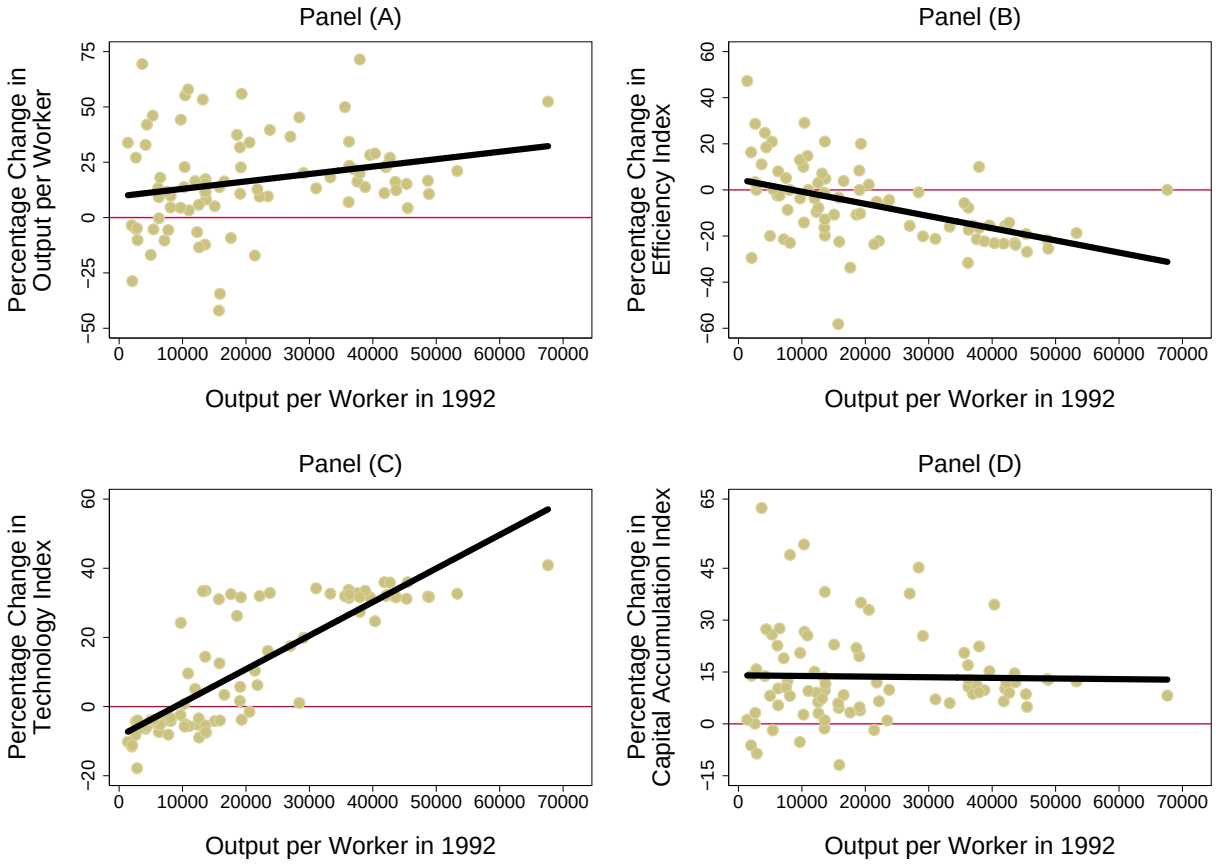

Figure F.2. Percentage change in output per worker and three decomposition indexes, plotted against output per worker in 1992

Note: Each panel contains a GLS regression line.

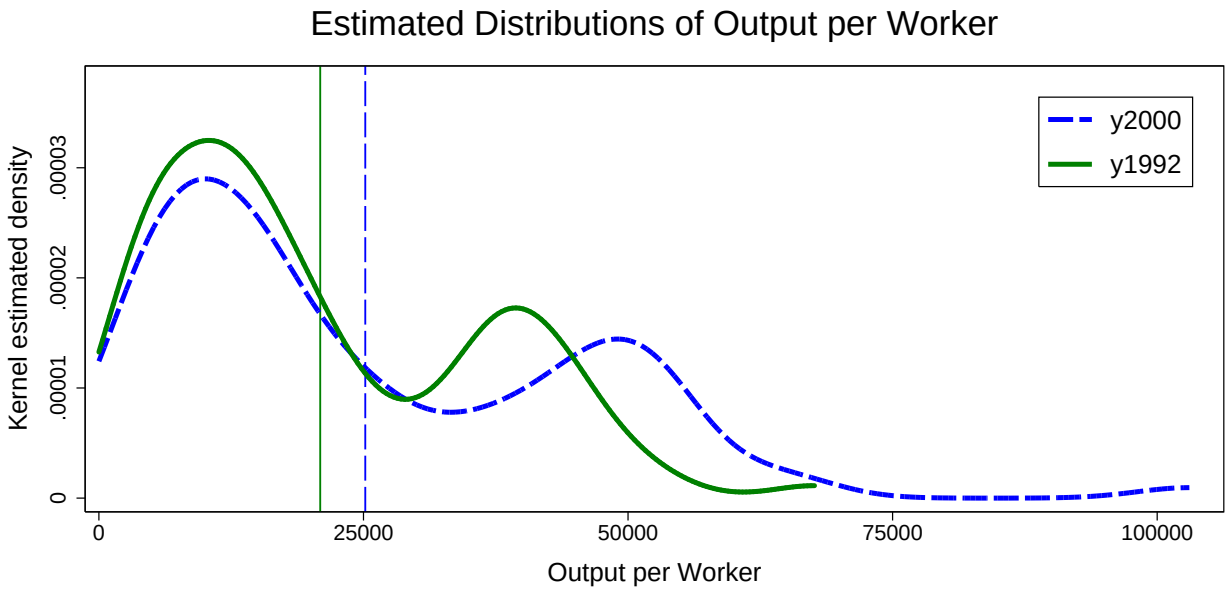

Figure F.3. Estimated 1992 and 2000 output per worker distributions

Notes: In the panel, the solid curve is the estimated 1992 distribution and the solid vertical line represents the 1992 mean value. The dashed curve is the estimated 2000 distribution and the dashed vertical line represents the 2000 mean value.

