ENVIRONMENT, DEVELOPMENT, AND GLOBALIZATION

An Overview of the Macrosociological Research

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Professor of Sociology and Environmental Studies
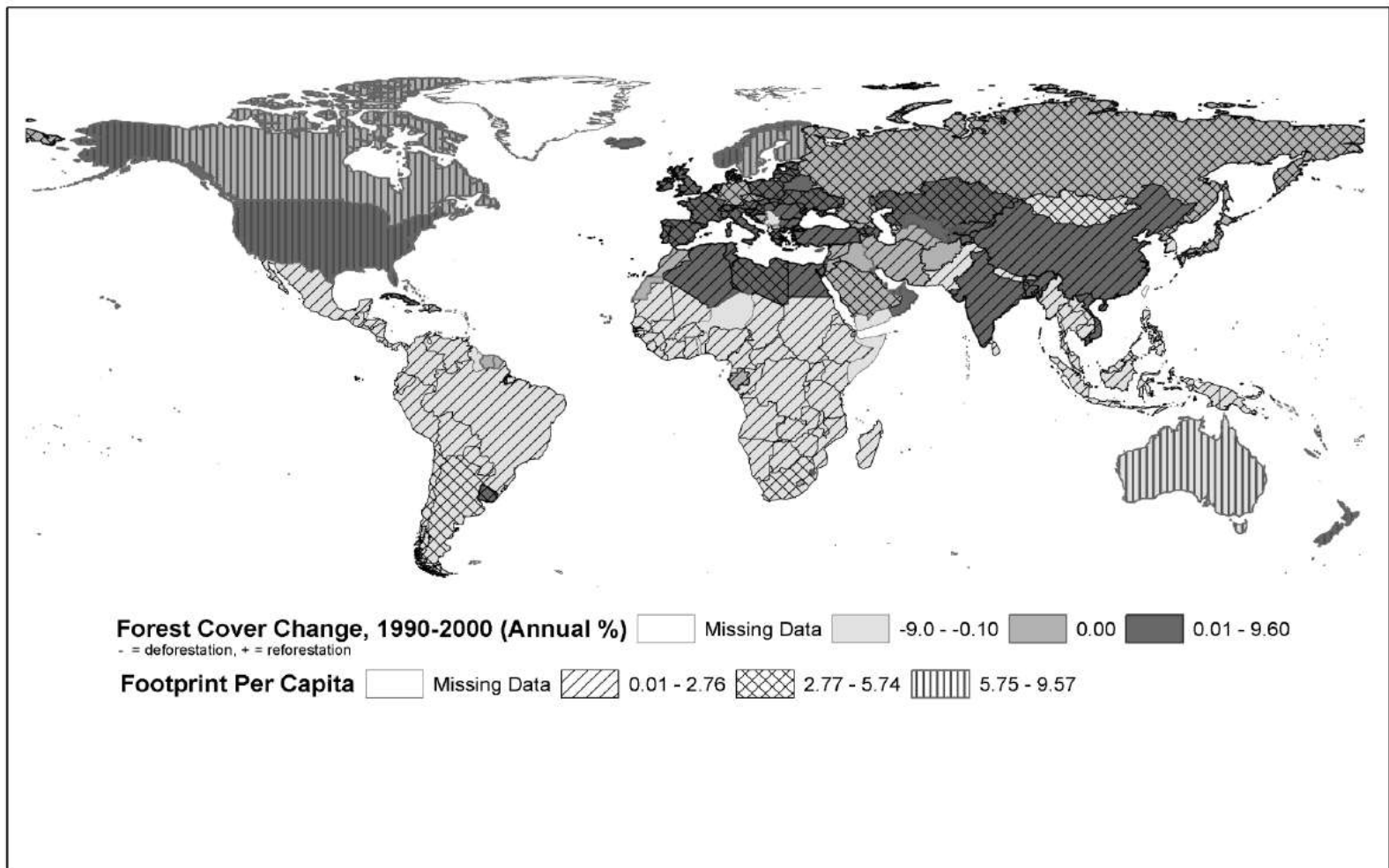Boston College

Focus today will be on a few small slices of comparative-international work that employ longitudinal statistical methods

Development

Globalization

New Stuff on Sustainability

Multilevel?

Forest Cover Change, 1990-2000 (Annual %) — = deforestation, + = reforestation

Footprint Per Capita

Jorgenson and Kick, 2006, *Globalization and the Environment*

What is Development?

Many scholars and researchers typically envision development as economic growth

Nations are ranked as more or less developed according to any of several common measures, especially GDP per capita

   GDP is the sum of gross value added by all resident producers in the economy plus any product taxes and minus any subsidies not included in the value of the products, and it is calculated without making deductions for depreciation of fabricated assets or for depletion/degradation of natural resources (World Bank definition)

   Other operationalizations (e.g., average life expectancy, Human Development Index)

Economist Amartya Sen (1985) promoted a capabilities definition of development, arguing that an ideal society would provide individuals with both the freedom and the opportunity to choose a lifestyle they value

Pritchett et al. (2013) define development as a transformational vision of entire countries, where transformation is sought across the four dimensions of economy, polity, social relations, and public administration

Viterna and Robertson, 2015, *Annual Review of Sociology*

What is (Structural) Globalization?

Structural Globalization is the increasing spatial scale and intensity of interaction networks (Chase-Dunn et al. 2000, *American Sociological Review*)

Charles Tilly (1995) proposes a similar definition of globalization as an increase in the geographic range of locally consequential social interactions, especially when that increase stretches a significant proportion of all interactions across international or intercontinental limits

