"Re-Exploring the Trade and Environment Nexus Through the Diffusion of Pollution"

A Supplementary Appendix

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Contents

A1 Overview

This supplementary appendix presents formal extensions, robustness tests, and additional empirical analyses for the article "Re-Exploring the Trade and Environment Nexus Through the Diffusion of Pollution."

A2 Sources

The sources for the data employed in these analyses are:

- CO_2 per capita
  - Climate Analysis Indicators Tool (CAIT) Version 8.0. (Washington, DC: World Resources Institute, 2010). Available at: `http://cait.wri.org/`
  - Boden, Marland, and Andrews (2010).
- Bilateral trade data: Gleditsch (2002).
- OECD membership is available at `http://www.oecd.org` (accessed November 2010).
- Income per capita:
  - Heston, Summers, and Aten (2009).
  - Maddison, Angus. "Statistics on World Population, GDP and Per Capita GDP, 1-2008 AD". University of Groningen. Available at: `http://www.ggdc.net/MADDISON` (accessed November 2010).
- Democracy (Polity): Polity IV Annual Time-Series 1800-2008. Available at `http://www.systemicpeace.org/inscr/p4v2008.xls` (accessed November 2010).
- Population density, population: *World Development Indicators*, World Bank `http://data.worldbank.org/data-catalog/world-development-indicators` (accessed August 2011).

	Industrialized Country	Developing Country
Efficiency Hypothesis	CO_2 per capita $\downarrow$	CO_2 per capita $\downarrow$
Outsourcing Hypothesis	CO_2 per capita $\downarrow$	CO_2 per capita $\uparrow$

Table A1: Comparison of theories and prediction. Arrows indicate the effect of trade on per-capita carbon dioxide emissions compared to the 'business as usual' counterfactual without trade.

A3 Pollution, Trade, and the Timing of Development

A3.1 The Timing of Development and the Second Mover Disadvantage

The efficiency and outsourcing hypotheses are hard to disentangle. One reason for that is that they make identical predictions for industrialized countries: whether trade shifts polluting production of goods or whether it leads to more efficient production, we expect pollution intensity to decrease in wealthy countries. Table A1's first column summarizes this using the case of per capita carbon dioxide. A second reason is that both the efficiency and the outsourcing effects may operate at the same time in any given country. To overcome these issues, I exploit the difference in predictions about developing countries to test the two theories.

The predictions for the two hypotheses are radically different for developing countries. If trade leads to a more efficient use of resources and easier access to clean technologies, then the pollution trajectories of developing countries should be below that of industrialized countries. That is, developing countries would benefit from an environmental standpoint from developing *after* industrialized countries, since they can thus benefit from both a more sustainable use of their resources and new, cleaner technologies. I refer to this as a *second mover advantage*.

To illustrate this claim, consider the following scenario. Consider two countries, i (a developing country) and j (an industrialized country) when they were at a comparable stage of their respective economic development. This could mean that we are comparing a country such as Mexico nowadays with Canada in the past. If the currently developing country pollute at the same level on a per-capita basis, then this would suggest that for a similar level of economic activity the efficiency gains are equal to the outsourcing effects. Now, if trade is predominantly

a source of efficiency, then j should emit less pollution at an identical level of economic activity once we let these countries trade. Hence, by developing later in time, j has a second mover advantage. This implies that j's carbon trajectory would go underneath that of i's.

The situation is reversed if trade is predominantly a source of pollution movement. Here, a country developing later in time, such as j, will be disadvantaged. Country j will inherit the dirty production activities from i, the wealthier country, without being able to compensate with better technology. As i's income grows, its economic focus will shift towards the service sector and high added-value goods production. Further, its population may be expected to ask for a better environment, further disadvantaging those producers who generate high-pollution goods (Dasgupta et al., 2002). If this scenario is accurate, then countries that develop later suffer from a *second mover disadvantage*, since by growing later in time they have to accommodate the outsourced pollution in addition to the usual pollution that they would produce under their own growth. Hence, their environmental pollution trajectory would be expected to be above that of already industrialized countries at any level of socio-economic development.

This claim is illustrated in Figure A1. The question is whether the carbon trajectory of developing countries goes above or underneath that of industrialized countries. If it goes above, *ceteris paribus*, then this strongly would suggest that developing countries are carrying an excess of carbon that is likely coming from inter-industry trade.

A3.2 Timing of Development: Empirical Strategy

I can hence test the rival hypotheses on the effects of trade on the environment by comparing the pollution trajectories of developing and industrialized countries. I do so by deriving an estimate of the treatment effect of 'being' a developing countries on CO_2 emissions per capita. The notion of 'being' a developing country simply refers to whether a country is a second mover or not. This captures the timing of development. Denote the treatment effect τ and the treatment Z. According to the theories presented above, τ will reflect the combined (but opposite) effects of innovation and pollution outsourcing on the treated (i.e. on developing countries).

Suppose that we can obtain an estimate of the treatment, such that $\hat{\tau} = (\bar{Y}_{Z=1}|\mathbf{X}) - (\bar{Y}_{Z=0}|\mathbf{X})$,