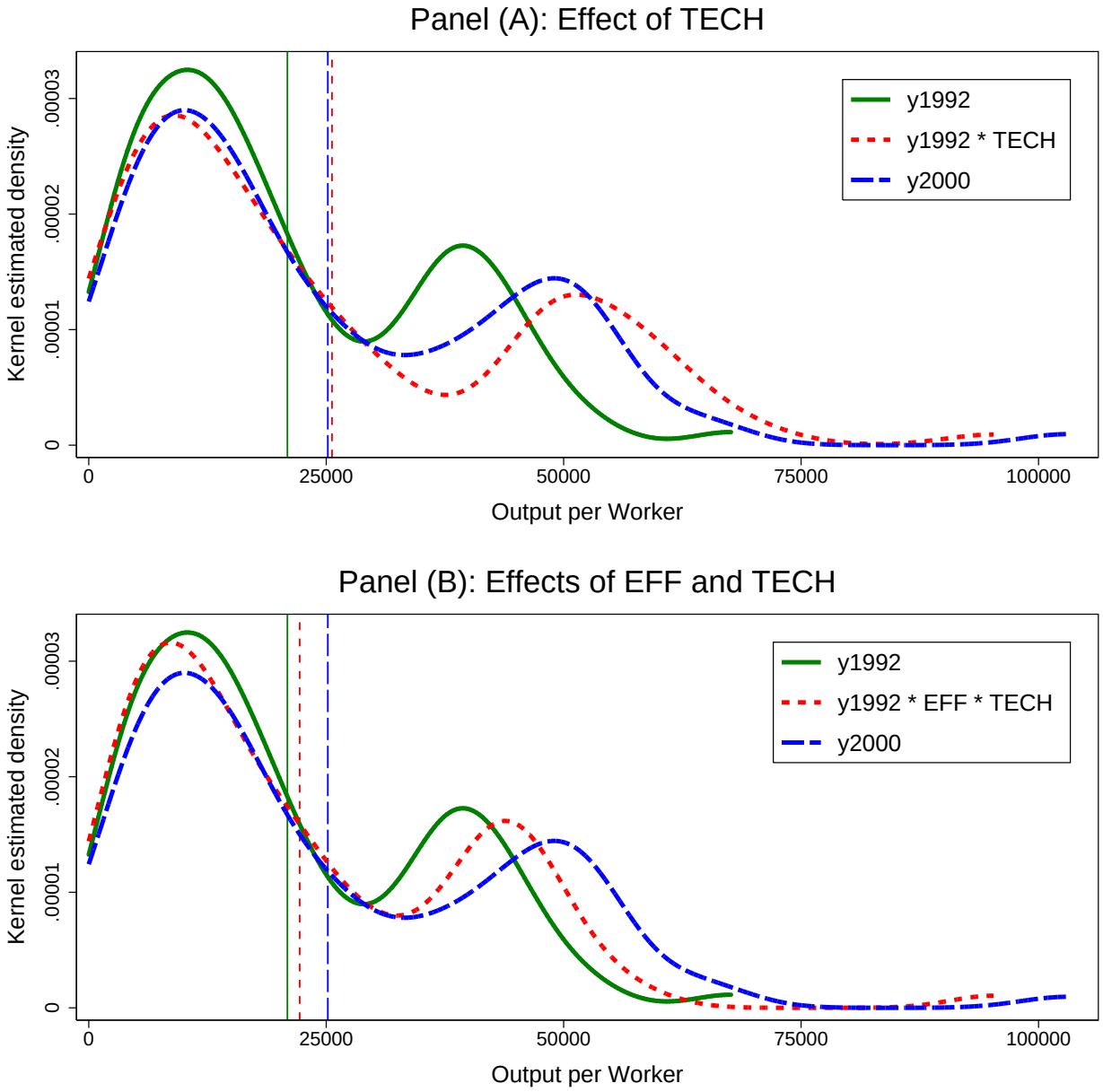

Figure F.4. Counterfactual distributions of output per worker. Sequence of introducing effects of decomposition: TECH, EFF

Notes: In each panel, the solid curve is the estimated 1992 distribution and the solid vertical line represents the 1992 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 and efficiency change on the 1992 distribution, and the dotted vertical line represents the respective counterfactual mean.

