

Beyond the inverted-U shape: Challenging the long-term relationship of the Environmental Kuznets Curve hypothesis - Online Appendix

Abstract: This paper empirically tests the validity of the postulated Environmental Kuznets Curve for a panel of 69 countries from 1971 to 2014 which are clustered into all-, high-, middle-, and lower-income groupings. Since the quadratic EKC specification between carbon dioxide emissions and GDP produces highly biased results in favour of an inverted U-shaped pattern, we adopt a cubic formulation and estimate the long-term coefficients signs and significance accounting for country specific slope heterogeneity. Our empirical results rather support a N-shaped than an inverted U-shaped pattern for the pollution income relationship particularly in the all-income panel. We find no evidence of an inverted U-shaped pattern associated with the EKC hypothesis in any panel. Our analysis indicates that promoting economic growth is not a panacea to simply grow out of pollution related problems in the long-term.

Keywords: Environmental Kuznets Curve, CO₂ emissions, energy consumption, economic growth, trade-openness, nonstationary panel data methods

A Online Appendix

To evaluate the robustness of our main empirical results we estimate three further cubic specifications. We control for the economic structure in order to address omitted variable bias concerns:

$$CO_{2it} = \beta_{0i} + \beta_{1i}GDP_{it} + \beta_{2i}GDP_{it}^2 + \beta_{3i}GDP_{it}^3 + \beta_{4i}E_{it} + \beta_{5i}TO_{it} + \beta_{6i}ES_{it} + \epsilon_{it}, \quad (1)$$

where $i = 1, \dots, N$ denotes each country in the panel and subscript $t = 1, \dots, T$ refers to the time period measured in years. $ES_{it} = A_{it}, I_{it}, S_{it}$ is our set of control variables containing value added in the sectors agriculture, industry, and services as % of GDP used in three separate regression to account for different measures of economic structure. Table 1 in the online appendix displays the results for the hypothesized cubic pollution income specification given in equation (2) for the global panel.¹

Table 1: Results of Pedroni (2001) DOLS estimation for the all-income panel

	CO_2 is the dependent variable								
	GDP	GDP^2	GDP^3	E	TO	ES	adj. R^2	Turning points	
$ES_{it} = A_{it}$	24.910 (0.909)	-2.386 (0.8991)	0.071 ^a (-2.704)	1.079 ^a (36.270)	0.161 ^a (7.566)	-0.216 ^a (-4.086)	0.70	-	
$ES_{it} = I_{it}$	-15.820 (-0.501)	2.376 (1.410)	-0.111 ^a (-2.799)	1.029 ^a (39.460)	0.072 (-0.161)	-0.282 ^a (1.938)	0.72	-	
$ES_{it} = S_{it}$	-4.514 ^a (4.084)	0.907 ^a (-2.300)	-0.0478 (0.606)	0.962 ^a (35.520)	0.029 ^a (3.805)	0.549 ^a (1.938)	0.71	-	

Notes: t-statistics are in brackets; superscripts a , b , and c represent significance at 1%, 5%, and 10%, respectively; number of lags and leads included in the DOLS regression is set to one; turning points are in GDP per capita (constant 2010 USD).

For all three regressions, the estimated coefficients on per capita energy consumption are statistically significant at the 1% level in our global panel. Compared to our main results, both the sign and magnitude for the estimated coefficients on per capita energy consumption do not change substantially. However, a higher degree of trade-openness

¹We use a different dataset from the World Bank Development Indicators (WDI) on 37 countries from 1971 to 2014 to have an equal time frame for the robustness check. However, due to the lack of data availability for our economic structure control variables, we cannot divide the global panel into income groupings. All variables are again integrated of order one and we find evidence for cointegration for at least one of the cross-sectional units. The results for the Pesaran (2007) panel unit root test and Westerlund (2007) panel cointegration test are in shown in Tables 6 and 7 in the online appendix.

now tends to significantly increase CO₂ emissions per capita globally at least when we control for either for the value added from the agricultural or the services sector. Contrary to our main results we do not find any specification where the estimated coefficients on GDP per capita, the quadratic term, or the cubic term are statistically significant. However, considering the implications for the EKC hypothesis when we separately control for three indicators for the structure of the economy, the results neither support the inverted U-shaped nor inverted N-shaped curves for the pollution income relationship to hold in the long-term, either. The main implications from our previous empirical results are thus robust to the inclusion of indicators for the structure of the economy: again, we do not find empirical evidence for the long-term relationship of the EKC.