Globalization in the structural sense is increasing integration and interdependence
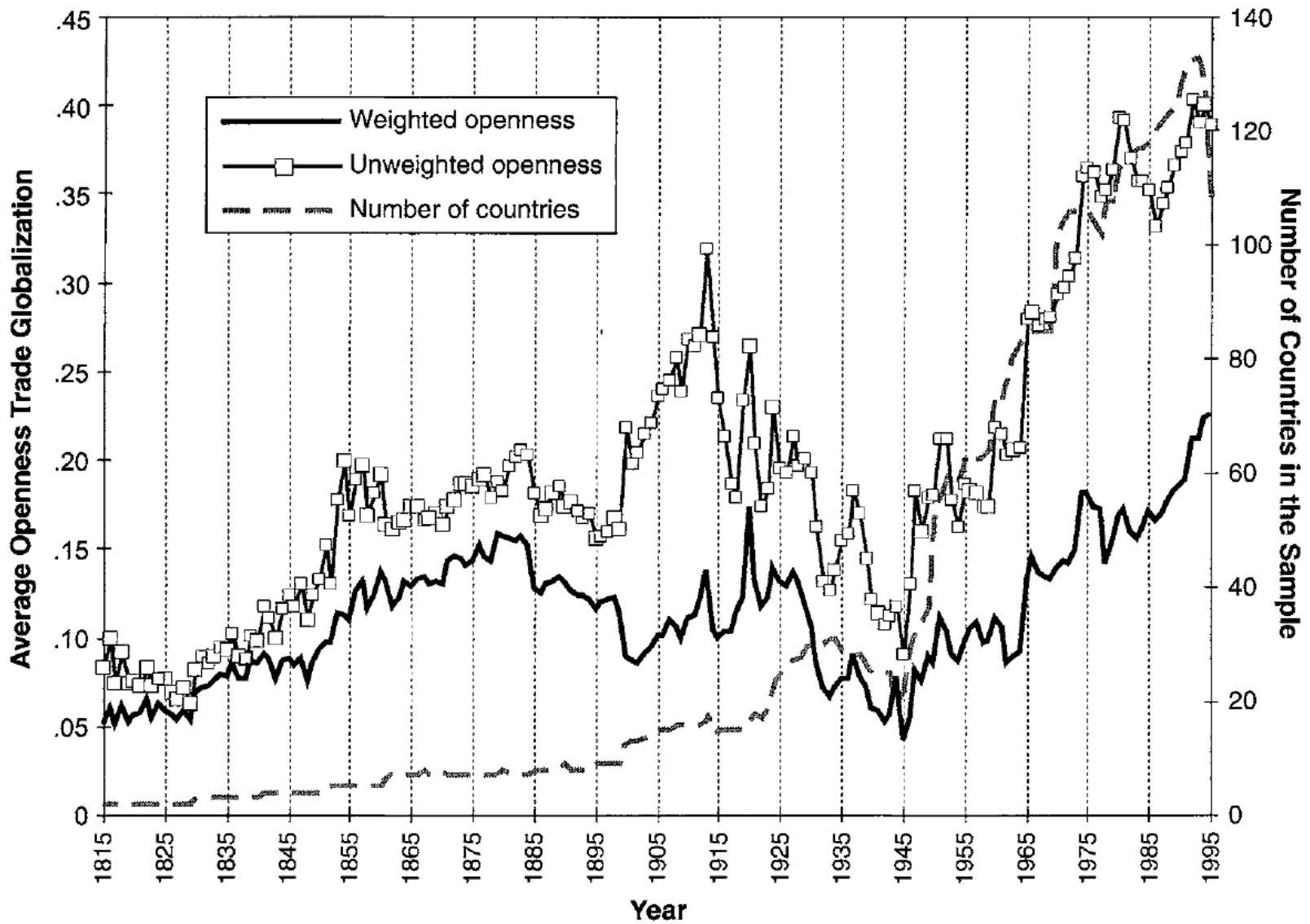
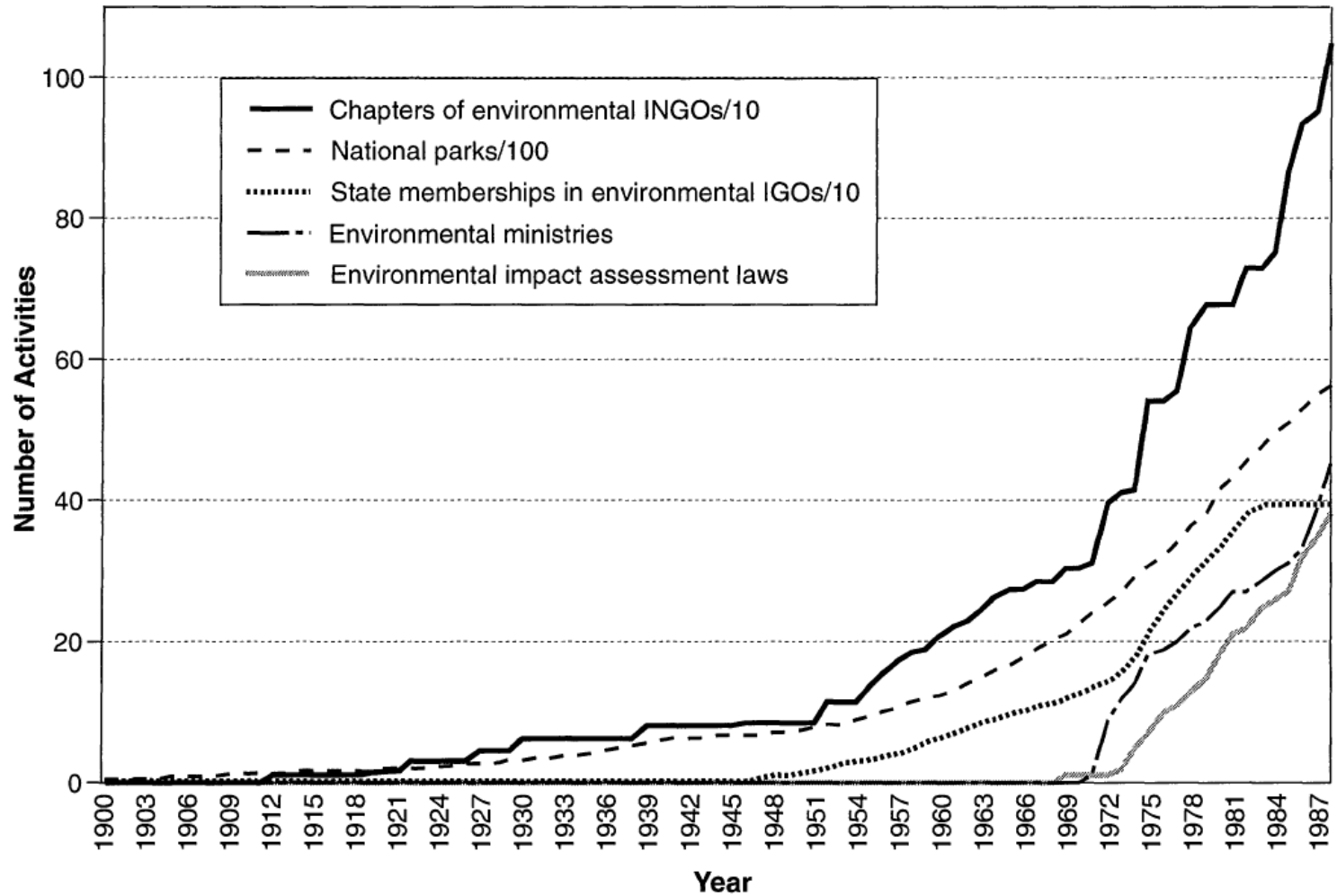Figure 3. Weighted and Unweighted Trade Globalization, 1815 to 1990

Chase-Dunn et al., 2000, *American Sociological Review*

Figure 1. Cumulative Numbers of Five National Environmental Activities, 1900 to 1988

Note: INGOs are international nongovernmental organizations; IGOs are intergovernmental organizations.

Frank et al., 2000, *American Sociological Review*

Why Longitudinal Methods?

Development and globalization are not static and neither is environmental change

Relatively better for assessing causality

Ability to partially account for heterogeneity bias
   case-specific and time-specific fixed effects

Common Dependent Variables in Longitudinal Analyses

Anthropogenic GHG emissions, especially CO_2

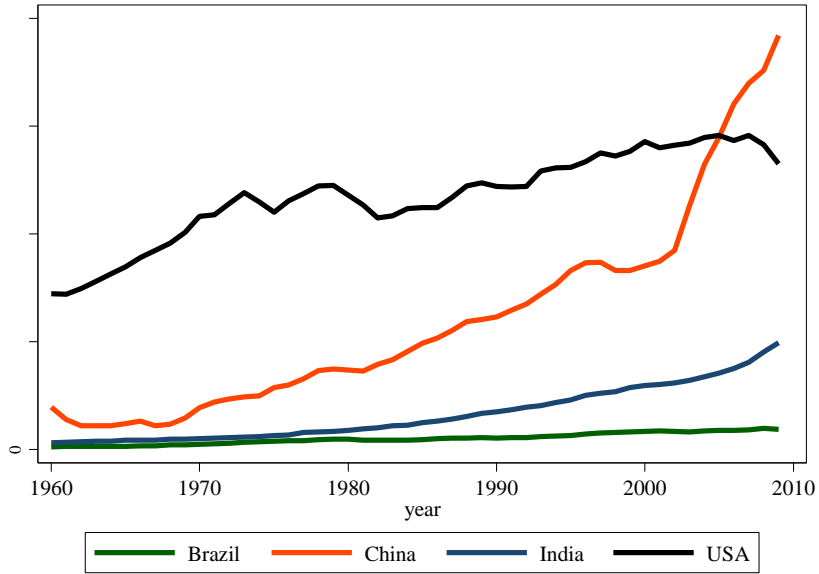Various composite indices, such as the ecological footprint