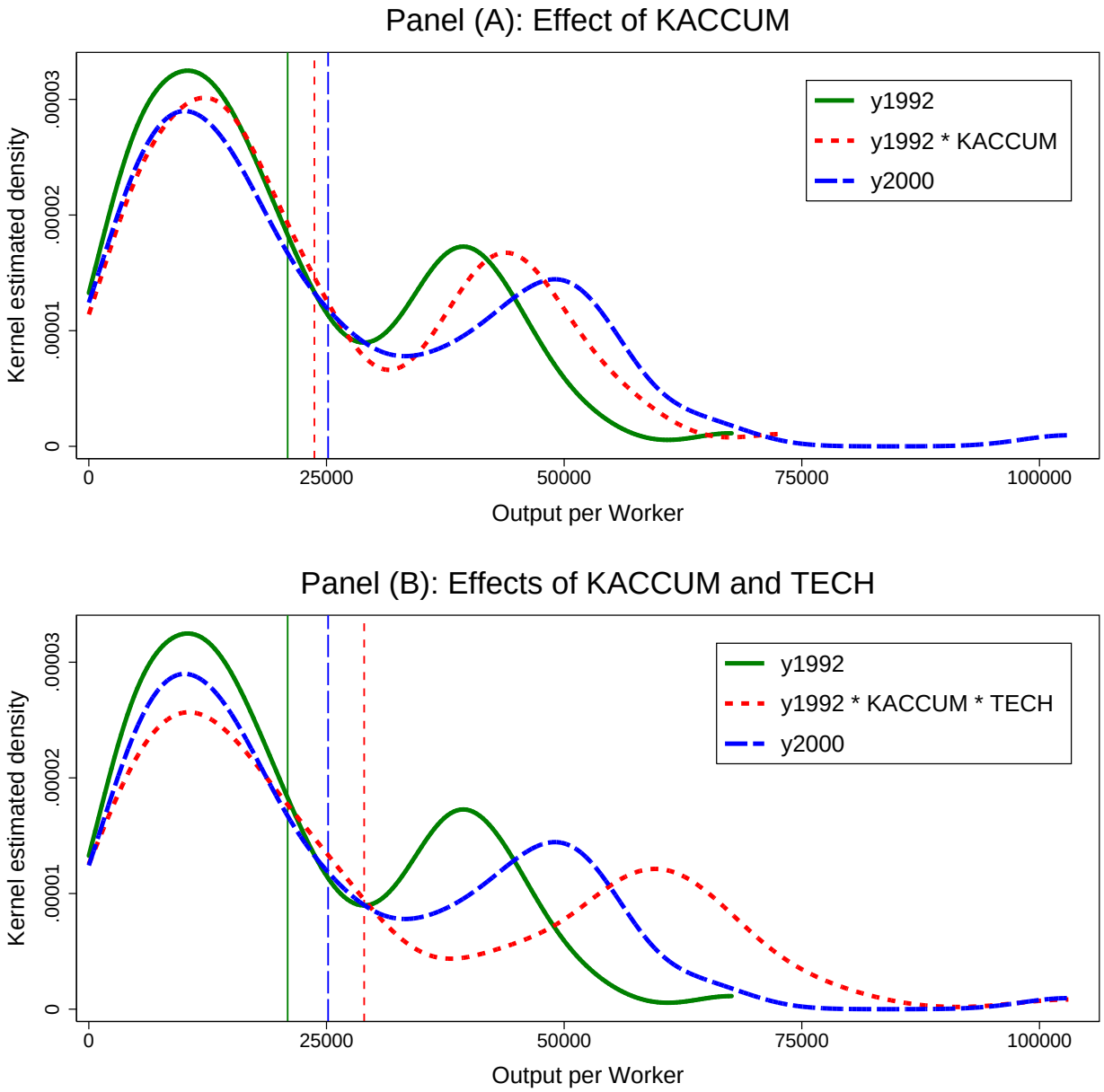

Figure F.5. Counterfactual distributions of output per worker. Sequence of introducing effects of decomposition: KACCUM, TECH

Notes: In each panel, the solid curve is the estimated 1992 distribution and the solid vertical line represents the 1992 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 accumulation and technological change on the 1992 distribution, and the dotted vertical line represents the respective counterfactual mean.

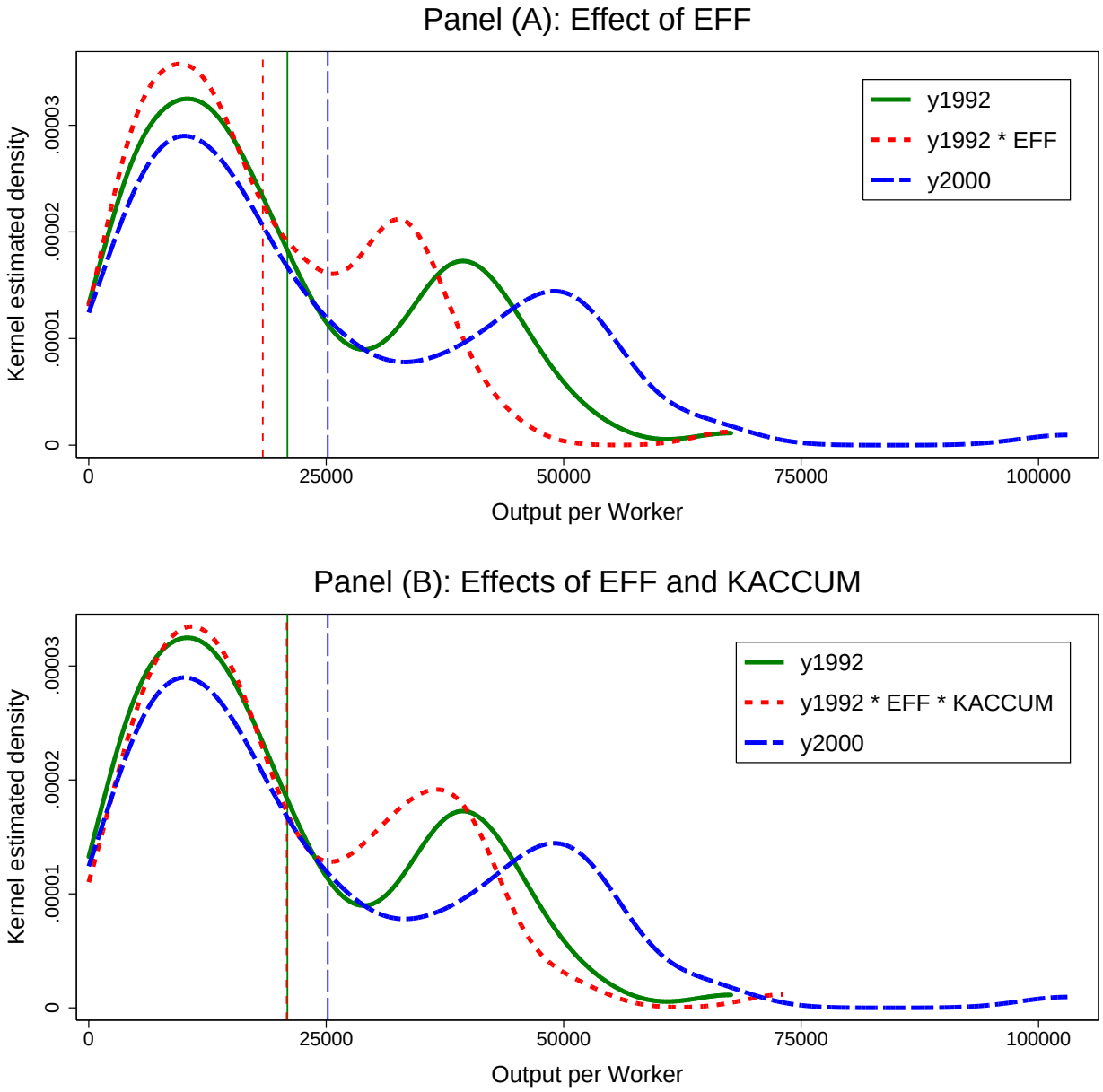

Figure F.6. Counterfactual distributions of output per worker. Sequence of introducing effects of decomposition: EFF, KACCUM

Notes: In each panel, the solid curve is the estimated 1992 distribution and the solid vertical line represents the 1992 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 and capital accumulation on the 1992 distribution, and the dotted vertical line represents the respective counterfactual mean.

Appendix G Results for Artificial Restriction of Luxembourg's GDP and Capital per Worker to be Fixed at its 1992 Level

TABLE G.1
Estimation results for the change in productivity from its sources, 1992–2000