Table 2: Results of Pesaran (2004) CD tests

		Variables in levels					
		<i>CO</i> ₂	<i>GDP</i>	<i>GDP</i> ²	<i>GDP</i> ³	<i>E</i>	<i>TO</i>
All-income	abs (corr)	0.52	0.73	0.74	0.74	0.57	0.50
	CD statistic	51.75 ^a (0.00)	177.75 ^a (0.00)	178.52 ^a (0.00)	179.28 ^a (0.00)	114.35 ^a (0.00)	121.19 ^a (0.00)
High-income	abs (corr)	0.49	0.92	0.92	0.92	0.68	0.65
	CD statistic	13.77 ^a (0.00)	111.15 ^a (0.00)	111.28 ^a (0.00)	111.39 ^a (0.00)	70.23 ^a (0.00)	72.94 ^a (0.00)
Middle-income	abs (corr)	0.51	0.75	0.76	0.76	0.56	0.53
	CD statistic	24.29 ^a (0.00)	46.68 ^a (0.00)	47.08 ^a (0.00)	47.47 ^a (0.00)	25.84 ^a (0.00)	20.53 ^a (0.00)
Lower-income	abs (corr)	0.55	0.60	0.60	0.60	0.50	0.35
	CD statistic	32.70 ^a (0.00)	34.13 ^a (0.00)	34.63 ^a (0.00)	35.12 ^a (0.00)	33.25 ^a (0.00)	29.97 ^a (0.00)

Notes: P-values are in brackets; superscripts *a*, *b*, and *c* represent significance at 1%, 5%, and 10%, respectively; all variables in natural logarithms.

Table 3: Results of Pesaran (2007) panel unit root tests

	All-income		High-income		Middle-income		Lower-income	
	No Trend	Trend	No Trend	Trend	No Trend	Trend	No Trend	Trend
CO_2	-1.875	-1.909	-1.855	-2.253	-1.509	-2.281	-1.795	-2.415
GDP	-1.559	-2.105	-1.828	-2.084	-1.791	-2.721 ^b	-1.672	-2.699 ^b
GDP^2	-1.504	-2.022	-1.824	-2.004	-1.752	-2.661 ^b	-1.637	-2.708 ^b
GDP^3	-1.388	-1.919	-1.796	-2.002	-1.708	-2.608 ^c	-1.605	-2.714 ^b
E	-1.660	-1.548	-2.311 ^a	-2.821 ^a	-1.725	-2.206	-1.514	-1.963
TO	-1.998	-2.475	-2.268 ^a	-2.800 ^a	-1.907	-2.000	-2.091	-2.296
ΔCO_2	-5.741 ^a	-5.958 ^a	-5.810 ^a	-6.069 ^a	-5.671 ^a	-5.755 ^a	-5.846 ^a	-6.020 ^a
ΔGDP	-4.426 ^a	-4.755 ^a	-4.427 ^a	-4.713 ^a	-4.732 ^a	-4.821 ^a	-4.770 ^a	-5.133 ^a
ΔGDP^2	-4.383 ^a	-4.709 ^a	-4.448 ^a	-4.708 ^a	-4.686 ^a	-4.800 ^a	-4.762 ^a	-5.107 ^a
ΔGDP^3	-4.342 ^a	-4.668 ^a	-4.465 ^a	-4.702 ^a	-4.643 ^a	-4.787 ^a	-4.716 ^a	-5.077 ^a
ΔE	-5.641 ^a	-5.905 ^a	-5.848 ^a	-6.092 ^a	-5.602 ^a	-5.853 ^a	-5.706 ^a	-5.956 ^a
ΔTO	-5.457 ^a	-5.570 ^a	-5.342 ^a	-5.405 ^a	-5.215 ^a	-5.296 ^a	-5.930 ^a	-6.108 ^a

Notes: P-values are in brackets; superscripts *a*, *b*, and *c* represent significance at 1%, 5%, and 10%, respectively; critical values are from Pesaran (2007).