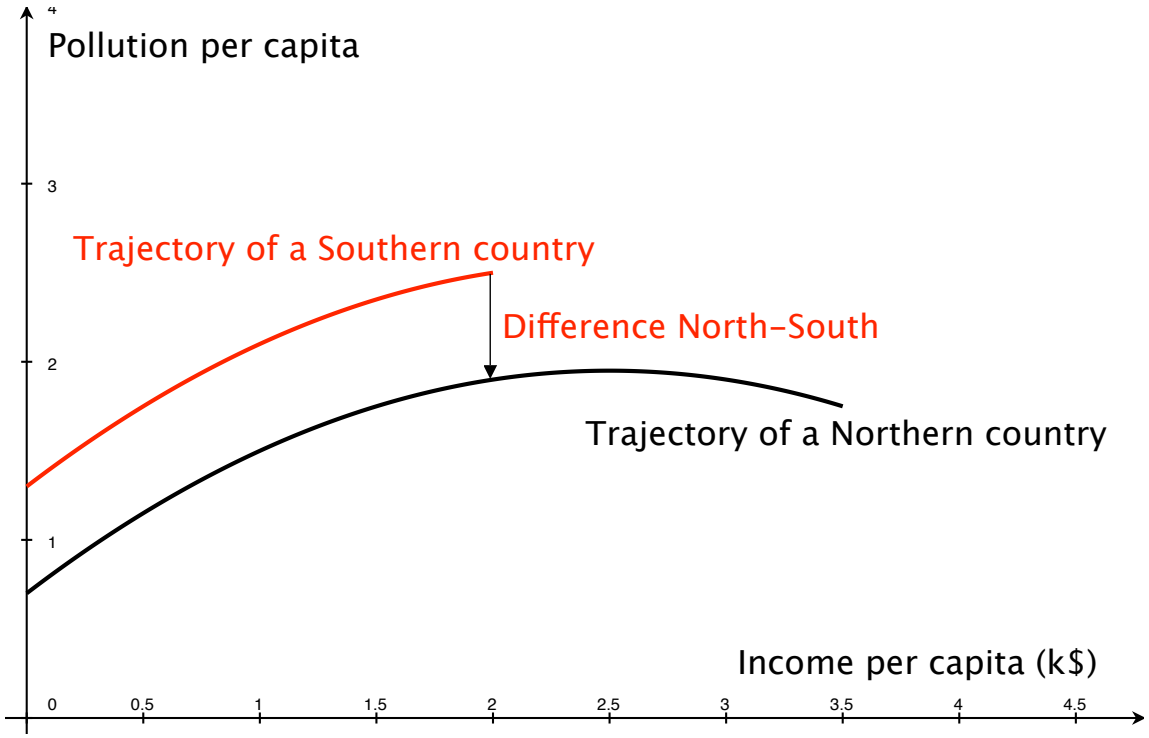

Figure A1: Intra- vs. Inter-Industry Trade

where $\mathbf{X}$ is a set of confounding variables that includes various socio-economic variables (described below). Then, three cases main obtain. First, if $\hat{\tau} < 0$, developing countries are emitting less pollution than industrialized countries at similar levels of economic activity. The efficiency effect is larger than the outsourcing effect. Second, if $\hat{\tau} = 0$, then we observe no difference between developing and industrialized countries. The efficiency effect cancels out the outsourcing effect. (Alternatively, it could also be that none has any effect.) Finally, if $\hat{\tau} > 0$: developing countries are emitting more pollution than industrialized countries at similar levels of economic activity. The outsourcing effect is larger than the efficiency effect.

A few comments are necessary here. First, the functional form of pollution trajectories both within developing and industrialized countries is unknown and as we saw above the object of many debates. Hence, assumption of linearity of the effect of income becomes tenuous. Second, the carbon trajectories of developing and industrialized countries do not overlap enough to alleviate concerns of model dependency. Notice that this is an important theoretical concern: my interest is in comparing countries over their observed socio-economic development. It would make little sense to compare a developing and an industrialized countries at levels of income that the former has not yet reached.

To avoid these issues, I derive an estimate of the treatment on the treated using propensity score matching. Data preprocessing has become increasingly popular in the social sciences in the past two decades (Dehejia and Wahba, 2002; Ho et al., 2007). Matching is done in two steps: firstly, I estimate a model determining selection in the treatment group. This yields predictions (propensity scores) about treatment membership. Secondly, I estimate a weighted regression using the propensity scores as weights.

To ensure the robustness of the propensity score findings, I also estimate the models using the *k*-nearest neighbors approach (Abadie and Imbens, 2006). The procedure is similar to one-to-one matching, except that the matched outcomes are an average over the *k* nearest neighbors (Todd, 1999, 7). This might help stabilizing the effect and reducing the influence of outliers. Using various values for *k*, I show in the appendix that the results remain unchanged (Table A7, A8).

The main regression estimate is given by Equation 2:

$$\begin{aligned} \text{CO}_2 \text{ per capita}_{i,t} &= \tau \text{Developing Country}_i + \lambda \text{GDP per capita}_{i,t} + \phi \text{GDP per capita}_{i,t}^2 \quad (1) \\ &+ \mathbf{X}'_{i,t}\beta + \gamma_k + \delta_t + \varepsilon_{i,t} \quad (2) \end{aligned}$$

where i indexes countries, t denotes a year, and $\mathbf{X}$ is a vector of potential confounding variables, described below. The parameter γ are continent fixed effects; since the treatment is time invariant, I cannot use a country fixed effects approach. Substantively, this is legitimate since I want to explain differences *across* countries, not *within* countries. Finally δ_t are year fixed effects and ε is a random error term. The model is estimated using least squares, and weight the observations based on the propensity weights from the matching design. I report robust standard errors.

A3.3 Data & Variables

To estimate this model, I built a dataset covering 157 countries over the period 1900-2007, though missing data on some covariates reduces the time span in some estimates. The length of the time series is important, since I want to compare countries at different stages of their socio-economic development. All variables are summarized in Table A2. The sources are listed in the appendix.

The main dependent variable used in this paper is per-capita carbon dioxide emissions and is obtained from Boden, Marland, and Andrews (2010). Carbon dioxide is a major greenhouse gas (Solomon et al., 2007). As such, carbon emissions capture a type of environmental degradation. Furthermore, as they are correlated with other polluting activities, they are a useful proxy for a variety of pollutants that could be affected by some trade-related diffusion. Using per-capita data allows to consider the elasticity of change of the polluting structure in a country with respect to changes in the covariates. The variable is measured in metric tons of carbon per inhabitant. The mean is 1.1 metric ton of carbon dioxide emissions per capita.

On the right hand side, $\mathbf{X}$ is a vector of covariates for country i at time t, which includes an index of democracy, population, population density, oil prices, and OPEC membership. Some

Table A2: Summary Statistics

	Obs	Mean	St. Dev.	Min.	Max.
CO2 per Capita (t)	5918	1.05	1.86	-0.09	23.13
CO2 per capita (s-weighted)	5918	31.98	119.95	0.00	2804.93
GDP per capita (s-weighted)	5918	2.27e+08	9.55e+08	0.00	2.46e+10
GDP per capita (k)	5918	4.61	5.11	0.22	42.92
GDP per capita (squared) (k)	5918	47.37	107.41	0.05	1841.80
Democracy	5918	-0.40	7.53	-10.00	10.00
Industry (% GDP)	3768	29.87	12.69	1.88	85.90
Service (% GDP)	3771	47.64	12.78	4.14	82.30
Population (K)	5774	32317.31	109435.25	124.49	1263638.00
Population Density	5010	111.43	364.50	0.63	6010.00
Oil Prices (2009 USD)	5918	31.45	22.28	9.94	95.89
OPEC Member	5918	0.10	0.30	0.00	1.00
Imports per Capita	5774	0.81	2.11	0.00	36.31

analyses include continent fixed effects γ_k and year fixed effects δ_t. If no year fixed effects are included, then a linear time trend is estimated. This ensures that the change of energy intensity of economic output is accounted for.

The key question is how to operationalize the 'development' treatment, that is, how to identify second movers. In the following analysis, the development treatment splits the data between countries that are *not* members of the Organization for Economic Cooperation and Development (OECD) and those that are members. The use of the OECD does not imply any effect of this organization; OECD membership simply proxies for whether a country is at more or less advanced stages of socio-economic development. In the terminology followed in this paper, OECD membership hence provides a good distinction between first and second movers. Concretely, the variable is coded 1 for non-OECD members, and 0 for OECD members. A noticeable exception are those OECD members which recently joined the organization and which may not qualify as 'first movers'. This concerns all countries that joined the OECD after 1980 as well Turkey. The results are virtually identical when those countries are coded as industrialized countries (see Table A9 in the appendix), although they arguably are second movers in the sense that they developed later in time than industrialized countries. Hence, they may be under the influence of changes in industrialized countries.

A3.4 Timing of Development: Results

The first step is to define the propensity score which simply gives the likelihood of being a developing country. There is no intrinsic meaning attached to this score in this paper. The aim is to obtain the best balance on the covariates of interest, which in this case and following the literature mentioned above are set as income per capita, income per capita squared, and how democratic a country is. Table A9 in the appendix reports the results across treatment and control groups before and after matching. Using propensity score matching substantially improves the balance of the mean and standard deviation for the main covariates. Using the propensity scores thus obtained, I then estimate various models using weighted least squares.