Country	TE_b	TE_c	$PROD-1$ $\times 100$	$EFF-1$ $\times 100$	$TECH-1$ $\times 100$	$KACCUM-1$ $\times 100$
Albania	0.62	0.75	46.06	20.90	−3.96	25.80
Argentina	0.58	0.54	9.57	−6.52	16.08	0.98
Armenia	0.23	0.29	32.89	24.78	−6.45	13.83
Australia	0.77	0.78	22.74	0.78	15.39	5.55
Austria	0.79	0.75	16.14	−4.51	12.03	8.57
Azerbaijan	0.31	0.30	−0.31	−2.39	−7.37	10.26
Belarus	0.28	0.24	17.39	−14.15	29.01	5.98
Belgium	0.81	0.84	16.63	3.36	5.54	6.92
Bolivia	0.57	0.62	9.22	8.07	−4.09	5.37
Brazil	0.53	0.55	16.34	3.87	3.40	8.33
Bulgaria	0.68	0.57	−12.21	−16.48	−7.33	13.42
Canada	0.81	0.79	23.72	−3.15	19.54	6.87
Chile	0.65	0.70	31.71	8.39	1.62	19.57
China	0.67	0.74	69.40	11.11	−6.14	62.43
Colombia	0.81	0.74	−6.55	−9.56	−5.22	9.01
Costa Rica	0.67	0.70	8.23	4.90	−7.54	11.59
Croatia	0.43	0.41	13.81	−3.29	12.52	4.59
Czech Republic	0.40	0.36	9.48	−8.00	14.52	3.91
Denmark	0.70	0.75	28.29	7.52	9.73	8.74
Dominican Republic	0.75	0.97	55.25	29.13	−5.07	26.65
Ecuador	0.47	0.43	−13.46	−7.76	−8.95	3.04
Estonia	0.33	0.38	57.91	14.77	9.58	25.56
Finland	0.65	0.73	34.30	13.14	12.11	5.88
France	0.78	0.74	12.38	−5.88	11.96	6.65
Germany	0.63	0.68	11.07	8.22	0.94	1.68
Greece	0.64	0.54	13.25	−16.13	29.76	4.06
Guatemala	0.97	1.00	5.76	3.00	−3.40	6.30
Honduras	0.74	0.58	−10.35	−21.39	−4.15	18.98
Hong Kong	1.00	0.79	28.98	−20.63	22.75	32.40
Hungary	0.45	0.40	37.39	−10.76	26.25	21.94
Iceland	0.70	0.68	21.86	−3.40	20.12	5.03

(*continued on next page*)

TABLE G.1 (*Continued*)

Country	TE_b	TE_c	$PROD-1 \times 100$	$EFF-1 \times 100$	$TECH-1 \times 100$	$KACCUM-1 \times 100$
India	0.74	0.88	42.00	18.42	−5.84	27.34
Indonesia	0.96	0.74	9.87	−22.96	−4.19	48.86
Ireland	0.91	1.00	71.44	10.00	27.34	22.39
Israel	0.80	0.67	16.25	−16.67	28.99	8.15
Italy	0.83	0.80	10.68	−4.00	7.32	7.42
Jamaica	0.34	0.31	−5.64	−8.64	−8.12	12.42
Japan	0.75	0.58	6.98	−21.64	24.58	9.58
Kazakhstan	0.36	0.32	11.45	−13.29	14.33	12.42
Kenya	0.54	0.56	−5.06	3.37	−8.20	0.05
Korea, Republic of	0.77	0.65	36.56	−15.58	17.49	37.68
Kyrgyzstan	0.83	0.81	13.36	−2.44	−5.24	22.62
Latvia	0.24	0.23	44.23	−3.65	24.21	20.52
Lithuania	0.38	0.37	16.49	−3.69	5.11	15.08
Luxembourg	1.00	1.00	0.00	0.00	0.00	0.00
Macedonia	0.34	0.37	13.79	10.00	0.75	2.68
Madagascar	0.58	0.68	−3.51	16.33	−11.54	−6.23
Malawi	0.37	0.55	33.83	47.25	−10.17	1.18
Malaysia	0.75	0.76	33.92	2.29	−1.53	32.96
Mauritius	0.83	1.00	55.90	20.00	−3.82	35.08
Mexico	0.68	0.64	12.80	−5.13	6.20	11.96
Moldova	0.36	0.28	−16.85	−19.94	−3.96	8.15
Morocco	0.65	0.65	3.30	0.00	−5.68	9.53
Netherlands	0.79	0.78	15.21	−0.78	10.74	4.86
New Zealand	0.63	0.60	18.19	−5.95	21.45	3.47
Nigeria	0.65	0.46	−28.70	−29.49	−11.23	13.92
Norway	0.66	0.80	27.04	20.80	1.97	3.14
Panama	0.57	0.51	5.14	−10.71	−4.19	22.91
Paraguay	1.00	0.78	−34.43	−22.48	−4.01	−11.88
Peru	0.32	0.36	4.47	13.00	−2.42	−5.25
Philippines	0.55	0.57	11.72	5.17	−3.84	10.47
Poland	0.27	0.31	53.35	15.69	26.94	4.42
Portugal	0.76	0.61	20.13	−20.12	19.91	25.42
Romania	0.28	0.28	4.56	0.00	−3.27	8.10
Russia	0.33	0.24	−9.26	−27.25	22.46	1.86
Sierra Leone	1.00	1.00	−4.83	0.00	−17.81	15.80
Singapore	0.76	0.81	49.94	6.45	24.18	13.43
Slovak Republic	0.32	0.35	22.70	10.92	8.25	2.19

(*continued on next page*)

TABLE G.1 (*Continued*)

Country	TE_b	TE_c	$PROD-1 \times 100$	$EFF-1 \times 100$	$TECH-1 \times 100$	$KACCUM-1 \times 100$
Slovenia	0.46	0.50	39.58	9.50	20.70	5.60
Spain	0.78	0.67	13.81	−13.42	24.59	5.51
Sri Lanka	0.83	0.81	18.03	−2.42	−5.20	27.59
Sweden	0.68	0.68	20.00	0.00	13.95	5.30
Switzerland	0.68	0.70	4.32	3.52	0.34	0.44
Syria	0.79	0.95	15.52	20.95	−5.46	1.02
Taiwan	1.00	0.99	45.28	−0.99	1.06	45.20
Tajikistan	0.28	0.36	27.09	28.67	−4.29	3.20
Thailand	0.53	0.46	22.83	−14.16	−5.79	51.88
Turkey	0.77	0.67	11.65	−12.75	−7.38	38.16
Ukraine	0.25	0.14	−41.99	−46.28	4.39	3.44
United Kingdom	0.78	0.68	23.41	−11.64	28.07	9.06
Uruguay	0.58	0.58	10.78	0.00	5.70	4.81
USA	1.00	0.97	21.08	−2.91	16.72	6.85
Venezuela	0.58	0.44	−17.13	−23.56	10.38	−1.79
Zambia	0.26	0.27	−10.16	2.41	−4.01	−8.61
Zimbabwe	0.36	0.36	−5.33	0.36	−3.90	−1.84
Average			13.99	−2.44	4.82	11.46

TABLE G.2
Mean percentage changes of the tripartite decomposition indices (country groupings)

Country Group	*Productivity change*	$EFF-1$ $\times 100$	$TECH-1$ $\times 100$	$KACCUM-1$ $\times 100$
OECD*	19.29	−1.72	13.38	7.06
Non OECD	12.17	−2.36	1.48	13.20
Asian Tigers†	32.63	−11.16	17.66	26.89
Latin America	2.98	−2.98	−1.61	7.88
Africa	1.46	4.91	−8.60	5.81
Transition (all)‡	16.32	−3.22	6.10	13.28
Non-Transition	13.09	−2.13	−2.13	4.33
Baltic Countries§	38.44	2.12	12.68	20.31
Central and Eastern Europe¶	21.23	2.17	8.87	8.99
Republics of Former USSR$	0.99	−10.84	4.00	8.91
All countries	14.56	−2.44	4.82	11.46

* OECD countries by UNESCO classification as of 2004; excluding Czech Republic, Hungary, Korea, Poland, Slovak Republic, and *Luxembourg*.