Energy consumption
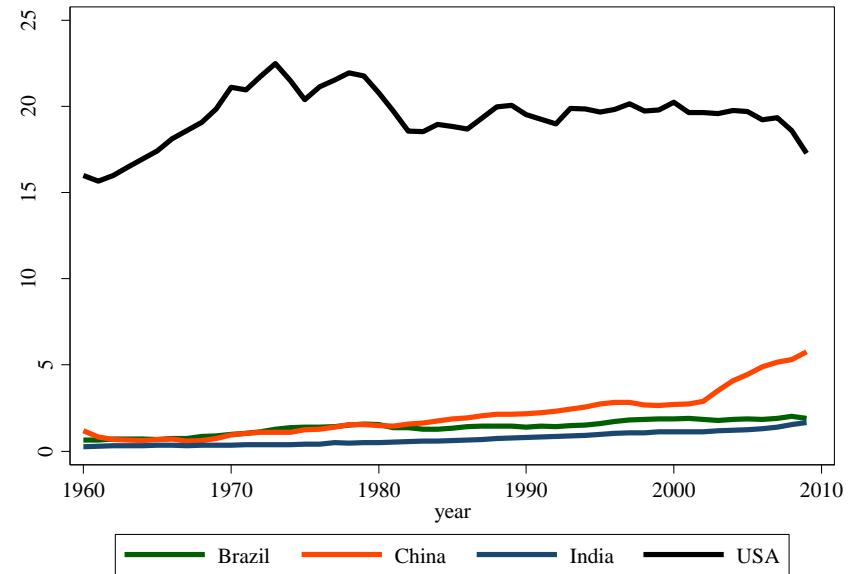
Other air pollutants, industrial water pollution
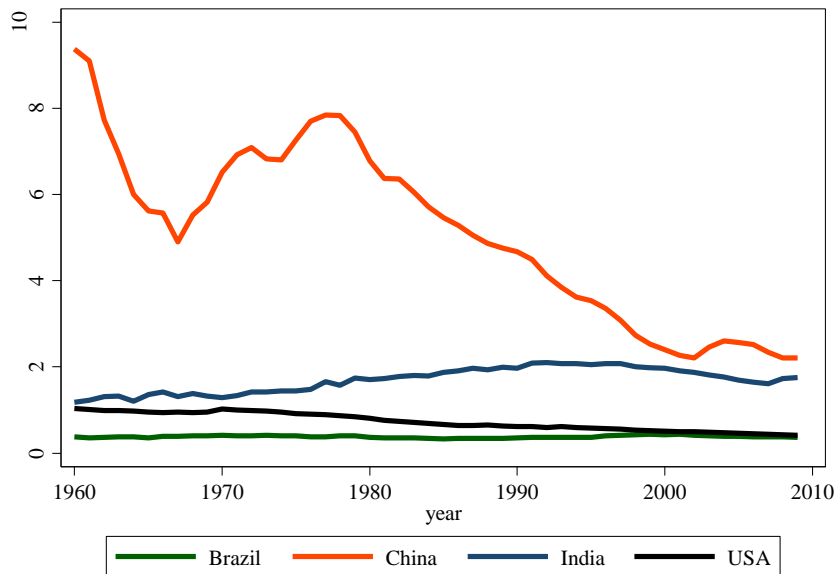
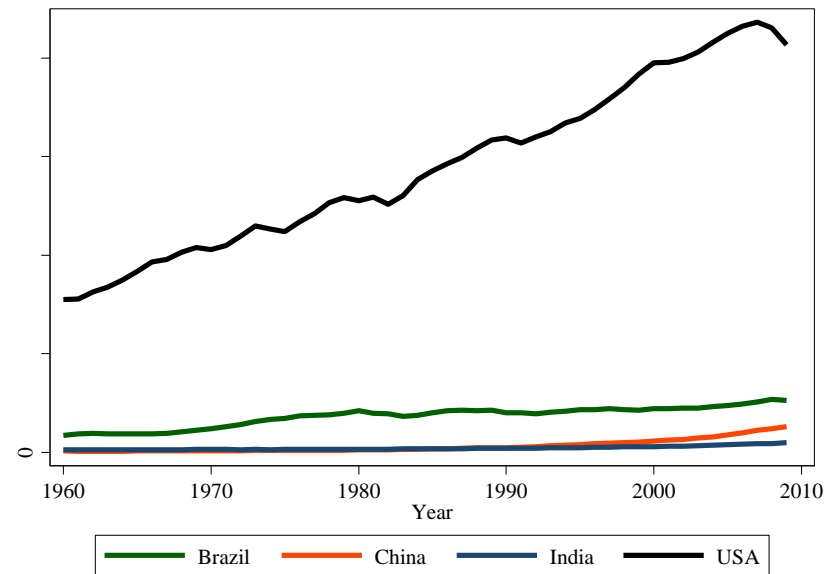Pesticide and fertilizer use

Deforestation…

Total CO$_2$ Emissions

CO$_2$ Emissions Per Capita

CO$_2$ Emissions Per GDP

GDP Per Capita

Per Capita CO$_2$ Emissions, 1960-2010
(annual mean values in metric tons per capita reported)

Mean of 11.10 in the Year 2010

Mean of 6.75 in the Year 1960

Mean of 1.78 in the Year 2010

Mean of 0.57 in the Year 1960

32 Developed Countries   105 Developing Countries
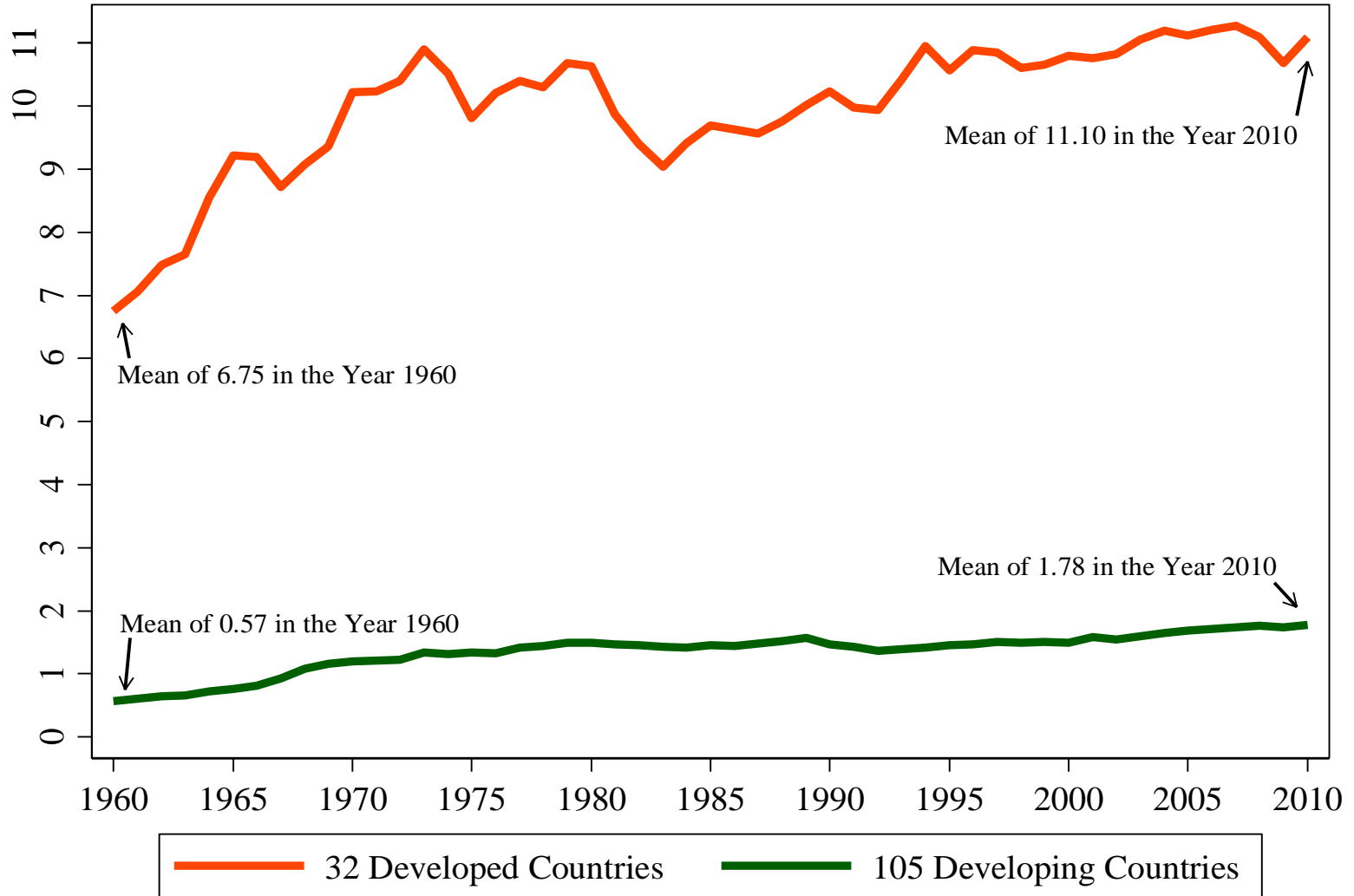
CO$_2$ data obtained from the World Bank's World Development Indicators database