Table A3 summarizes the results. Model (1) replicates the naive findings of the literature by considering the influence of income (and its squared term) only, as well as democracy. Model (2) to (6) estimate the model presented above after data processing, using the propensity score approach. These models differ in terms of control variables and the presence of continent or year fixed effects. Model (1) identifies an EKC, since GDP per capita has a positive and significant effect on carbon emissions per capita, and its squared term is negative and also significantly different from 0. This suggests an inverted-U shape relation between income and pollution. The maximum of the carbon trajectory is located at an income of $58,000 per capita. This is coherent with the literature reviewed above (Grossman and Krueger, 1995). Furthermore, I performed an F-test on income and income squared in all specifications of this paper; regardless of the results for the individual terms, income and its squared term are always jointly significant.

Model (2) to (6) include the development treatment with the propensity score design. Two main findings are obtained. First, I find that the EKC is not robust when controlling for the timing of development. The squared term becomes actually positive, contradicting earlier evidence of an inverted-U relationship.

Second, I find that countries that develop later in time emit more carbon emissions on a per-capita basis than early developers. The effect, depending on the specification, is between .48 and .92 (which compares with a mean value in 2008 of 1.36 metric tons of carbon per inhabitant) and is highly significant throughout. The effect is robust to the inclusion of a range of control

Table A3: Explaining Carbon Trajectories - P-Score Matching Design

	(1) OLS	(2) P-Match	(3) P-Match	(4) P-Match	(5) P-Match	(6) P-Match
Developing Country		0.293***	0.629***	0.407***	0.705***	0.550***
		(0.107)	(0.118)	(0.087)	(0.118)	(0.103)
GDP per capita (k)	0.179***	0.119***	0.119***	0.199***	0.079***	0.108***
	(0.024)	(0.024)	(0.027)	(0.020)	(0.028)	(0.026)
GDP per capita (squared) (k)	0.001	0.011***	0.010***	0.009***	0.008***	0.008***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.002)	(0.002)
Imports per Capita	0.032	0.150***	0.128**	0.079	0.221***	0.203***
	(0.031)	(0.055)	(0.053)	(0.048)	(0.054)	(0.054)
Democracy	-0.020***	-0.021***	-0.019***	-0.034***	-0.007***	-0.012***
	(0.002)	(0.004)	(0.004)	(0.004)	(0.002)	(0.003)
Industry (% GDP)	0.027***				0.023***	0.021***
	(0.003)				(0.002)	(0.002)
Population (K)	-0.000***				-0.000***	-0.000***
	(0.000)				(0.000)	(0.000)
Population Density	0.000				-0.001***	-0.001***
	(0.000)				(0.000)	(0.000)
OPEC Member	0.519***				0.293***	0.252***
	(0.095)				(0.072)	(0.070)
Oil Prices (2009 USD)	-0.001				-0.001	-0.001
	(0.001)				(0.001)	(0.001)
Year	-0.002*	0.004***	0.004***		0.004**	
	(0.001)	(0.002)	(0.002)		(0.002)	
Constant	3.579	-8.446***	-8.612***	-0.595**	-7.757**	-0.652*
	(2.665)	(3.093)	(3.203)	(0.260)	(3.293)	(0.352)
Continent FE						
Year FE						
Observations	3702	4966	4966	4966	3146	3146
R^2	0.677	0.604	0.616	0.648	0.718	0.731
$\hat{\sigma}$	0.915	0.933	0.919	0.885	0.609	0.599

Standard errors in parentheses
Dependent Variable: CO2 per capita.
All P-Match models use weights based on propensity scores, where the balance is based on income per capita, its squared term, and democracy.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

variables. Further, it is not affected by the inclusion of continent fixed effects, nor by the inclusion of year fixed effects. Hence, these findings are robust to any unobserved, year-specific and continent-specific, shock. It appears thus that in terms of environmental quality, late developers are disadvantaged in comparison to countries that developed earlier. This finding confirms at the cross-national level findings from micro-studies that show that developing countries emit more carbon as they trade more (Zhang, 2012). In turn, this implies that the outsourcing effect appears to dominate any improvement in technology or efficient use of resources that trade may induce.

These claims are vulnerable to the criticism that trade *per se* is not present in these models; rather, the underlying trade effect is a conjecture. To identify a causal relation between trade and environmental degradation, I next examine the spatiality of trade effects.

A3.5 Robustness Tests

The robustness tests reported below are the following:

- Table A4 reports the estimates of the matching estimates when using the k-nearest neighbor approach, where $k = 3$
- Table A5 reports the estimates of the matching estimates when using the k-nearest neighbor approach, where $k = 4$
- Table A6 reports the estimates of the matching design when developing countries are defined differently: Chile, South Korea, Mexico, and Turkey are listed as industrialized countries
- Table A7 controls for trade openness
- Table A8 limits the sample to the post-1960 period
- Table A9 removes least developed countries (as defined by the U.N.) from the sample
- Table A10 provides the balance on the main covariates
- Table A11 shows the result for the study within the OECD.

- Table A17 shows the direct, indirect, and total effects of the main independent variables from the spatial-autoregressive and the Durbin models.
- Table A18 reports the results when using the inverse of the distance between two countries as the connectivity (spatial) matrix.

Table A4: Explaining Carbon Trajectories - 3-Nearest Neighbor Matching Design

	(1) OLS	(2) K P-Match	(3) K P-Match	(4) K P-Match	(5) K P-Match	(6) K P-Match
GDP per capita (k)	0.235***	0.219***	0.206***	0.248***	0.150***	0.170***
	(0.017)	(0.023)	(0.024)	(0.023)	(0.029)	(0.027)
GDP per capita (squared) (k)	-0.002***	0.006***	0.006***	0.005***	0.004*	0.004*
	(0.001)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Democracy	-0.023***	-0.038***	-0.033***	-0.047***	-0.012***	-0.018***
	(0.002)	(0.005)	(0.004)	(0.004)	(0.003)	(0.002)
Industry (% GDP)	0.022***				0.024***	0.021***
	(0.002)				(0.002)	(0.002)
Population (K)	-0.000***				-0.000***	-0.000***
	(0.000)				(0.000)	(0.000)
Population Density	0.000				-0.000	-0.000*
	(0.000)				(0.000)	(0.000)
OPEC Member	0.660***				0.549***	0.526***
	(0.092)				(0.083)	(0.080)
Oil Prices (2009 USD)	-0.002***				-0.000	-0.001
	(0.001)				(0.001)	(0.001)
Africa	-0.395***		-0.418*	0.029	-0.507*	-0.148
	(0.130)		(0.222)	(0.209)	(0.259)	(0.257)
Asia	0.001		0.092	0.477**	-0.057	0.279
	(0.138)		(0.213)	(0.205)	(0.263)	(0.261)
Europe	-0.439***		0.157	0.538***	-0.031	0.313
	(0.117)		(0.209)	(0.199)	(0.253)	(0.250)
North America	0.024		-0.373*	0.090	-0.342	0.016
	(0.132)		(0.218)	(0.208)	(0.266)	(0.266)
Latin America	-0.896***		-0.745***	-0.307	-0.973***	-0.616**
	(0.124)		(0.214)	(0.207)	(0.267)	(0.268)
Developing Country		0.690***	1.036***	0.613***	0.856***	0.567***
		(0.108)	(0.104)	(0.091)	(0.089)	(0.106)
Constant	-0.351**	-0.789***	-0.830***	-0.985***	-1.044***	-1.059***
	(0.141)	(0.119)	(0.198)	(0.207)	(0.223)	(0.235)
Observations	4657	6269	6269	6269	4054	4054
R^2	0.659	0.519	0.540	0.578	0.644	0.666
$\hat{\sigma}$	0.922	1.063	1.040	1.001	0.696	0.678