† Hong Kong, Japan, Singapore, South Korea and Taiwan.

‡ Albania, Armenia, Azerbaijan, Belarus, Bulgaria, China, Croatia, Czech Republic, Estonia, Hungary, Kazakhstan, Kyrgyzstan, Latvia, Lithuania, Macedonia, Moldova, Poland, Romania, Russia, Slovak Republic, Slovenia, Tajikistan, Ukraine.

§ Estonia, Latvia, Lithuania.

¶ Albania, Bulgaria, Croatia, Czech Republic, Hungary, Macedonia, Poland, Romania, Slovak Republic, Slovenia.

$ Excluding Baltic Countries.

TABLE G.3

Growth regressions of the percentage change in output per worker and the three decomposition indices on output per worker in base (1992) period

	Regression (A)	*Regression (B)*	*Regression (C)*	*Regression (D)*
	$PROD-1$ $\times 100$	$EFF-1$ $\times 100$	$TECH-1$ $\times 100$	$KACCUM-1$ $\times 100$
Constant	11.63 (0.009)	1.37 (0.660)	-4.2 (0.027)	15.40 (0.000)
Slope	0.0002 (0.137)	-0.0001 (0.197)	0.0005 (0.000)	-0.0002 (0.067)

Notes: p-values in parentheses, based on robust standard errors (see footnote **??**).

TABLE G.4

Testing for changes in the distribution of labor productivity due to different sources (comparison year, 2000)

H_0 : *Distributions are equal* H_1 : *Distributions are not equal*	*Value of statistic*	*Bootstrap p-value*	*Conclusion of testing* H_0
$g(y2000)$ vs. $f(y1992)$	1.0652	0.0795	reject
$g(y2000)$ vs. $f(y1992 \times EFF)$	0.7873	0.1435	fail to reject
$g(y2000)$ vs. $f(y1992 \times TECH)$	0.0851	0.9120	fail to reject
$g(y2000)$ vs. $f(y1992 \times KACCUM)$	0.5584	0.3550	fail to reject
$g(y2000)$ vs. $f(y1992 \times EFF \times TECH)$	0.1235	0.8655	fail to reject
$g(y2000)$ vs. $f(y1992 \times EFF \times KACCUM)$	0.3514	0.5980	fail to reject
$g(y2000)$ vs. $f(y1992 \times TECH \times KACCUM)$	0.0062	0.9945	fail to reject

Notes: We used the bootstrapped Li (1996) tests with 5,000 bootstrap replications and the Silverman's (1986) rule-of-thumb bandwidth.

TABLE G.5

Testing for changes in the distribution of labor productivity due to different sources (comparison year, 1992)

H_0 : *Distributions are equal* H_1 : *Distributions are not equal*	*Value of statistic*	*Bootstrap p-value*	*Conclusion of testing* H_0
$g(y1992)$ vs. $f(y2000)$	1.0652	0.0895	reject
$g(y1992)$ vs. $f(y1992 \times EFF)$	0.1060	0.8745	fail to reject
$g(y1992)$ vs. $f(y1992 \times TECH)$	1.0016	0.0885	reject
$g(y1992)$ vs. $f(y1992 \times KACCUM)$	0.2551	0.7135	fail to reject
$g(y1992)$ vs. $f(y1992 \times EFF \times TECH)$	0.6729	0.2340	fail to reject
$g(y1992)$ vs. $f(y1992 \times EFF \times KACCUM)$	0.1873	0.7945	fail to reject
$g(y1992)$ vs. $f(y1992 \times TECH \times KACCUM)$	1.7610	0.0250	reject

Notes: We used the bootstrapped Li (1996) tests with 5,000 bootstrap replications and the Silverman's (1986) rule-of-thumb bandwidth.