Environment and Development Theories

Treadmill of Production Theory: the economic system is driven by growth on an ever larger and more intensive scale (e.g., Gould et al. 2008; Schnaiberg 1980)

What about efficiency?

Ecological Modernization Theory: as modernization continues, an ecological rationality will emerge and increasingly influence economic rationality (e.g., Mol 2003; Mol et al. 2014)

Social institutions transforming from within → "green capitalism"

TABLE 3
UNSTANDARDIZED COEFFICIENTS FOR THE REGRESSION OF PER CAPITA CARBON DIOXIDE EMISSIONS, 1960–2005: PW REGRESSION MODEL ESTIMATES WITH PCSE AND AN AR(1) CORRECTION

	MODEL A	MODEL B	MODEL C		
			All	DCs	LDCs
Urban population	.014***	.015***	.014***	.008**	.012***
	(9.81)	(10.87)	(9.95)	(3.11)	(7.18)
Trade	.001*	.001*	.001*	−.002***	.001***
	(2.18)	(2.21)	(2.35)	(3.62)	(3.36)
GDP per capita	.547***	.737***	.467***	.757***	.388***
	(20.81)	(19.59)	(16.57)	(13.14)	(11.05)
GDP per capita × LDCs		−.230***			
		(7.01)			
Interactions with time:					
GDP per capita × 1965			.035***	.006*	.026
			(4.52)	(2.40)	(1.86)
GDP per capita × 1970			.071***	.016***	.044*
			(7.19)	(4.44)	(2.55)
GDP per capita × 1975			.072***	.016**	.071***
			(6.54)	(2.68)	(3.82)
GDP per capita × 1980			.076***	.013*	.088***
			(6.61)	(2.56)	(4.59)
GDP per capita × 1985			.063***	.005	.077***
			(5.29)	(.81)	(3.85)
GDP per capita × 1990			.064***	.001	.077***
			(5.16)	(.19)	(3.84)
GDP per capita × 1995			.060***	.003	.069***
			(4.79)	(.43)	(3.47)
GDP per capita × 2000			.065***	.001	.076***
			(5.16)	(.17)	(3.84)
GDP per capita × 2005			.068***	−.002	.083***
			(5.29)	(.32)	(4.14)
R^2 overall	.941	.941	.942	.916	.887
N	860	860	860	220	640
Estimated coefficients	98	99	107	43	85

NOTE.—Absolute values of z-ratios are in parentheses; all models include unreported unit-specific and period-specific intercepts.
* $P < .05$ (two-tailed).
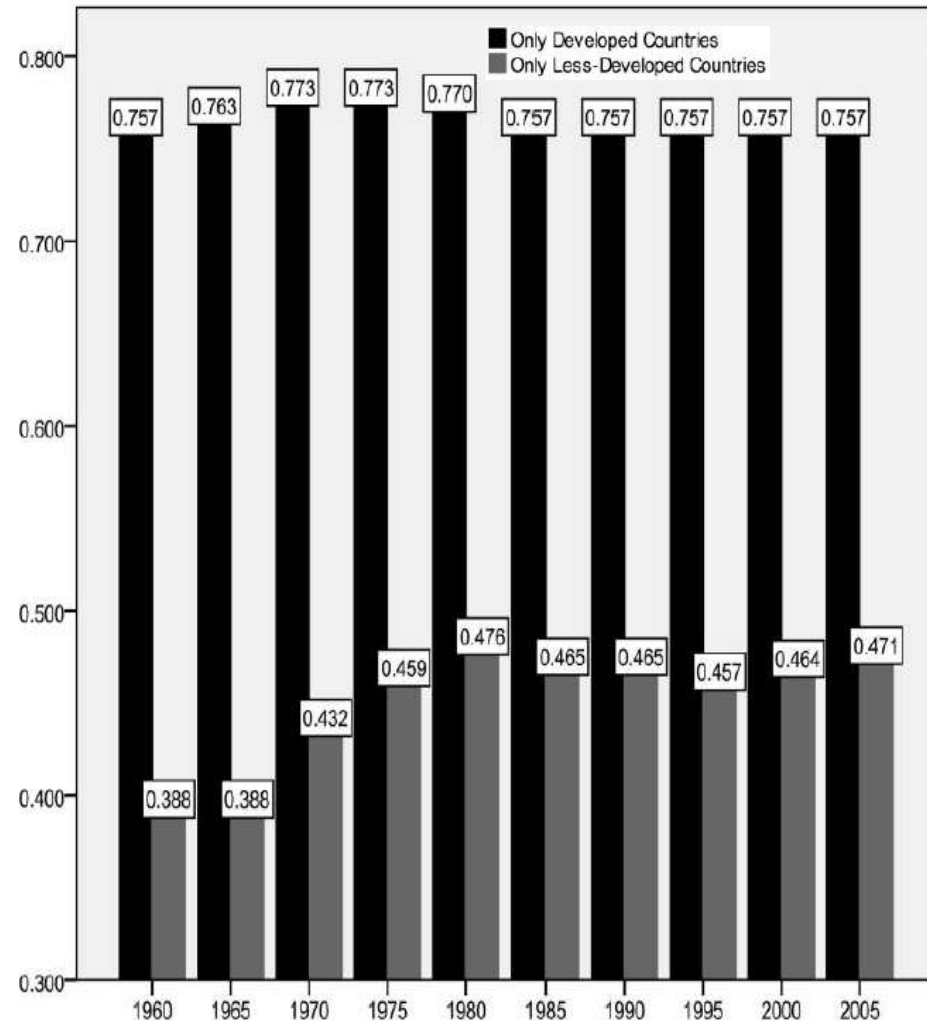** $P < .01$.
*** $P < .001$.