Standard errors in parentheses
Dependent Variable: CO2 per capita.
All P-Match models use weights based on propensity scores, where the balance is based on income per capita, its squared term, and democracy.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table A5: Explaining Carbon Trajectories - 4-Nearest Neighbor Matching Design

	(1) OLS	(2) K P-Match	(3) K P-Match	(4) K P-Match	(5) K P-Match	(6) K P-Match
GDP per capita (k)	0.235***	0.214***	0.202***	0.246***	0.142***	0.167***
	(0.017)	(0.021)	(0.022)	(0.022)	(0.028)	(0.026)
GDP per capita (squared) (k)	-0.002***	0.006***	0.006***	0.005***	0.005**	0.004**
	(0.001)	(0.001)	(0.001)	(0.001)	(0.002)	(0.002)
Democracy	-0.023***	-0.034***	-0.029***	-0.046***	-0.009**	-0.016***
	(0.002)	(0.006)	(0.006)	(0.004)	(0.004)	(0.003)
Industry (% GDP)	0.022***				0.025***	0.022***
	(0.002)				(0.003)	(0.002)
Population (K)	-0.000***				-0.000***	-0.000***
	(0.000)				(0.000)	(0.000)
Population Density	0.000				-0.000	-0.000**
	(0.000)				(0.000)	(0.000)
OPEC Member	0.660***				0.523***	0.508***
	(0.092)				(0.086)	(0.082)
Oil Prices (2009 USD)	-0.002***				0.000	-0.000
	(0.001)				(0.001)	(0.001)
Africa	-0.395***		-0.460**	0.019	-0.409*	-0.030
	(0.130)		(0.204)	(0.196)	(0.245)	(0.249)
Asia	0.001		0.045	0.461**	0.030	0.389
	(0.138)		(0.198)	(0.194)	(0.249)	(0.253)
Europe	-0.439***		0.119	0.533***	0.042	0.413*
	(0.117)		(0.192)	(0.185)	(0.239)	(0.241)
North America	0.024		-0.430**	0.073	-0.257	0.123
	(0.132)		(0.203)	(0.195)	(0.251)	(0.256)
Latin America	-0.896***		-0.801***	-0.323*	-0.893***	-0.512**
	(0.124)		(0.200)	(0.193)	(0.252)	(0.257)
Oceania	0.000					
	(.)					
Developing Country		0.717***	1.072***	0.607***	0.865***	0.562***
		(0.120)	(0.116)	(0.087)	(0.089)	(0.101)
Constant	-0.351**	-0.803***	-0.808***	-0.967***	-1.194***	-1.201***
	(0.141)	(0.123)	(0.187)	(0.199)	(0.229)	(0.235)
Observations	4657	6340	6340	6340	4096	4096
R^2	0.659	0.512	0.533	0.577	0.639	0.664
$\hat{\sigma}$	0.922	1.072	1.049	1.003	0.700	0.679

Standard errors in parentheses
Dependent Variable: CO2 per capita.
All P-Match models use weights based on propensity scores, where the balance is based on income per capita, its squared term, and democracy.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table A6: P-Score Matching Design - Different Developing Countries

	(1) OLS	(2) P-Match	(3) P-Match	(4) P-Match	(5) P-Match	(6) P-Match
GDP per capita (k)	0.233***	0.204***	0.191***	0.250***	0.146***	0.169***
	(0.017)	(0.023)	(0.024)	(0.019)	(0.027)	(0.025)
GDP per capita (squared) (k)	-0.002***	0.007***	0.007***	0.006***	0.006***	0.005***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.002)	(0.002)
Democracy	-0.021***	-0.033***	-0.029***	-0.044***	-0.009***	-0.015***
	(0.002)	(0.005)	(0.005)	(0.003)	(0.003)	(0.002)
Industry (% GDP)	0.022***				0.021***	0.019***
	(0.002)				(0.002)	(0.002)
Population (K)	-0.000***				-0.000***	-0.000***
	(0.000)				(0.000)	(0.000)
Population Density	0.000				-0.000**	-0.000***
	(0.000)				(0.000)	(0.000)
OPEC Member	0.661***				0.505***	0.478***
	(0.092)				(0.082)	(0.079)
Oil Prices (2009 USD)	-0.002***				-0.002*	-0.001
	(0.001)				(0.001)	(0.001)
Year	-0.004**	0.003**	0.003**		0.003**	
	(0.001)	(0.001)	(0.001)		(0.002)	
Africa	-0.371***		-0.101***	-0.063**	-0.183***	-0.171***
	(0.131)		(0.033)	(0.032)	(0.045)	(0.044)
Asia	0.027		0.409***	0.351***	0.259***	0.244***
	(0.140)		(0.047)	(0.041)	(0.052)	(0.050)
Europe	-0.424***		0.266***	0.335***	0.024	0.159***
	(0.117)		(0.057)	(0.052)	(0.056)	(0.054)
North America	0.037		0.000	0.000	0.000	0.000
	(0.132)		(.)	(.)	(.)	(.)
Latin America	-0.888***		-0.356***	-0.406***	-0.615***	-0.625***
	(0.125)		(0.035)	(0.035)	(0.044)	(0.044)
Oceania	0.000		0.401	0.129	0.180	0.095
	(.)		(0.250)	(0.223)	(0.340)	(0.317)
Developing Country		0.634***	0.756***	0.541***	0.560***	0.427***
		(0.114)	(0.088)	(0.058)	(0.063)	(0.055)
Constant	6.809**	-6.311**	-7.214***	-0.852***	-7.428**	-0.805***
	(2.769)	(2.498)	(2.527)	(0.106)	(3.079)	(0.125)
Observations	4657	6049	6049	6049	3932	3932
R^2	0.660	0.544	0.561	0.598	0.662	0.683
$\hat{\sigma}$	0.921	1.033	1.014	0.975	0.681	0.663

Standard errors in parentheses
Dependent Variable: CO2 per capita.
All P-Match models use weights based on propensity scores, where the balance is based on income per capita, its squared term, and democracy.
Chile, South Korea, Mexico, and Turkey are here coded as industrialized countries.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table A7: Explaining Carbon Trajectories - Trade Openness