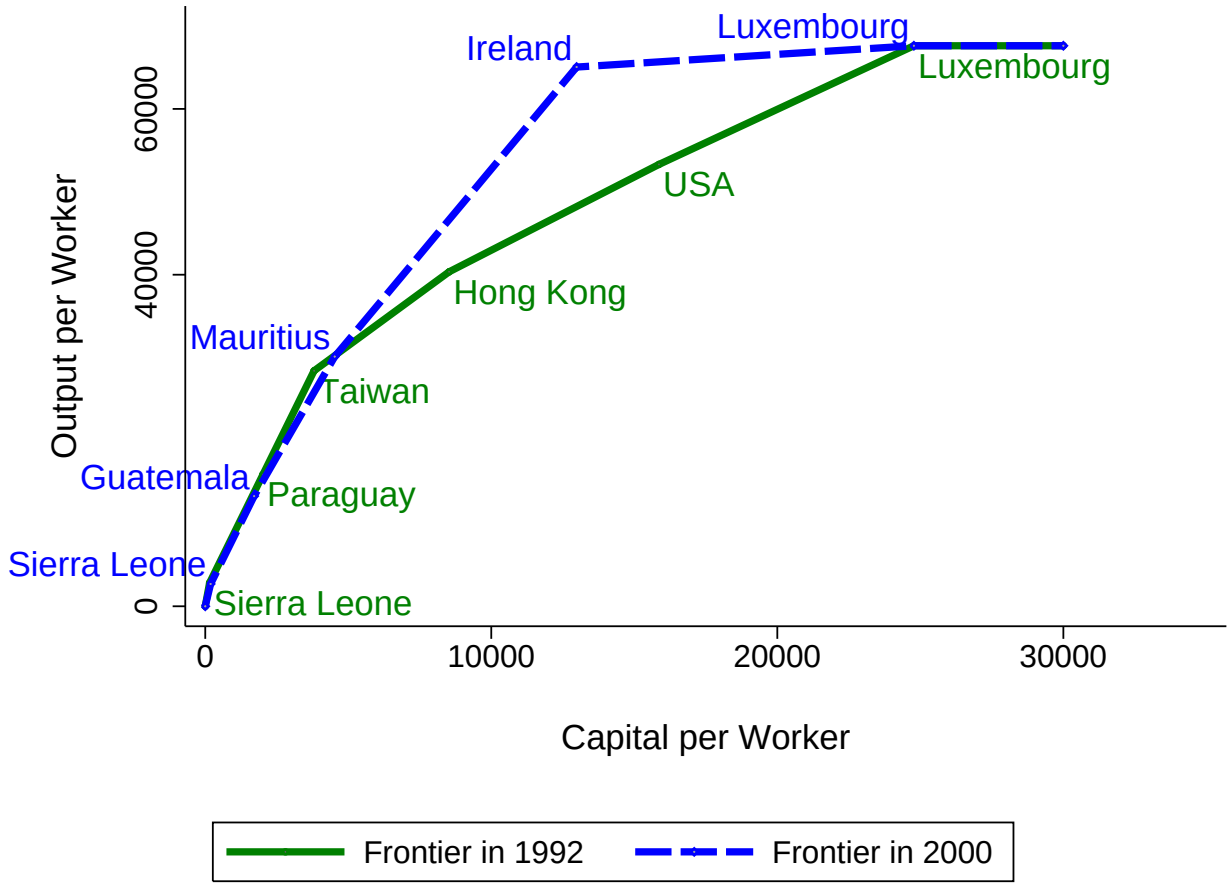

Figure G.1. Estimated best-practice world production frontiers in 1992 and in 2000

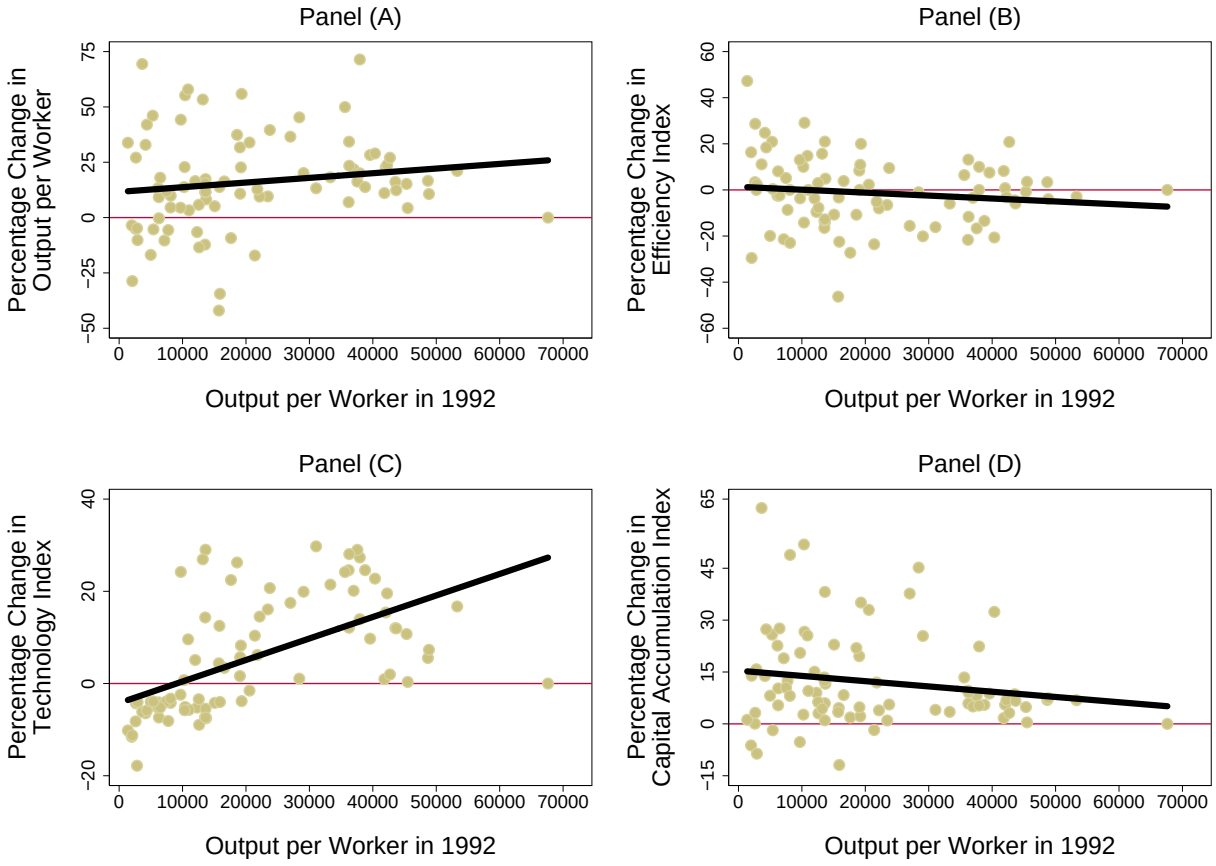

Figure G.2. Percentage change in output per worker and three decomposition indexes, plotted against output per worker in 1992

Note: Each panel contains a GLS regression line.

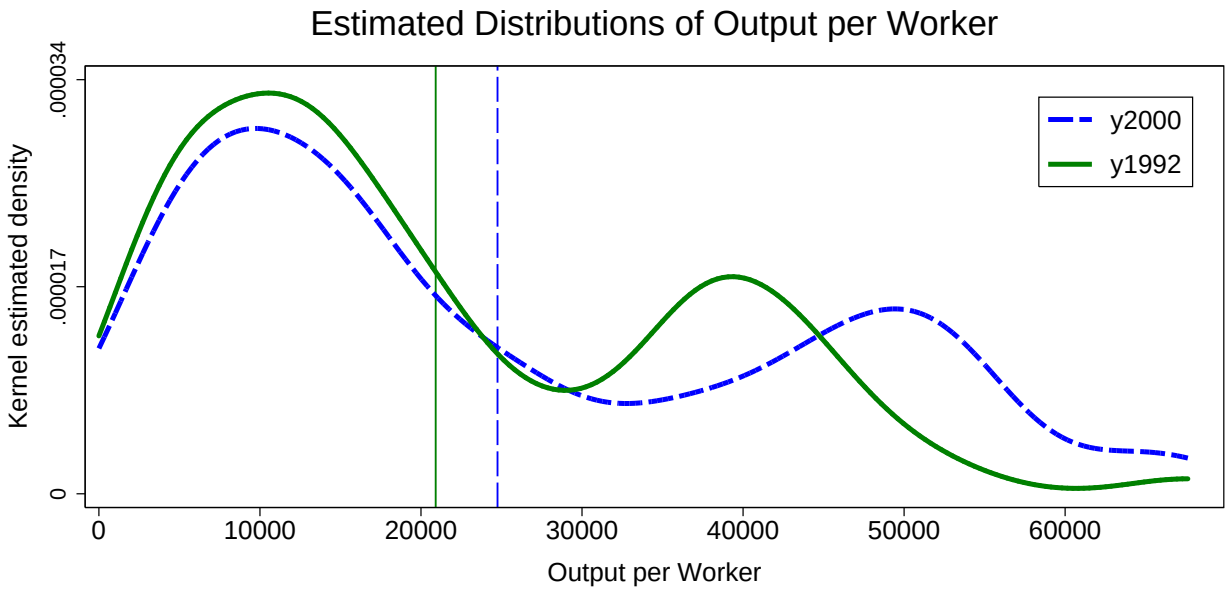

Figure G.3. Estimated 1992 and 2000 output per worker distributions

Notes: In the panel, the solid curve is the estimated 1992 distribution and the solid vertical line represents the 1992 mean value. The dashed curve is the estimated 2000 distribution and the dashed vertical line represents the 2000 mean value.