FIG. 2.—Estimated effects of GDP per capita on per capita carbon dioxide emissions

Jorgenson and Clark, 2012, *American Journal of Sociology*

Asymmetric Effects of Economic Growth and Decline on CO_2 Emissions

Table. Change in CO_2 emissions per capita from a 1% change in GDP per capita

	Model 1	Model 2
GDP per capita growth	0.733 ± 0.126	0.752 ± 0.147
GDP per capita decline	0.430 ± 0.130	0.346 ± 0.166

Error terms reflect 95% confidence intervals. Estimates are from generalized least-squares elasticity models of first-differenced values from 1960 to 2008 for most nations of the world, correcting for first-order autocorrelation. In both models, the coefficients for growth and decline are significantly different from each other and significantly different from 0.

In Model 1 no control variables were included. This model indicates that **for each 1% of growth in GDP per capita, CO_2 emissions per capita grew by 0.733%, whereas for each 1% decline in GDP per capita, CO_2 emissions per capita declined only by 0.430%.** Model 2 includes a few control variables, findings substantively the same.

York, 2012, *Nature Climate Change*

A Panel Analysis of State-Level Energy Use in the United States, 1960 - 1990

Table III. Fixed-Effects Panel-Model Estimates, Dependent Variable = Total Energy Use (All Variable Have Been Transformed into Their Natural Logarithms)

Variable	Total Energy Use, 1960–1990				Total Energy Use, 1970–1990			
	Model 1		Model 2		Model 3		Model 4	
	b	SE	b	SE	b	SE	b	SE
Population	0.969***	0.071	0.838***	0.098	0.928***	0.068	0.994***	0.090
Prices					−0.033	0.026	−0.038	0.026
% Manufacturing	0.010	0.069	−0.020	0.070	0.099	0.065	0.074	0.067
GDP per capita	0.439***	0.067	0.485***	0.068	0.176**	0.066	0.166*	0.071
GDP per capita squared			−0.165*	0.066			−0.024	0.064
Urbanization	1.237***	0.189	1.649***	0.329	0.823**	0.270	0.467	0.379
Urbanization squared			0.657	0.457			−0.914	0.646
Constant	10.423***	0.900	10.243***	0.949	15.300***	0.998	16.052***	1.124
Within R^2	0.888		0.889		0.851		0.855	

Clement and Schultz, 2011, *Sociological Forum*

Global Theories

Ecologically Unequal Exchange / Transnational Organization of Production → Environmental Load Displacement

World Society Theory

INGOs are characterized as carriers of a "world culture" who diffuse progressive global models that are adopted by local actors

A "world environmental regime," composed of EINGOs and other civil society configurations

- Provide support for environmental protection efforts
- Encourage stronger regulatory mechanisms
- Fund technology inputs and facilitate technology transfers
- Set standards, codes of conduct, and technical guidelines
- Employ frames and discourses that encourage sustainability efforts and increases environmental concern
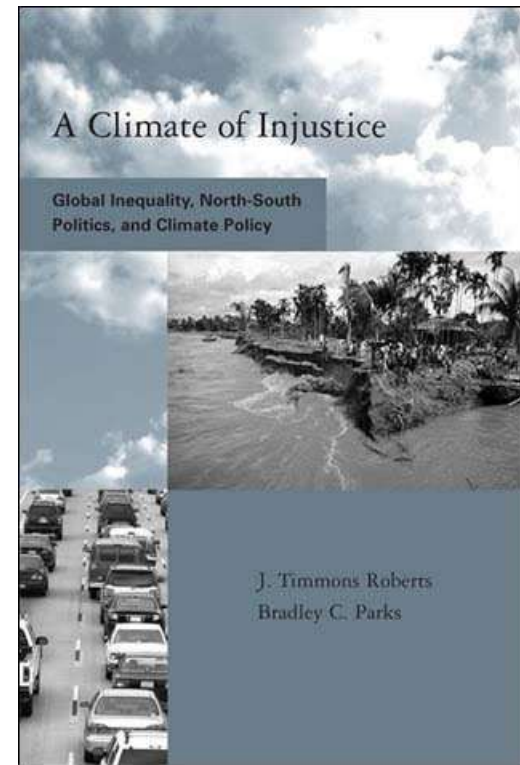
Estimated Effect of % Exports to High Income Countries on Per Capita CO_2 Emissions for 64 Developing Countries, 1965-2005
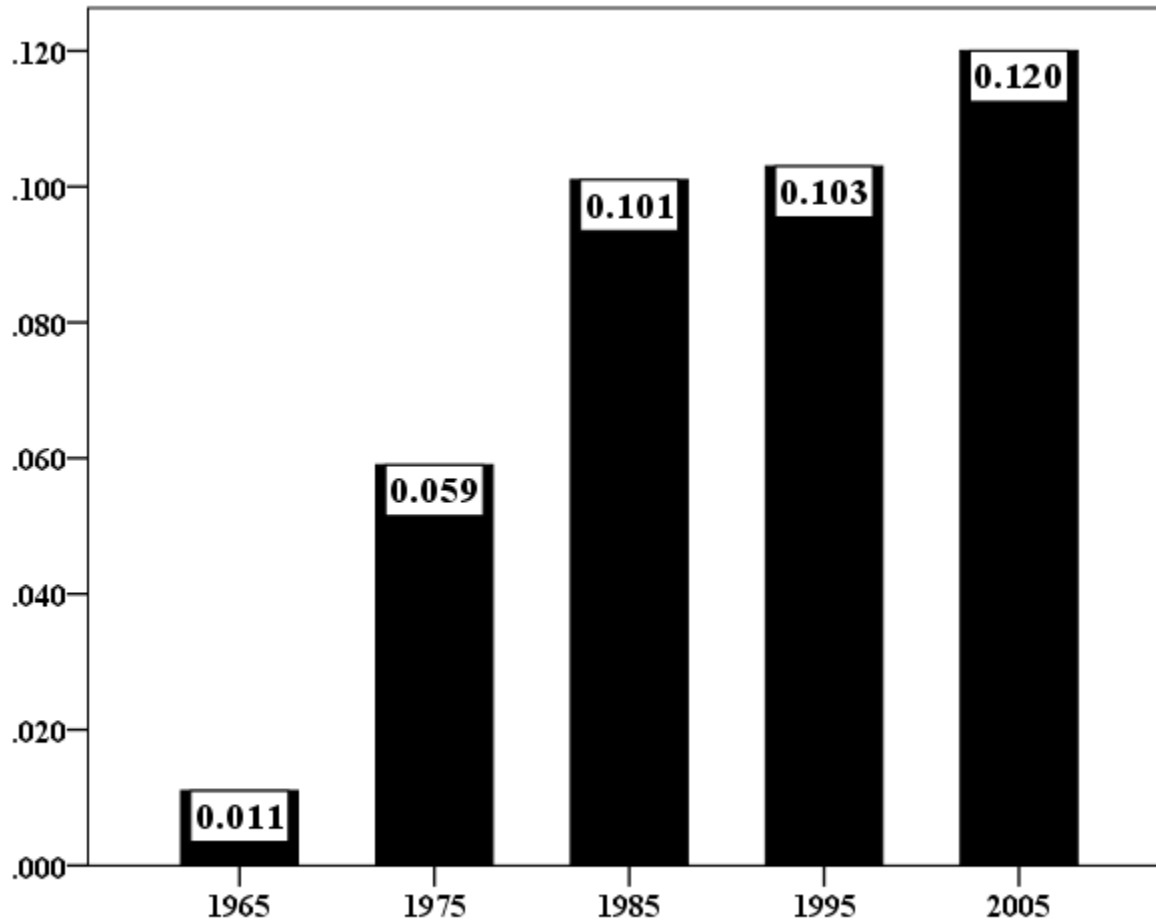
Estimated effect of % exports to HICs is nonsignificant for developed countries

Jorgenson, *2012, Social Science Research*

Standardized Regression Coefficients (and *t*-ratios) of Four Measures of Responsibility for Climate Change