	(1) OLS	(2) P-Match	(3) P-Match	(4) P-Match	(5) P-Match	(6) P-Match
Openness in Constant Prices	0.000	0.004***	0.003***	0.002***	0.001**	0.001**
	(0.000)	(0.001)	(0.001)	(0.000)	(0.000)	(0.000)
GDP per capita (k)	0.284***	0.338***	0.357***	0.417***	0.219***	0.232***
	(0.013)	(0.019)	(0.021)	(0.020)	(0.019)	(0.018)
GDP per capita (squared) (k)	-0.006***	-0.007***	-0.008***	-0.010***	-0.002	-0.002
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Democracy	-0.019***	-0.026***	-0.023***	-0.038***	-0.011***	-0.015***
	(0.002)	(0.004)	(0.004)	(0.004)	(0.003)	(0.002)
Industry (% GDP)	0.016***				0.017***	0.016***
	(0.001)				(0.002)	(0.002)
Population (K)	-0.000***				-0.000***	-0.000***
	(0.000)				(0.000)	(0.000)
Population Density	0.000***				0.000	-0.000
	(0.000)				(0.000)	(0.000)
OPEC Member	0.445***				0.489***	0.469***
	(0.084)				(0.083)	(0.081)
Oil Prices (2009 USD)	-0.002***				-0.001	-0.000
	(0.001)				(0.001)	(0.001)
Year	0.000	0.007***	0.006***		0.005***	
	(0.001)	(0.001)	(0.001)		(0.001)	
Africa	-0.490***		-0.783***	-0.479**	-0.978***	-0.768**
	(0.142)		(0.261)	(0.239)	(0.375)	(0.357)
Asia	-0.226		-0.311	-0.101	-0.619	-0.421
	(0.144)		(0.259)	(0.239)	(0.376)	(0.359)
Europe	-0.510***		-0.629**	-0.364	-0.611*	-0.392
	(0.129)		(0.247)	(0.231)	(0.367)	(0.349)
North America	-0.089		-0.835***	-0.566**	-0.881**	-0.671*
	(0.147)		(0.260)	(0.240)	(0.378)	(0.361)
Latin America	-1.042***		-1.178***	-0.995***	-1.431***	-1.233***
	(0.133)		(0.251)	(0.235)	(0.371)	(0.354)
Oceania	0.000		0.000	0.000	0.000	0.000
	(.)		(.)	(.)	(.)	(.)
Developing Country		0.410***	0.572***	0.398***	0.644***	0.412***
		(0.098)	(0.103)	(0.079)	(0.091)	(0.083)
Constant	-0.982	-15.370***	-12.173***	-0.468*	-10.309***	-0.305
	(1.808)	(2.240)	(2.337)	(0.248)	(2.548)	(0.372)
Year FE						
Observations	4554	5383	5383	5383	3830	3830
R^2	0.671	0.427	0.454	0.494	0.616	0.637
$\hat{\sigma}$	0.792	0.918	0.896	0.867	0.603	0.590

Standard errors in parentheses
Dependent Variable: CO2 per capita.
All P-Match models use weights based on propensity scores, where the balance is based on income per capita, its squared term, and democracy.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table A8: Post-1960

	(1) P-Match	(2) P-Match	(3) P-Match
Developing Country	0.372***	0.196*	0.210*
	(0.100)	(0.111)	(0.117)
Imports per Capita	0.082*	0.064	0.189***
	(0.048)	(0.046)	(0.055)
GDP per capita (k)	0.175***	0.210***	0.090***
	(0.021)	(0.022)	(0.028)
GDP per capita (squared) (k)	0.009***	0.008***	0.007***
	(0.001)	(0.001)	(0.002)
Africa	0.767*	0.581	0.609*
	(0.394)	(0.382)	(0.318)
Asia	1.175***	1.012***	1.001***
	(0.394)	(0.384)	(0.319)
Europe	1.301***	1.004***	1.118***
	(0.387)	(0.370)	(0.309)
North America	0.663*	0.641*	0.733**
	(0.389)	(0.378)	(0.319)
Latin America	0.249	0.222	0.203
	(0.386)	(0.374)	(0.314)
Oceania	0.000	0.000	0.000
	(.)	(.)	(.)
Democracy		-0.038***	-0.008***
		(0.005)	(0.003)
Industry (% GDP)			0.024***
			(0.002)
Population (K)			-0.000***
			(0.000)
Population Density			-0.001***
			(0.000)
OPEC Member			0.330***
			(0.077)
Oil Prices (2009 USD)			-0.001
			(0.001)
Constant	-1.174***	-1.071***	-1.388***
	(0.422)	(0.404)	(0.327)
Year FE			
Observations	4334	4334	3173
R^2	0.621	0.637	0.702
$\hat{\sigma}$	1.086	1.061	0.775

Standard errors in parentheses
Dependent Variable: CO2 per capita.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table A9: P-Score Matching Design - Without Least Developed Countries

	(1) OLS	(2) P-Match	(3) P-Match	(4) P-Match	(5) P-Match	(6) P-Match
Imports per Capita	0.035	0.141**	0.116**	0.075	0.224***	0.207***
	(0.031)	(0.055)	(0.053)	(0.049)	(0.058)	(0.058)
GDP per capita (k)	0.173***	0.109***	0.123***	0.189***	0.070**	0.108***
	(0.026)	(0.026)	(0.028)	(0.022)	(0.031)	(0.028)
GDP per capita (squared) (k)	0.001	0.011***	0.010***	0.009***	0.008***	0.007***
	(0.002)	(0.001)	(0.001)	(0.001)	(0.002)	(0.002)
Democracy	-0.020***	-0.032***	-0.028***	-0.041***	-0.009***	-0.014***
	(0.003)	(0.005)	(0.005)	(0.004)	(0.003)	(0.003)
Industry (% GDP)	0.041***				0.035***	0.031***
	(0.003)				(0.003)	(0.002)
Population (K)	-0.000***				-0.000***	-0.000***
	(0.000)				(0.000)	(0.000)
Population Density	0.000				-0.001***	-0.001***
	(0.000)				(0.000)	(0.000)
OPEC Member	0.423***				0.233***	0.194**
	(0.099)				(0.079)	(0.075)
Oil Prices (2009 USD)	-0.002**				-0.000	-0.002
	(0.001)				(0.001)	(0.002)
Year	-0.003*	0.009***	0.007***		0.007**	
	(0.002)	(0.002)	(0.002)		(0.003)	
Africa	-0.459***		-0.039	-0.037	-0.220	0.017
	(0.137)		(0.037)	(0.037)	(0.331)	(0.334)
Asia	0.019		0.382***	0.346***	0.203	0.425
	(0.143)		(0.053)	(0.049)	(0.331)	(0.334)
Europe	-0.425***		0.433***	0.373***	0.294	0.559*
	(0.128)		(0.062)	(0.064)	(0.325)	(0.326)
North America	0.109		0.000	0.000	0.035	0.248
	(0.136)		(.)	(.)	(0.333)	(0.336)
Latin America	-0.847***		-0.269***	-0.338***	-0.567*	-0.372
	(0.131)		(0.043)	(0.043)	(0.328)	(0.330)
Oceania	0.000		0.103	-0.296	0.000	0.000
	(.)		(0.280)	(0.259)	(.)	(.)
Developing Country		0.207**	0.561***	0.412***	0.602***	0.534***
		(0.104)	(0.114)	(0.087)	(0.139)	(0.104)
Constant	5.703*	-16.986***	-14.996***	-0.653***	-14.254**	-1.391***
	(3.451)	(3.583)	(3.806)	(0.149)	(5.892)	(0.359)
Year FE						
Observations	2782	3698	3698	3698	2223	2223
R^2	0.654	0.589	0.601	0.626	0.691	0.709
$\hat{\sigma}$	1.022	1.102	1.088	1.060	0.753	0.737

Standard errors in parentheses
Dependent Variable: CO2 per capita.
All P-Match models use weights based on propensity scores, where the balance is based on income per capita, its squared term, and democracy.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

		Mean		Standard Deviation	
Variable	**Sample**	**Treated**	**Control**	**Treated**	**Control**
GDP per capita (k)	Unmatched	3.1	8.8	3.6	6.5
	Matched	3.1	3.2	3.6	2.8
GDP per capita (square) (k)	Unmatched	22.3	119.5	76.8	160.7
	Matched	22.3	17.6	76.8	37.6
Democracy	Unmatched	-1.6	6.8	6.6	5.8
	Matched	-1.6	-1.2	6.6	6.1
Number of Obs.	Unmatched	6780	2347		
	Matched	6780	1040		

Table A10: Balance of covariates, pre- and post-matching. This table compares the mean and standard deviation of the unmatched sample and the matched sample on the three covariates of interest.