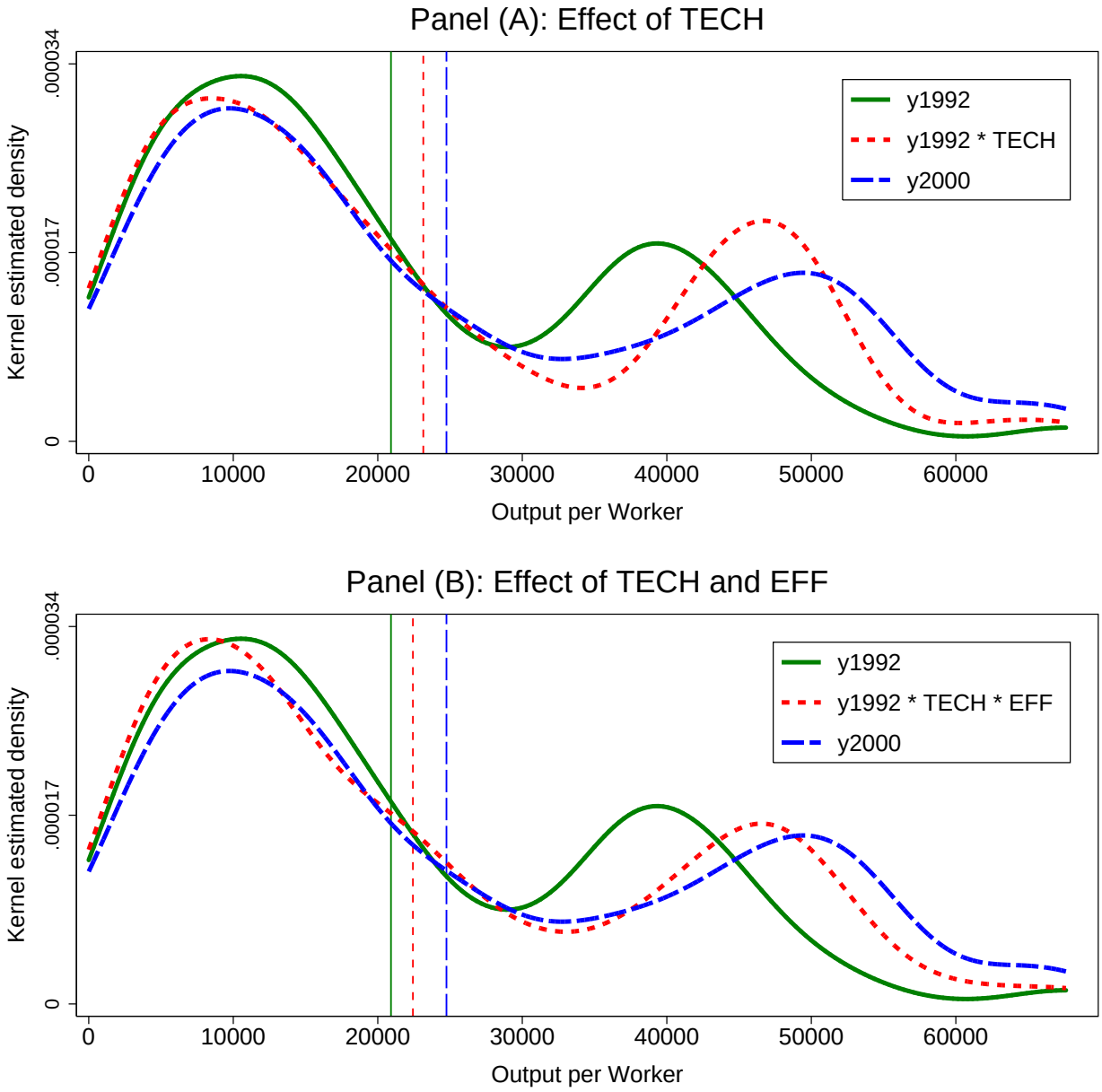

Figure G.4. Counterfactual distributions of output per worker. Sequence of introducing effects of decomposition: TECH, EFF

Notes: In each panel, the solid curve is the estimated 1992 distribution and the solid vertical line represents the 1992 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 and efficiency change on the 1992 distribution, and the dotted vertical line represents the respective counterfactual mean.