Table 4: Results of Westerlund (2007) panel cointegration tests

	No deterministic		No trend		Trend	
	Z-Value	P-Value	Z-Value	P-Value	Z-Value	P-Value
All-income						
G_τ	-7.003 ^a	0.00	-4.246 ^b	0.04	-5.289	0.14
G_α	0.004 ^a	0.00	3.683	0.21	6.666	0.78
P_τ	-9.092 ^b	0.02	-6.328 ^a	0.01	-4.973	0.58
P_α	-4.574 ^b	0.03	-0.838 ^a	0.19	2.709	0.81
High-income						
G_τ	-3.391 ^c	0.06	-1.310	0.28	-2.795 ^c	0.09
G_α	0.691 ^c	0.07	2.788	0.43	4.018	0.35
P_τ	-5.343 ^a	0.01	-3.167	0.16	-2.213	0.18
P_α	-2.158 ^b	0.04	0.001	0.31	2.432	0.58
Middle-income						
G_τ	-3.355 ^c	0.06	-2.732	0.17	-4.728 ^c	0.09
G_α	-1.062 ^a	0.00	0.561 ^c	0.10	1.900	0.20
P_τ	-5.243 ^c	0.06	-4.182	0.16	-5.953 ^c	0.08
P_α	-3.226 ^c	0.10	-1.454	0.37	-1.457	0.17
Lower-income						
G_τ	-5.408 ^a	0.00	-3.53 ^c	0.09	-2.036	0.53
G_α	0.115 ^b	0.02	2.723	0.49	5.336	0.98
P_τ	-5.261 ^b	0.05	-3.625 ^c	0.09	-2.465	0.56
P_α	-2.613	0.13	-0.359	0.33	1.92	0.83

Notes: Superscripts *a*, *b*, and *c* represent significance at 1%, 5%, and 10%, respectively; number of replications to obtain bootstrapped p-values is set to 100; bandwidth is selected according to the data depending rule $4(T/100)^{2/9} \approx 3$ recommended by Newey and West (1994); Barlett is used as the spectral estimation method.

Table 5: Results of Pedroni (2001) DOLS estimation for the reduced samples

	CO_2 is the dependent variable						Turning points
	GDP	GDP^2	GDP^3	E	TO	adj. R^2	
All-income	29.730 ^a (8.67)	-3.310 ^a (-7.37)	0.120 ^a (6.07)	1.049 ^a (44.21)	-0.021 (-1.15)	0.66	2,476.84 & 38,514.90
High-income	12.300 ^a (4.23)	-1.099 ^a (-4.07)	0.033 ^a (3.94)	1.003 ^a (35.78)	-0.212 ^a (-3.11)	0.70	67,137.64
Middle-income	-4.411 (1.39)	0.869 (-0.96)	-0.046 (0.63)	0.789 ^a (15.84)	-0.012 ^a (2.04)	0.68	-
Lower-income	-30.030 (-0.84)	5.117 (1.20)	-0.273 (-1.53)	0.692 ^a (9.84)	-0.007 ^a (1.97)	0.32	-

Notes: t-statistics are in brackets; superscripts a , b , and c represent significance at 1%, 5%, and 10%, respectively; number of lags and leads included in the DOLS regression is set to one; turning points are in GDP per capita (constant 2010 USD).

Table 6: Results of Pesaran (2007) panel unit root tests for the robustness checks

	All-income	
	No Trend	Trend
CO_2	-1.962	-2.168
GDP	-1.843	-2.475
GDP^2	-1.799	-2.383
GDP^3	-1.711	-2.484
E	-1.754 ^b	-1.850
TO	-2.113 ^b	-2.509
$ES_{it} = A_{it}$	-2.184	-2.907 ^a
$ES_{it} = I_{it}$	-1.864	-2.515
$ES_{it} = S_{it}$	-2.231 ^a	-2.671 ^b
ΔCO_2	-5.780 ^a	-5.959 ^a
ΔGDP	-4.630 ^a	-4.937 ^a
ΔGDP^2	-4.598 ^a	-4.911 ^a
ΔGDP^3	-4.587 ^a	-4.898 ^a
ΔE	-5.685 ^a	-5.946 ^a
ΔTO	-5.651 ^a	-5.770 ^a
$\Delta ES_{it} = \Delta A_{it}$	-5.776 ^a	-5.892 ^a
$\Delta ES_{it} = \Delta I_{it}$	-5.837 ^a	-6.095 ^a
$\Delta ES_{it} = \Delta S_{it}$	-5.659 ^a	-5.733 ^a

Notes: P-values are in brackets; superscripts a , b , and c represent significance at 1%, 5%, and 10%, respectively; critical values are from Pesaran (2007).