Table A11: Explaining Carbon Trajectories - Within OECD

	(1) OLS	(2) P-Match	(3) P-Match	(4) P-Match	(5) P-Match	(6) P-Match
Imports per Capita	-0.054***	-0.013	-0.226**	-0.165*	-0.078	-0.059
	(0.019)	(0.087)	(0.106)	(0.094)	(0.081)	(0.084)
GDP per capita (k)	0.114***	0.308***	0.205***	0.222***	0.068	-0.031
	(0.027)	(0.043)	(0.059)	(0.064)	(0.080)	(0.081)
GDP per capita (squared) (k)	0.001	-0.005	0.002	0.001	0.005	0.009**
	(0.001)	(0.003)	(0.004)	(0.004)	(0.004)	(0.005)
Democracy	0.054***	-0.014***	-0.001	0.003	0.024***	0.041***
	(0.006)	(0.004)	(0.005)	(0.006)	(0.006)	(0.007)
Industry (% GDP)	0.054***				0.041***	0.053***
	(0.005)				(0.009)	(0.008)
Population (K)	0.000				-0.000*	-0.000**
	(0.000)				(0.000)	(0.000)
Population Density	0.002***				0.001	0.000
	(0.000)				(0.001)	(0.001)
OPEC Member	0.000				0.000	0.000
	(.)				(.)	(.)
Oil Prices (2009 USD)	0.000				0.002	0.007*
	(0.001)				(0.001)	(0.004)
Year	-0.011***	0.014***	0.026***		0.013**	
	(0.003)	(0.005)	(0.006)		(0.006)	
Africa	0.578***		0.165	0.432	-0.109	0.137
	(0.113)		(0.349)	(0.352)	(0.468)	(0.405)
Asia	0.000		-0.135	0.082	-0.463	0.000
	(.)		(0.324)	(0.333)	(0.678)	(.)
Europe	0.810***		0.395	0.622*	-0.054	0.327
	(0.087)		(0.321)	(0.322)	(0.420)	(0.444)
North America	2.148***		-0.253	-0.012	0.103	0.621
	(0.125)		(0.353)	(0.359)	(0.538)	(0.502)
Latin America	0.246**		-0.965***	-0.747**	-1.132***	-0.710
	(0.110)		(0.326)	(0.330)	(0.414)	(0.539)
Oceania	1.575***		0.000	0.000	0.000	0.227
	(0.169)		(.)	(.)	(.)	(0.691)
OECD Member		-1.091***	-1.187***	-1.239***	-0.405***	-0.234*
		(0.092)	(0.095)	(0.087)	(0.135)	(0.133)
Constant	19.604***	-28.258***	-51.350***	0.112	-25.913**	-1.585***
	(6.200)	(9.647)	(11.074)	(0.459)	(10.767)	(0.581)
Year FE						
Observations	835	531	531	531	279	279
R^2	0.722	0.544	0.625	0.719	0.829	0.864
$\hat{\sigma}$	0.639	0.392	0.357	0.324	0.161	0.155

Standard errors in parentheses
Dependent Variable: CO2 per capita.
All P-Match models use weights based on propensity scores, where the balance is based on income per capita, its squared term, and democracy.
Sample restricted to OECD countries.
OECD variable denotes country-years in which country i
is a member of the OECD.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

A4 Spatial Model

This section provides additional material and robustness tests for the spatial model. The tables are the following:

- Table A12 reports the first stage of the 2-stage least squares approach
- Table A13 reports the estimates of the various lagged approaches to estimating the main models
- Table A14 reports the estimates when the spatial matrix is row-normalized
- Table A15 reports the estimates of the reduced form equation of the spatial model:

$$\text{CO2 per capita}_{i,t} = \rho \mathbf{W}_{i,j,t} \text{GDP per capita}_{j,t} + \beta \mathbf{X}_{i,t} + \varepsilon_{i,t}$$

Table A12: Spatial 2-SLS – First Stage

	(1) S-2SLS	(2) S-2SLS	(3) S-2SLS
GDP per Capita (S-Weighted)	0.000***	0.000***	0.000***
	(0.000)	(0.000)	(0.000)
GDP per capita (k)	4410.607***	2544.554***	2544.554***
	(233.829)	(501.845)	(649.848)
GDP per capita (squared) (k)	-106.262***	-99.431***	-99.431***
	(8.133)	(16.469)	(20.385)
Democracy	-183.031***	177.660**	177.660***
	(55.724)	(71.658)	(38.682)
Industry (% GDP)		43.263	43.263
		(47.612)	(36.174)
Population (K)		0.053***	0.053***
		(0.011)	(0.008)
Population Density		16.185***	16.185***
		(4.036)	(2.628)
Oil Prices (2009 USD)		186.979***	186.979***
		(13.207)	(17.113)
Constant	-9147.576***	-8795.946***	-62223.316***
	(768.732)	(1801.382)	(10997.440)
Country FE			
Observations	6087	3768	3768
F-stat	40356.226	12549.724	.

Standard errors in parentheses

Dependent Variable: CO2 per capita.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table A13: Various Lags Approaches to Spatial OLS

	(1) S-OLS	(2) S-OLS	(3) 2-SLS	(4) S-2SLS	(5) S-2SLS	(6) S-2SLS	(7) S-2SLS	(8) S-2SLS
GDP per capita (k)	0.147***	0.170***	0.151***	0.167***	0.167***	0.148***	0.170***	0.170***
	(0.010)	(0.015)	(0.010)	(0.015)	(0.027)	(0.010)	(0.015)	(0.025)
GDP per capita (squared) (k)	0.001***	-0.000	0.002***	0.000	0.000	0.001***	-0.000	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.001)	(0.000)	(0.000)	(0.001)
Democracy	0.000	0.005**	-0.000	0.005**	0.005***	0.000	0.005**	0.005***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
CO2 per Capita (S-Weighted) (t-1)	-0.000***	-0.000***				-0.000***	-0.000***	-0.000***
	(0.000)	(0.000)				(0.000)	(0.000)	(0.000)
Industry (% GDP)		0.009***		0.008***	0.008***		0.008***	0.008***
		(0.001)		(0.001)	(0.002)		(0.001)	(0.002)
Population (K)		0.000***		0.000***	0.000***		0.000***	0.000***
		(0.000)		(0.000)	(0.000)		(0.000)	(0.000)
Population Density		-0.000***		-0.000***	-0.000**		-0.000***	-0.000***
		(0.000)		(0.000)	(0.000)		(0.000)	(0.000)
Oil Prices (2009 USD)		0.000		0.000	0.000		0.000	0.000
		(0.001)		(.)	(0.001)		(.)	(0.001)
CO2 per Capita (S-Weighted)			-0.000***	-0.000***	-0.000***			
			(0.000)	(0.000)	(0.000)			
Constant	0.217***	-0.015	0.314***	-0.118	3.376***	0.286***	-0.114	3.403***
	(0.071)	(0.114)	(0.063)	(0.077)	(0.617)	(0.063)	(0.074)	(0.563)
Country FE								
Year FE								
Observations	5945	3830	5798	3694	3694	5945	3830	3830