Variable	Model 1 — Total Carbon Dioxide Emissions (ln) (million tons)	Model 2 — Carbon Intensity ln(CO$_2$/GDP)	Model 3 — Carbon Dioxide Emitted per Capita (ln)	Model 4 — Cumulative Emissions per Capita (ln) 1950–1999
Size of Economy/Wealth				
ln(GDP)	0.792*** (8.025)	—	—	—
ln(GDP/capita)	—	−0.164 (−0.889)	0.799*** (7.703)	0.587*** (5.306)
Squared(GDP/capita)	—	−0.196 (−1.662)	−0.094 (−1.399)	−0.052 (−0.739)
Geography/Size of Nation				
Population (ln)	0.219** (2.857)	0.292** (3.076)	0.173** (3.135)	0.142* (2.439)
Area (ln)	0.017 (−0.471)	−0.034 (−0.402)	0.021 (0.433)	−0.009 (−0.172)
Climate boreal (ln)	0.067+ (1.940)	0.189* (2.299)	0.107* (2.264)	0.154** (3.062)
% Population urban	0.221*** (4.089)	0.465*** (3.638)	0.289*** (4.067)	0.345*** (4.434)
Industrial Structure				
Manufactures/exports	0.075* (2.284)	0.179* (2.357)	0.092* (2.115)	0.137** (2.980)
Services/exports	−0.005 (−0.160)	−0.012 (−0.168)	0.001 (0.016)	−0.062 (−1.427)
Fuels/exports	−0.001 (−0.022)	−0.001 (−0.019)	0.001 (0.034)	0.005 (0.103)
Trade Intensity				
Trade/GDP	0.272*** (6.429)	0.578*** (5.597)	0.285*** (4.778)	0.250*** (4.027)
Trade × GDP	−0.260*** (−5.309)	−0.506*** (−3.960)	−0.257*** (−3.492)	−0.237** (−3.120)

A Climate of Injustice

Global Inequality, North-South Politics, and Climate Policy

J. Timmons Roberts
Bradley C. Parks

2007, MIT Press

"Poorer nations that participate more in international trade emit more CO$_2$, while wealthier nations that trade more emit less than those who traded less."

Table 4: Unstandardized Coefficients for the Regression of Carbon Dioxide Emissions on Secondary Sector Foreign Investment and Other Selected Independent Variables: Fixed Effects Model Estimates With AR[1] Correction for 2 to 25 Observations on 37 Less Developed Countries, 1975 to 2000 ($N = 519$)

|	Model 1	Model 2	Model 3	Model 4	Model 5
Secondary sector FDI stocks as % GDP (ln)	.108** (.030)	.097** (.030)	.091** (.030)	.094** (.029)	.076** (.029)
Total population (ln)	.876** (.041)	.873** (.041)	.845** (.042)	.822** (.040)	.804** (.039)
GDP per capita (ln)	.295** (.061)	.280** (.062)	.274** (.061)	.173** (.060)	.160** (.060)
Domestic investment as % GDP	.002 (.002)	.002 (.002)	.003 (.002)	.003 (.002)	.003 (.002)
Manufacturing as % GDP		.007* (.003)			.006* (.003)
Exports as % GDP (ln)			.123** (.034)		.068* (.033)
Urban population as % total population				.024** (.003)	.022* (.003)
Constant	−.915** (.048)	−.886** (.048)	−.792** (.050)	−.583** (.048)	−.511** (.049)
R^2 within	.943	.943	.945	.949	.950
R^2 between	.836	.838	.844	.886	.899
R^2 overall	.832	.834	.841	.880	.892

NOTE: Standard errors are in parentheses. FDI = foreign direct investment; GDP = gross domestic product.
*$p < .05$. **$p < .01$ (two-tailed tests).

Table 5: Unstandardized Coefficients for the Regression of Organic Water Pollution on Secondary Sector Foreign Investment and Other Selected Independent Variables: Fixed Effects Model Estimates With AR[1] Correction for 2 to 20 Observations on 29 Less Developed Countries, 1980 to 2000 ($N = 350$)

	Model 1	Model 2	Model 3	Model 4	Model 5
Secondary Sector FDI stocks as % GDP (ln)	.101** (.037)	.092* (.038)	.097** (.037)	.101** (.038)	.091* (.038)
Total population (ln)	.773** (.048)	.775** (.048)	.767** (.049)	.773** (.049)	.768** (.050)
GDP per capita (ln)	.478** (.079)	.457** (.081)	.470** (.080)	.485** (.093)	.472** (.094)
Domestic investment as % GDP	−.003 (.002)	−.003 (.002)	−.002 (.002)	−.003 (.002)	−.003 (.002)
Manufacturing as % GDP		.006 (.004)			.005 (.004)
Exports as % GDP (ln)			.034 (.047)		.030 (.049)
Urban population as % total population				.001 (.005)	−.002 (.005)
Constant	.099* (.049)	.137** (.050)	.110* (.049)	.093 (.051)	.126* (.052)
R^2 within	.967	.967	.967	.966	.967
R^2 between	.840	.850	.842	.845	.863
R^2 overall	.828	.838	.830	.833	.851

NOTE: Standard errors are in parentheses. FDI = foreign direct investment; GDP = gross domestic product.
*$p < .05$. **$p < .01$ (two-tailed tests).

Jorgenson, 2007, *Organization & Environment*

Estimated Effects of Various Factors on Deforestation for 49 Developing Countries, 1990 - 2005
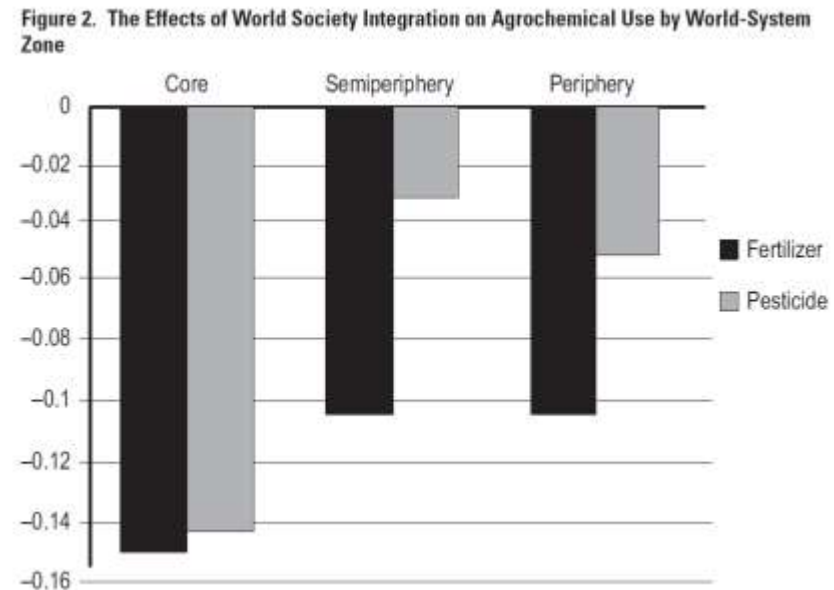