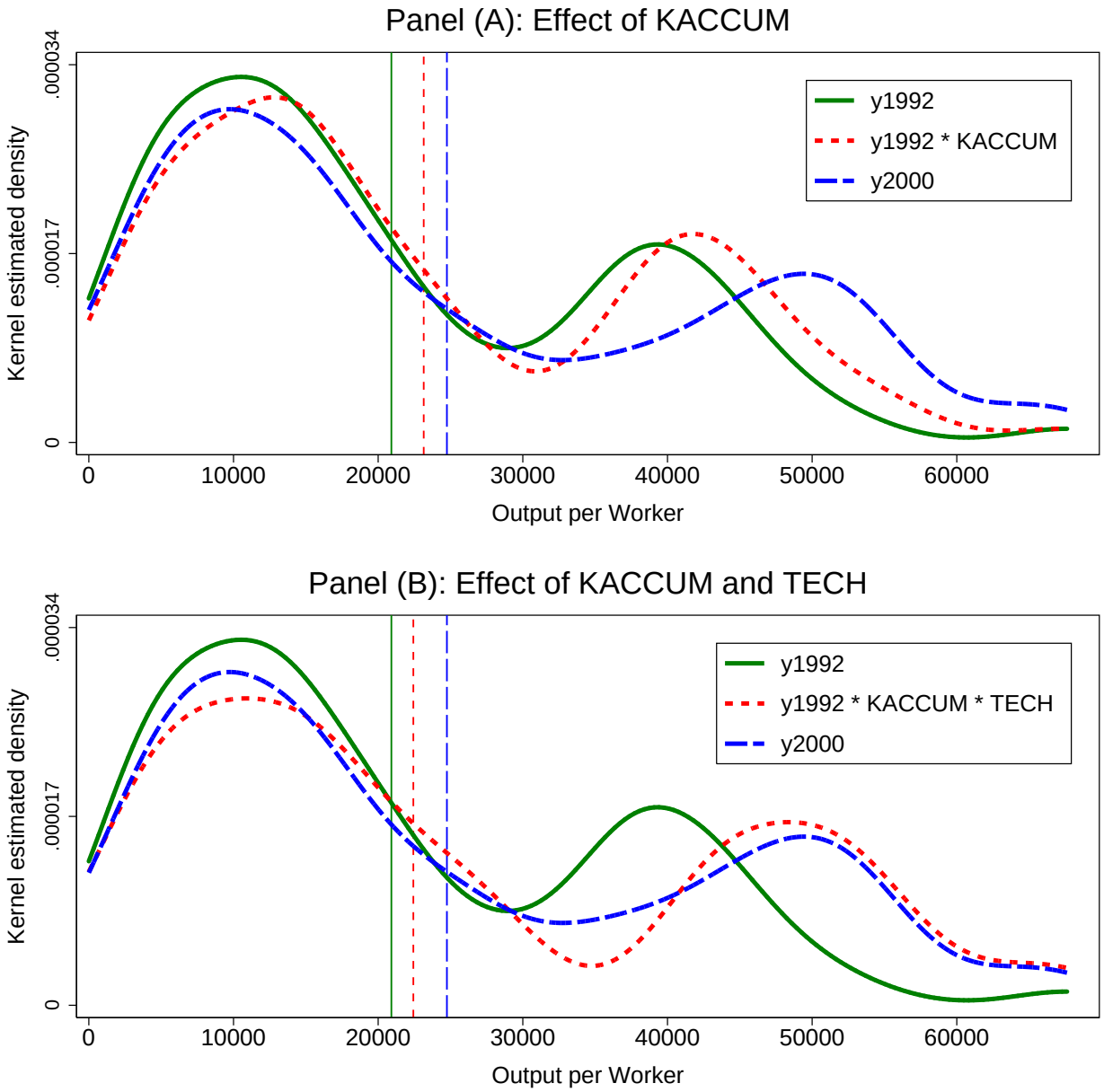

Figure G.5. Counterfactual distributions of output per worker. Sequence of introducing effects of decomposition: KACCUM, TECH

Notes: In each panel, the solid curve is the estimated 1992 distribution and the solid vertical line represents the 1992 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 accumulation and technological change on the 1992 distribution, and the dotted vertical line represents the respective counterfactual mean.

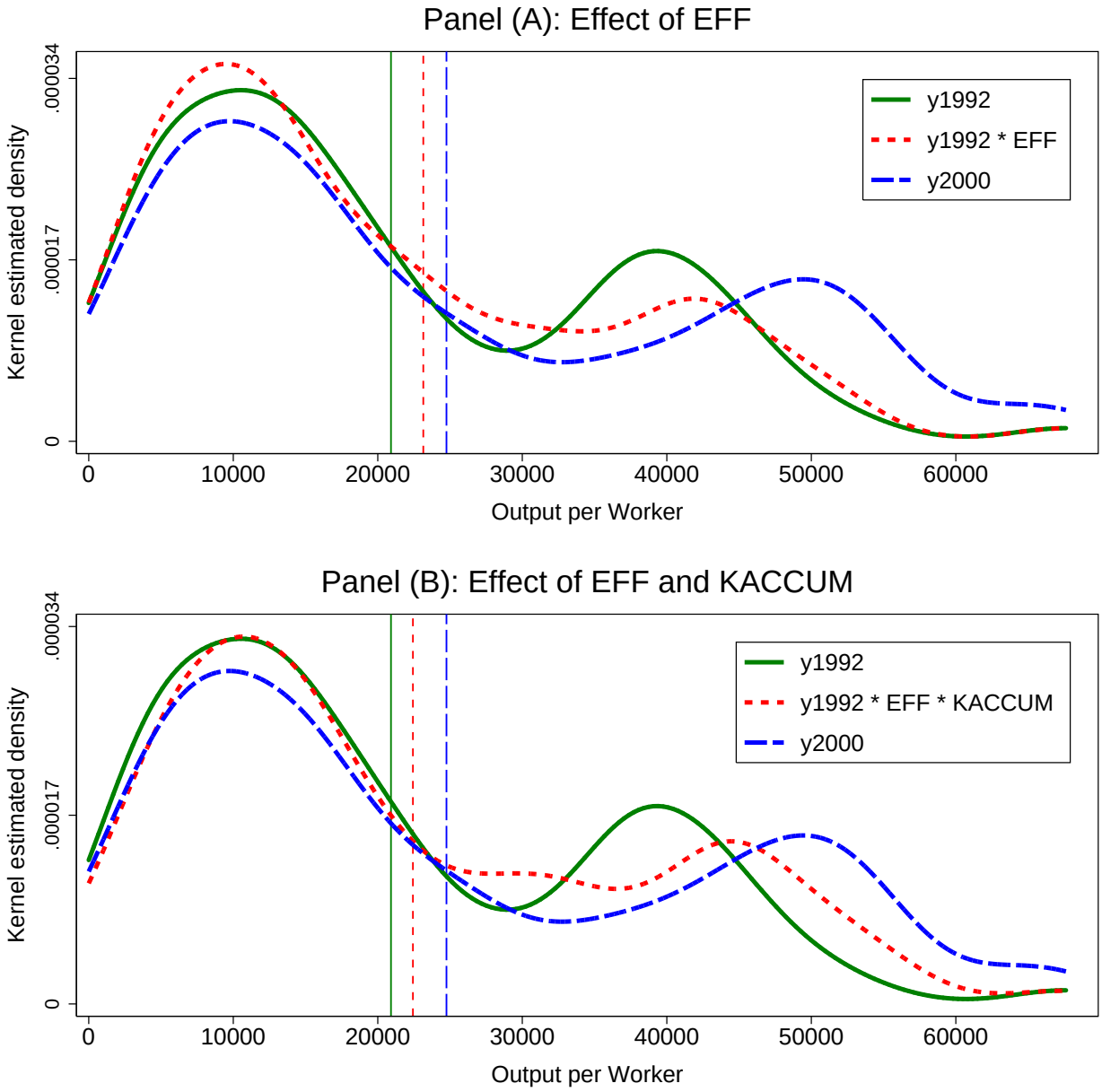

Figure G.6. Counterfactual distributions of output per worker. Sequence of introducing effects of decomposition: EFF, KACCUM

Notes: In each panel, the solid curve is the estimated 1992 distribution and the solid vertical line represents the 1992 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 and capital accumulation on the 1992 distribution, and the dotted vertical line represents the respective counterfactual mean.