Standard errors in parentheses
Dependent Variable: CO2 per capita.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table A14: Spatial 2-SLS – Row Normalized

	(1) FE	(2) FE	(3) S-OLS	(4) 2-SLS	(5) S-2SLS	(6) S-2SLS
GDP per capita (k)	0.189***	0.191***	0.131***	0.157***	0.167***	0.166***
	(0.011)	(0.011)	(0.010)	(0.011)	(0.016)	(0.016)
GDP per capita (squared) (k)	-0.003***	-0.003***	0.001***	0.001*	-0.001*	-0.001*
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.001)
Democracy	0.006***	0.007***	0.000	-0.003	0.005**	0.007***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Year	-0.006***		-0.001	0.000	-0.007***	
	(0.001)		(0.001)	(0.001)	(0.001)	
Industry (% GDP)	0.012***	0.012***			0.013***	0.012***
	(0.001)	(0.001)			(0.002)	(0.001)
Population (K)	0.000**	0.000**			0.000**	0.000**
	(0.000)	(0.000)			(0.000)	(0.000)
Population Density	-0.000***	-0.000***			-0.000***	-0.000***
	(0.000)	(0.000)			(0.000)	(0.000)
Oil Prices (2009 USD)	-0.001**	-0.000			0.001	-0.000
	(0.000)	(0.001)			(0.000)	(0.005)
CO2 per Capita (Row-Norm.; S-Weighted)			0.142***	-0.101**	-0.112**	-0.148***
			(0.018)	(0.042)	(0.048)	(0.051)
Constant	11.861***	-0.072	1.089	-0.071	14.415***	0.100
	(1.599)	(0.106)	(1.554)	(1.589)	(2.223)	(0.182)
Year FE						
Observations	4657	4657	5918	5918	3702	3702

Standard errors in parentheses
Dependent Variable: CO2 per capita.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table A15: Reduced Form

	(1) Reduced Form	(2) Reduced Form	(3) Reduced Form
GDP per capita (k)	0.155***	0.162***	0.162***
	(0.010)	(0.015)	(0.015)
GDP per capita (squared) (k)	0.002***	0.000	0.000
	(0.000)	(0.000)	(0.000)
Democracy	-0.002	0.004**	0.004*
	(0.002)	(0.002)	(0.002)
Year	0.002***	-0.004***	
	(0.001)	(0.001)	
GDP per Capita (S-Weighted)	-0.000***	-0.000***	-0.000***
	(0.000)	(0.000)	(0.000)
Industry (% GDP)		0.009***	0.008***
		(0.001)	(0.001)
Population (K)		0.000***	0.000***
		(0.000)	(0.000)
Population Density		-0.000***	-0.000***
		(0.000)	(0.000)
Oil Prices (2009 USD)		-0.000	0.000
		(0.000)	(0.001)
Constant	-4.240***	7.942***	-0.007
	(1.535)	(2.050)	(0.113)
Year FE			
Observations	5918	3702	3702

Standard errors in parentheses
Dependent Variable: CO2 per capita.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

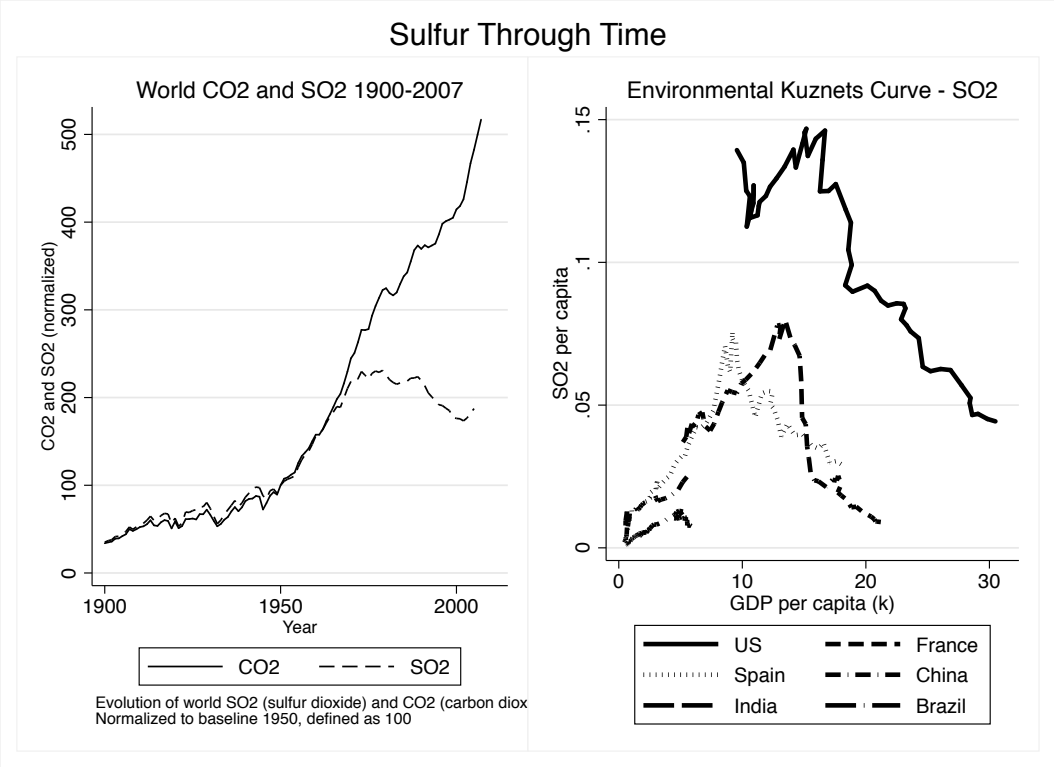

Figure A2: LEFT PANEL: Carbon and sulfur trajectories since 1900. Baseline of 100 defined as emissions in year 1950. RIGHT PANEL: sulfur EKC in a selection of countries.

A5 Specification Test

A5.1 Diffusion of Sulfur Dioxide

To verify the robustness of my main findings, I conduct a specification test using sulfur dioxide (SO_2) data. Sulfur is also a major pollutant, but it has been largely phased out over the past three decades (Figure A2 and Figure A3).