Jorgenson, 2010, *Critical Sociology*
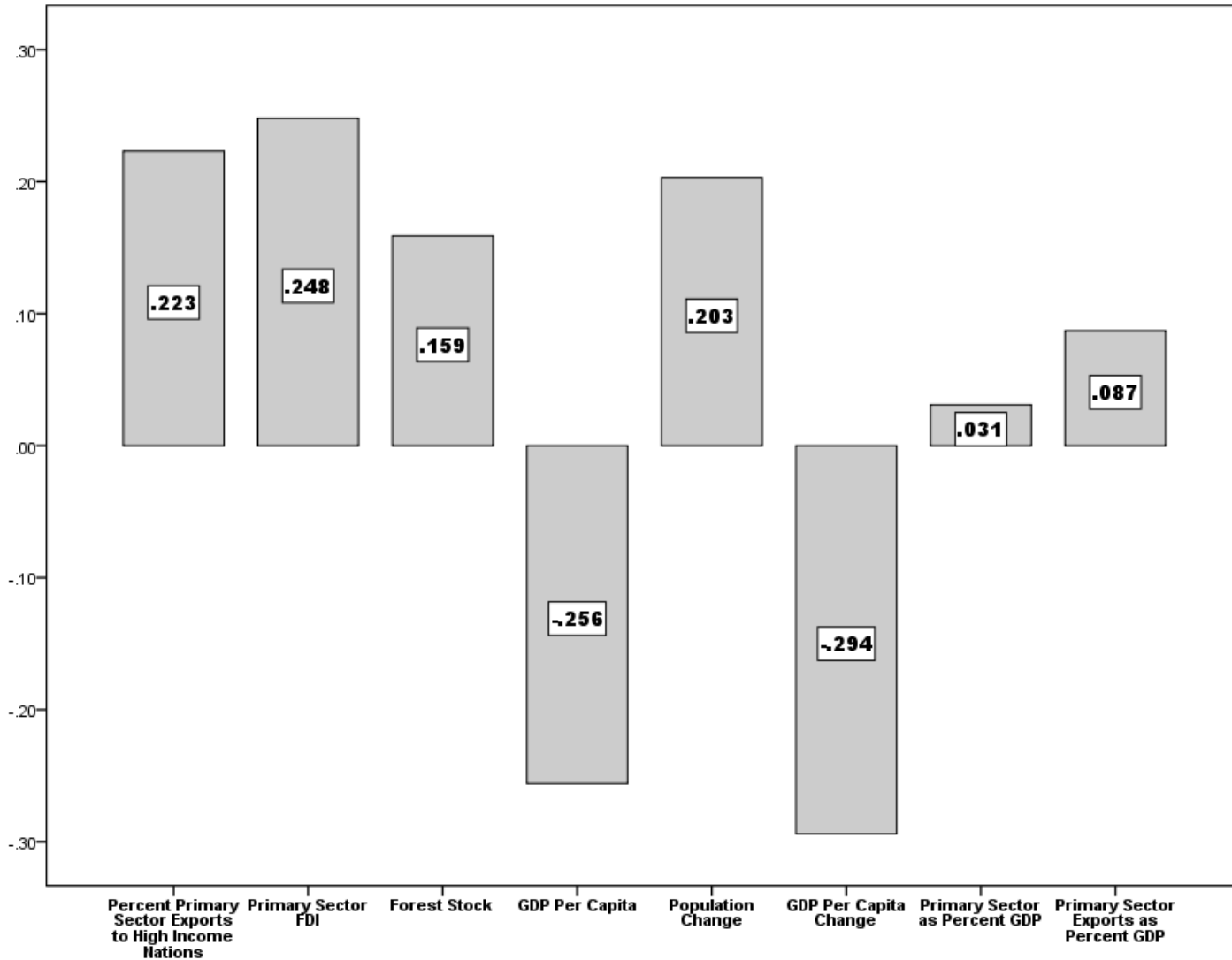
National Penetration of the World Environmental Regime / World Society Integration is measured by an index of national participation in environmental inter-governmental organizations (IGOs), environmental international non-governmental organizations (INGO), and environmental treaty ratifications

Table 2: OLS Regression Models: Nation Environmental Degradation

Variables	CO_2 Emissions 1980-1996 Model 9	Deforestation 1990-95 Model 10
Initial Level (CO2 1980, Forest Area 1990)	.70 +++ (.04)	- .04 (.06)
Population (logged)	.55 +++ (.11)	.002 (.004)
Economic Wealth (GDP p/cap, logged)	1.24 *** (.24)	.001 (.007)
Industrial Activity (% GDP)	- .01 (.01)	.59 + (.34)
Trade Openness	.02 +++ (.003)	- .15 (.12)
National Penetration by the World Environmental Regime	- .43 + (.21)	- .03 +++ (.008)
Constant	- 14.26 *** (2.28)	- .01 (.07)
Adjusted R-square	.92	.22
N of Cases	110	113

***p < .001 **p < .01 *p < .05, two-tailed test
+++p < .001 ++p < .01 +p < .05, one-tailed test
Unstandardized coefficients, standard errors in parentheses

Schofer and Hironaka, 2005, *Social Forces*

Fertilizer Analysis is for 1961-2006
Pesticide Analysis is for 1983-2004

Figure 2. The Effects of World Society Integration on Agrochemical Use by World-System Zone

Shorette, 2012, *Social Forces*

One potential pathway to effective climate change mitigation and other sustainability efforts involves reducing the carbon intensity of human well-being (CIWB) or ecological intensity of human well-being (EIWB)

Largely influenced by the work of sociologists Mazur and Rosa (1974, *Science*)

CIWB: the level of anthropogenic carbon emissions or other environmental impact per unit of human well-being

Numerator: anthropogenic CO_2 emissions / ecological footprint per capita

Denominator: average life expectancy at birth

Economic Development → EIWB, CIWB
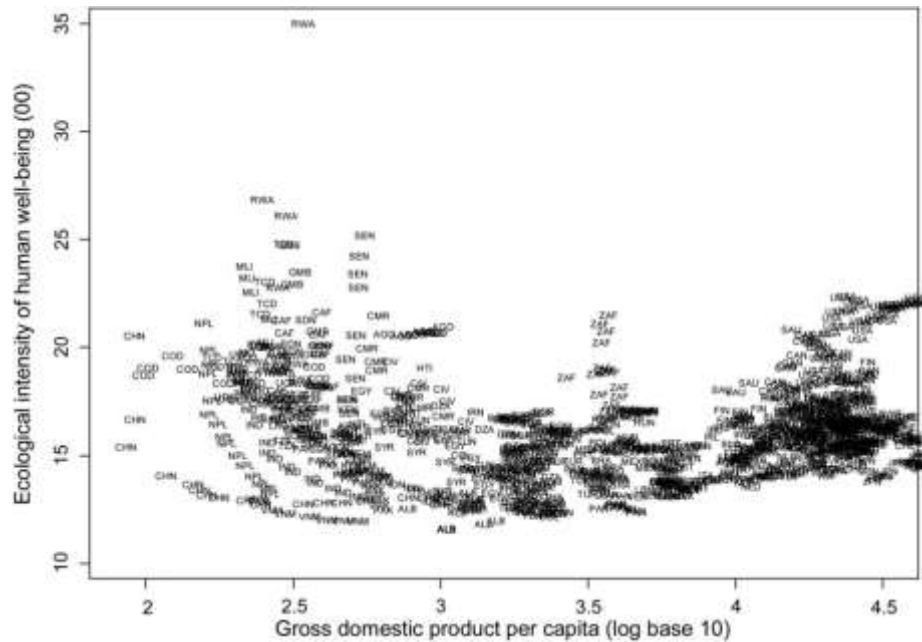
Table 1
Estimates of the effects of gross domestic product per capita on ecological intensity of human well-being.

	Fixed effects model	Between estimator
Gross domestic product (logged)	−18.878**	−16.992**
Square of logged gross domestic product	3.246**	2.493**
Time in years since 1960	−0.023	–
Time in years since 1960 squared	−0.003	–
Time in years since 1960 cubed	0.000	–
Intercept	42.330***	43.700***
Overall R^2	0.056**	0.174***
Number of observations (number of countries)	1221 (58)	1221 (58)

Note: standard errors in parentheses. For fixed effects model, standard errors are robust estimates treating countries as clusters. $*P < 0.05$; $**P < 0.01$.