Table 7: Results of Westerlund (2007) panel cointegration tests for the robustness checks

	No deterministic		No trend		Trend	
	Z-Value	P-Value	Z-Value	P-Value	Z-Value	P-Value
<i>ES_{it} = A_{it}</i>						
<i>G_τ</i>	-3.312 ^b	0.03	-0.409	0.47	0.205	0.76
<i>G_α</i>	2.032 ^b	0.03	4.190	0.23	7.103	0.81
<i>P_τ</i>	-5.298	0.38	-3.091	0.79	1.326	0.91
<i>P_α</i>	-1.912	0.32	0.626	0.81	3.639	0.94
<i>ES_{it} = I_{it}</i>						
<i>G_τ</i>	-4.894 ^a	0.01	-2.606	0.12	-2.559	0.16
<i>G_α</i>	1.317 ^a	0.00	3.606 ^b	0.04	6.081	0.21
<i>P_τ</i>	-7.323	0.42	-5.169	0.68	-4.121	0.94
<i>P_α</i>	-2.999	0.37	-0.481	0.71	1.946	0.94
<i>ES_{it} = S_{it}</i>						
<i>G_τ</i>	-5.341 ^a	0.01	-3.052 ^c	0.10	-3.836	0.11
<i>G_α</i>	1.658 ^a	0.01	4.009	0.13	6.952	0.68
<i>P_τ</i>	-6.754	0.15	-4.531	0.33	-2.841	0.71
<i>P_α</i>	-2.551	0.16	0.026	0.59	2.971	0.88

Notes: Superscripts *a*, *b*, and *c* represent significance at 1%, 5%, and 10%, respectively; number of replications to obtain bootstrapped p-values is set to 100; bandwidth is selected according to the data depending rule $4(T/100)^{2/9} \approx 3$ recommended by Newey and West (1994); Barlett is used as the spectral estimation method.

Table 8: Fixed (FE) and Random (RE) effects estimation

	<i>CO₂ is the dependent variable</i>					Hausmann	<i>R</i> ²	Turning points
	<i>GDP</i>	<i>GDP</i> ²	<i>GDP</i> ³	<i>E</i>	<i>TO</i>			
All-income (FE):	1.143 ^b (2.33)	0.048 (0.80)	-0.007 ^a (-3.04)	0.482 ^a (22.16)	0.031 ^c (1.95)	50.59 ^a	0.89	-
All-income (RE):	0.985 ^b (2.02)	0.068 (1.15)	-0.007 ^a (-3.39)	0.495 ^a (22.93)	0.015 (0.96)			
High-income (FE):	-0.599 (-0.28)	0.249 (1.11)	-0.014 ^c (-1.87)	0.415 ^a (18.90)	-0.086 ^a (-3.13)	13.64 ^a	0.61	-
High-income (RE):	-0.408 (-0.19)	0.226 (1.00)	-0.014 ^c (-1.75)	0.427 ^a (19.66)	-0.076 ^a (-2.89)			
Middle-income (FE):	-2.212 (-1.58)	0.279 (1.51)	-0.009 (-1.16)	0.544 ^a (15.38)	0.096 ^a (3.92)	41.68 ^a	0.66	-
Middle-income (RE):	-1.579 (-1.11)	0.194 (1.03)	-0.006 (-0.71)	0.606 ^a (17.38)	0.088 ^a (3.73)			
Lower-income (FE):	36.894 ^a (8.09)	-4.934 ^a (-7.47)	0.223 ^a (7.05)	0.495 ^a (9.07)	0.076 ^a (2.79)	4.89	0.62	1,595.90
Lower-income (RE):	36.954 ^a (8.13)	-4.939 ^a (-7.50)	0.223 ^a (7.08)	0.498 ^a (9.19)	0.071 ^a (2.66)			0.62

Notes: t-statistics are in brackets; superscripts *a*, *b*, and *c* represent significance at 1%, 5%, and 10%, respectively; a Hausmann (1987) specification test was used to decide between fixed or random effects; turning points are in GDP per capita (constant 2010 USD).