I reestimate the models presented in Table 2 (main manuscript). However, I replace carbon dioxide emissions with sulfur emissions. The rationale is the following. Ex ante, we know that sulfur dioxide decreased worldwide. Thus, it necessarily derives that sulfur emissions in most countries followed an inverted-U trajectory. Otherwise, the total amount of emissions would not have decreased. This, in turn, implies that any estimate of a country's trajectory should result in finding that income has a positive effect on emissions while its squared term has a negative

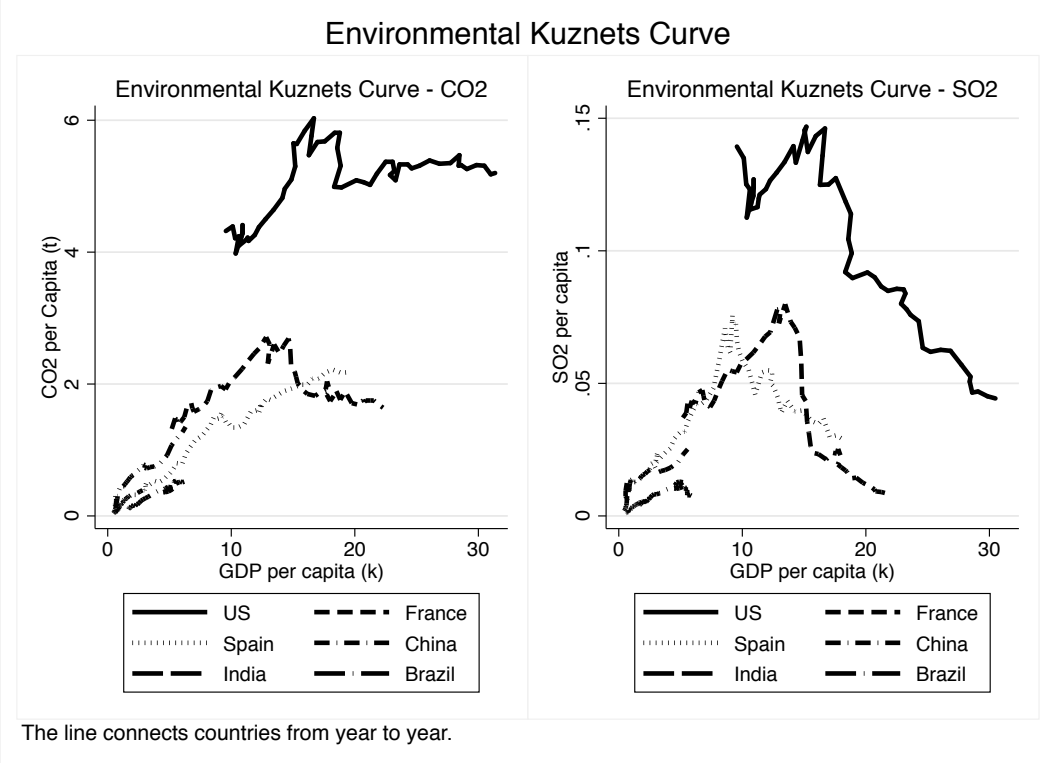

Figure A3: LEFT PANEL: per-capita carbon dioxide trajectories as income grows. RIGHT PANEL: per-capita sulfur dioxide trajectories as income grows.

effect, *regardless* of imports. If these estimates do not obtain, then it could be interpreted as a reason to distrust the specification used so far. In other words, if the estimates do not make any sense given our prior beliefs about what they ought to look like, then we may believe that the model is misspecified.

Thus, while I expect trade to have a significant affect (since any movement of trade and foreign SO_2 emissions should be correlated with domestic SO_2 emissions), it should not affect estimates that find an inverted-U relationship between SO_2 and income. The results are reported in Table A16.

The specification test yields estimates that are broadly consistent with the *a priori* expectations. Trade is always negative and significantly different from 0. This is expected, since the trade relation should still operate: if imports from j go up and j's SO_2 per capita emissions increase as well, we would expect a decrease in i, no matter what. More importantly, the EKC remains largely unaffected by the inclusion of spatial term. This suggests that the models fitted above yield estimates that are coherent for dependent variables that have followed different trajectories.

A6 Additional Models

These are the effects of income and income squared. T-statistics are indicated in parentheses. The Matlab code available in the replication package.

Table A16: Sulfur Dioxide – Spatial 2-SLS – Second Stage

	(1) FE	(2) FE	(3) S-OLS	(4) S-2SLS	(5) S-2SLS	(6) 2-SLS
SO2 per capita (s-weighted)			-0.004***	-0.006***	-0.003***	-0.002***
			(0.000)	(0.000)	(0.001)	(0.001)
GDP per capita (k)	0.005***	0.005***	0.006***	0.006***	0.006***	0.006***
	(0.001)	(0.001)	(0.000)	(0.000)	(0.001)	(0.001)
GDP per capita (squared) (k)	-0.000***	-0.000***	-0.000***	-0.000***	-0.000***	-0.000***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Democracy (Polity IV)	0.000	0.000	-0.000	-0.000	0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Year	-0.001***		-0.000***	-0.000***	-0.001***	
	(0.000)		(0.000)	(0.000)	(0.000)	
Industry (% of GDP)	0.001***	0.001***			0.001***	0.000***
	(0.000)	(0.000)			(0.000)	(0.000)
Population (K)	0.000***	0.000***			0.000***	0.000***
	(0.000)	(0.000)			(0.000)	(0.000)
Population density	0.000***	0.000***			0.000***	0.000***
	(0.000)	(0.000)			(0.000)	(0.000)
Oil Prices (2009 USD)	-0.000	-0.000**			-0.000	-0.000
	(0.000)	(0.000)			(0.000)	(0.000)
Constant	1.868***	0.013**	0.582***	0.537***	1.957***	-0.021***
	(0.100)	(0.006)	(0.066)	(0.066)	(0.115)	(0.008)
Country FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	No	Yes	No	No	No	Yes
R^2 (within)	0.19	0.19	0.08	0.07	0.18	0.18
Observations	3600	3600	4924	4924	3015	3015

Dependent Variable: SO2 per capita. Standard errors in parentheses.
This table reports the fixed effect regression (1) and (2), the spatial OLS regression (3), and the second stage of the spatial 2-stage least squares (4), (5), and (6).
See the appendix for the first stage results.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

	SAR	Durbin
Direct		
GDP/capita	0.161 (18.17)	0.169 (2.61)
GDP/capita (squared)	0.001 (1.54)	0.001 (0.14)
Indirect		
GDP/capita	0.037 (17.85)	-0.059 (-2.98)
GDP/capita (squared)	0.0003 (1.55)	0.0005 (0.02)
Total		
GDP/capita	0.199 (18.16)	0.11 (1.3)
GDP/capita (squared)	0.002 (1.55)	0.002 (0.07)

Table A17: Effects of income and income squared on carbon emissions per capita; t-statistics in parentheses.

	Spatial Non-Row-Normalized		Spatial Row-Normalized	
	(1) 2-SLS	(2) S-2SLS	(3) S-2SLS	(4) est4
CO2 per Capita (Distance-Weighted)	-12.07	-11.73		
	(9.41)	(9.34)		
GDP per capita (k)	0.16***	0.14***	0.16***	0.14***
	(0.01)	(0.01)	(0.01)	(0.01)
GDP per capita (squared) (k)	-0.00	0.00	-0.00	0.00
	(0.00)	(0.00)	(0.00)	(0.00)
Democracy	0.00	0.01**	0.00	0.01**
	(0.00)	(0.00)	(0.00)	(0.00)
Year	-0.00***		-0.00***	
	(0.00)		(0.00)	
CO2 per Capita (Row-Norm.; Distance-Weighted)			-0.01	-0.02
			(0.01)	(0.01)
Constant	6.02***	0.22***	5.87***	0.23***
	(1.65)	(0.07)	(1.65)	(0.07)
Year FE				
Observations	5260	5260	5260	5260
R^2				
$\hat{\sigma}$				
# Countries	153	153	153	153

Standard errors in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table A18: Replication of main results when using inverted spatial distance as the connectivity matrix.

Supplementary Appendix: References

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