Table 9: Summary statistics for high-income countries

High-income	CO ₂		GDP		E		TO	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Australia	15.63	1.74	38,526.12	9,276.16	5,080.49	541.77	34.97	5.77
Austria	7.66	0.56	35,390.40	8,757.07	3,363.82	474.03	75.68	16.00
Belgium	11.18	1.52	34,255.42	7,710.98	4,978.36	465.59	122.84	22.32
Canada	16.49	0.83	38,117.94	7,488.68	7,713.85	425.76	58.72	11.59
Chile	3.04	0.96	7,934.48	3,384.52	1,277.44	469.30	55.18	13.24
Denmark	10.31	1.67	47,025.85	9,900.52	3,591.22	253.82	74.92	14.97
Finland	10.59	1.16	33,910.44	9,332.81	5,697.08	894.16	62.31	12.06
France	6.84	1.43	32,966.71	6,606.17	3,759.54	383.64	46.31	7.42
Greece	6.73	1.62	21,223.95	4,091.61	2,028.51	507.97	44.09	10.05
Hong Kong	4.83	1.39	19,521.15	8,918.72	1,546.42	482.45	252.65	85.72
Iceland	7.34	0.73	32,397.16	8,122.09	9,576.67	4,079.41	74.43	11.86
Ireland	8.67	1.33	30,607.87	14,774.26	2,829.79	498.56	128.96	37.66
Israel	7.56	1.63	22,542.23	5,642.53	2,461.35	466.04	82.43	16.25
Italy	7.01	0.73	30,044.69	6,238.52	2,603.33	364.14	43.84	7.08
Japan	8.75	0.82	35,481.35	9,003.31	3,449.93	497.77	23.57	5.59
Korea, Rep.	6.78	3.31	11,184.79	7,280.47	2,727.34	1,642.73	64.74	18.04
Luxembourg	25.42	6.19	71,387.99	26,216.90	8,924.33	1,493.22	224.38	67.32
Malta	4.97	1.55	13,633.76	5,869.93	1,601.23	513.09	200.24	60.35
Netherlands	11.02	0.83	38,306.31	8,968.85	4,582.68	316.46	111.49	18.50
Norway	9.04	1.39	66,196.05	18,864.16	5,124.12	892.22	72.10	4.19
Portugal	4.15	1.41	16,914.21	4,575.99	1,670.32	621.79	59.63	9.83
Saudi Arabia	14.70	2.53	22,907.71	7,415.42	4,123.54	1,681.77	78.11	12.94
Singapore	11.46	2.85	26,247.90	13,581.02	3,838.24	1,636.90	344.87	46.29
Spain	5.92	1.05	23,397.19	5,862.85	2,325.35	588.44	43.40	11.53
Sweden	6.99	1.88	39,379.20	8,818.71	5,336.13	399.53	67.88	14.19
Trinidad and Tobago	19.51	8.63	10,158.08	3,740.44	7,050.93	4,418.36	88.46	15.15
United Kingdom	9.49	1.23	29,825.57	7,573.39	3,566.23	259.26	51.51	5.04
United States	19.47	1.46	37,847.88	8,877.32	7,680.29	372.59	21.19	5.17
Uruguay	1.76	0.38	8,172.11	2,229.13	902.12	191.55	42.78	10.11
Panel	9.77	5.82	30,189.84	17,626.58	4,117.61	2,630.75	91.44	78.23

Notes: CO₂ emissions are measured in metric tons per capita; GDP per capita is measured in constant 2010 USD; per capita energy consumption is measured in kg of oil equivalent per capita; trade is the sum of exports and imports of goods and services measured as a share of gross domestic product; mean is the arithmetic mean, and SD denotes the standard deviation; data obtained from the World Bank Development Indicators database (last updated 15 September 2017).

Table 10: Summary statistics for middle-income countries

Middle-income	CO ₂		GDP		E		TO	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Argentina	3.85	0.39	7,998.72	1,255.03	1,577.82	193.88	22.40	10.21
Brazil	1.65	0.35	8,566.96	1,575.97	1,033.79	184.93	20.24	4.50
China	3.04	1.96	1,675.80	1,681.65	986.58	527.11	31.26	17.53
Colombia	1.56	0.14	4,586.27	1,137.71	660.67	44.14	32.84	3.93
Costa Rica	1.26	0.33	5,797.60	1,499.72	674.22	213.72	73.87	11.24
Cuba	2.80	0.43	3,910.97	1,093.49	1,222.36	238.99	54.13	21.22
Dominican Rep.	1.66	0.51	3,387.68	1,212.02	663.59	98.24	63.04	14.76
Ecuador	1.83	0.53	3,888.03	602.62	638.03	122.06	44.75	10.99
Gabon	5.31	2.35	10,952.00	2,163.84	1,854.42	537.02	94.33	13.34
Malaysia	4.33	2.27	5,620.18	2,494.98	1,609.23	796.24	145.99	44.56
Mexico	3.71	0.53	7,694.28	1,149.91	1,382.27	220.38	39.48	16.16
Panama	1.81	0.44	5,329.66	1,747.70	859.45	153.71	129.76	19.15
Peru	1.28	0.29	3,723.35	788.81	551.23	97.96	38.38	9.30
South Africa	8.61	0.88	6,411.46	601.11	2,478.13	254.36	52.14	7.71
Thailand	2.20	1.39	2,905.46	1,487.56	957.86	522.85	84.61	36.45
Turkey	2.80	0.92	7,462.41	2,415.56	1,023.71	297.11	35.01	13.75
Panel	2.98	2.16	5,619.43	2,815.16	1,135.84	616.70	60.14	40.59

Notes: CO₂ emissions are measured in metric tons per capita; GDP per capita is measured in constant 2010 USD; per capita energy consumption is measured in kg of oil equivalent per capita; trade is the sum of exports and imports of goods and services measured as a share of gross domestic product; mean is the arithmetic mean, and SD denotes the standard deviation; data obtained from the World Bank Development Indicators database (last updated 15 September 2017).

Table 11: Summary statistics for lower-income countries

Lower-income	CO ₂		GDP		E		TO	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Benin	0.24	0.17	655.31	77.02	353.84	29.90	53.32	7.98
Bolivia	1.08	0.36	1,630.25	246.39	469.53	142.42	56.24	13.04
Cameroon	0.29	0.16	1,207.63	207.80	402.40	32.74	45.42	8.01
Congo, Dem. Rep.	0.08	0.05	576.46	278.62	322.64	21.18	46.87	20.25
Congo, Rep.	0.47	0.21	2,484.27	388.62	337.35	77.47	114.79	26.08
Cote d'Ivoire	0.49	0.13	1,559.31	360.92	435.12	73.36	75.48	10.65
Egypt	1.55	0.58	1,666.36	562.04	558.94	209.35	52.24	12.40
El Salvador	0.74	0.28	2,818.68	521.94	603.74	91.94	62.02	10.53
Ghana	0.32	0.08	1,004.29	232.18	345.36	38.44	56.35	30.06
Guatemala	0.66	0.19	2,419.27	291.57	550.76	93.92	48.42	12.32
Honduras	0.70	0.23	1,647.09	192.81	511.84	43.91	89.36	27.55
India	0.82	0.38	705.34	369.45	386.12	103.93	25.04	15.15
Indonesia	1.09	0.55	1,940.83	797.46	577.97	201.08	52.07	10.51
Kenya	0.28	0.05	877.61	68.56	452.19	14.28	58.17	6.73
Morocco	1.09	0.39	1,868.27	601.55	353.73	111.94	57.86	12.45
Nepal	0.08	0.06	406.51	116.81	327.18	30.45	38.87	12.89
Nicaragua	0.69	0.13	1,576.57	420.06	510.84	32.50	68.46	21.45
Nigeria	0.65	0.19	1,687.86	410.61	694.50	53.50	48.92	15.71
Pakistan	0.64	0.22	764.20	202.44	405.10	76.90	33.21	3.49
Philippines	0.79	0.12	1,667.71	287.50	455.86	25.27	67.70	21.47
Senegal	0.45	0.08	910.68	65.19	254.37	26.73	66.01	9.57
Sri Lanka	0.41	0.19	1,586.55	786.18	376.06	75.94	67.50	11.66
Togo	0.24	0.08	538.44	58.00	371.41	56.12	91.25	17.25
Tunisia	1.76	0.50	2,650.28	863.63	645.98	189.56	83.63	15.38
Panel	0.65	0.50	1,452.07	800.19	445.95	146.45	60.80	25.15

Notes: CO₂ emissions are measured in metric tons per capita; GDP per capita is measured in constant 2010 USD; per capita energy consumption is measured in kg of oil equivalent per capita; trade is the sum of exports and imports of goods and services measured as a share of gross domestic product; mean is the arithmetic mean, and SD denotes the standard deviation; data obtained from the World Bank Development Indicators database (last updated 15 September 2017).