"This pattern is the inverse of the inverted-U predicted by the Kuznets proposition. It appears that increases in affluence from the lowest levels to a mid-range tend to reduce the ecological stresses of producing well-being. But past a turning point of about $2558 dollars per capita (based on between estimates), ecological stresses per unit well-being increase."

Dietz et al., 2012, *Applied Geography*

Estimated Effects of GDP per capita on the Carbon Intensity of Well-Being, 1970-2009
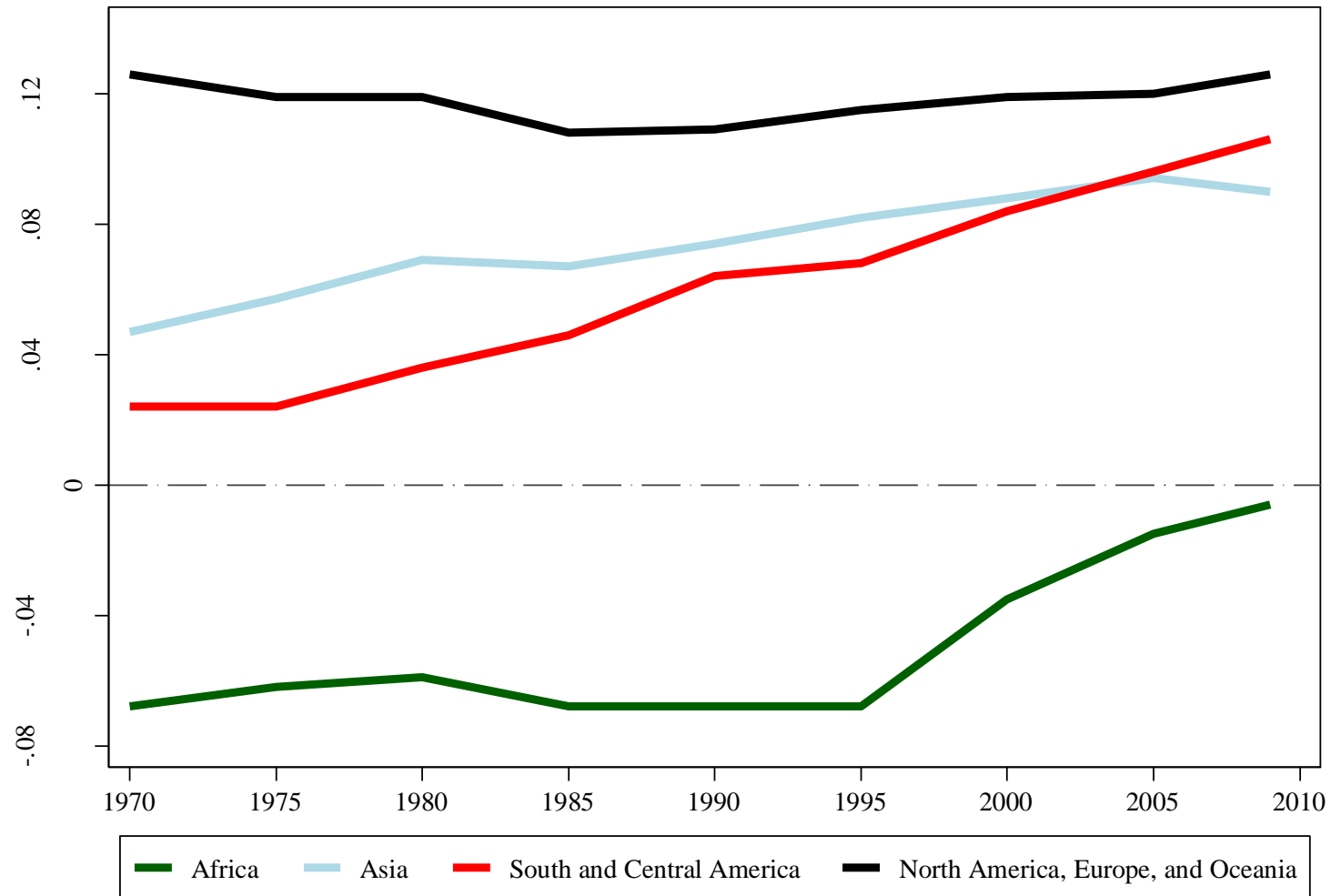
Africa sample includes 36 nations; Asia sample includes 22 nations; South and Central America sample includes 21 nations; North America, Europe, and Oceania sample includes 27 nations

Jorgenson, 2014, *Nature Climate Change*

Multilevel Analysis: Do We Have the Data?

http://socdev.ucpress.edu/
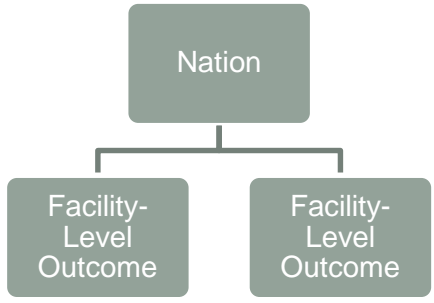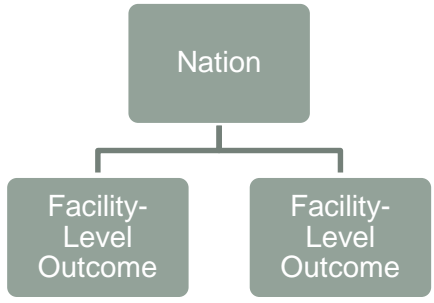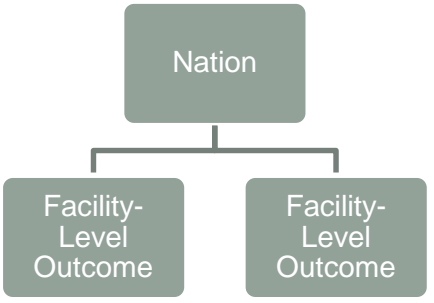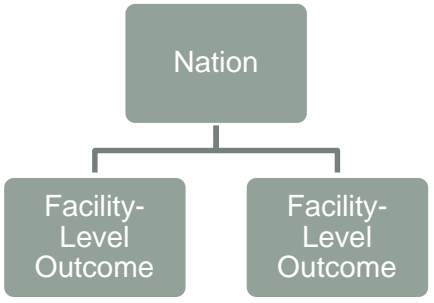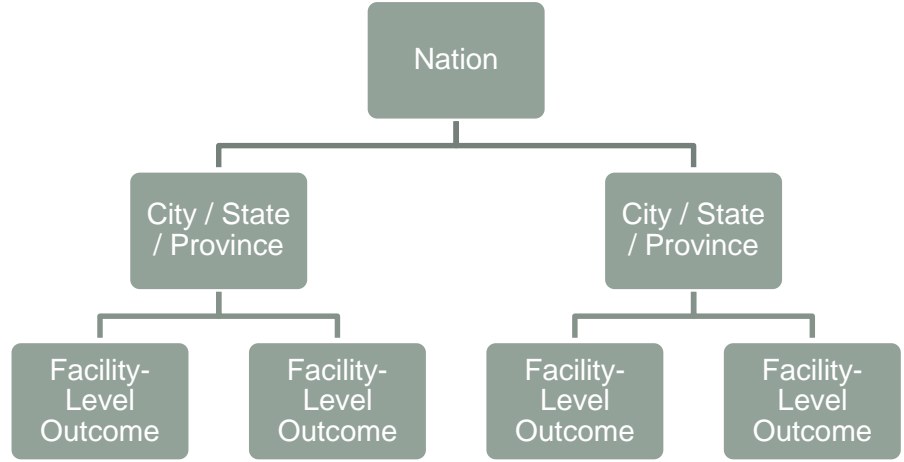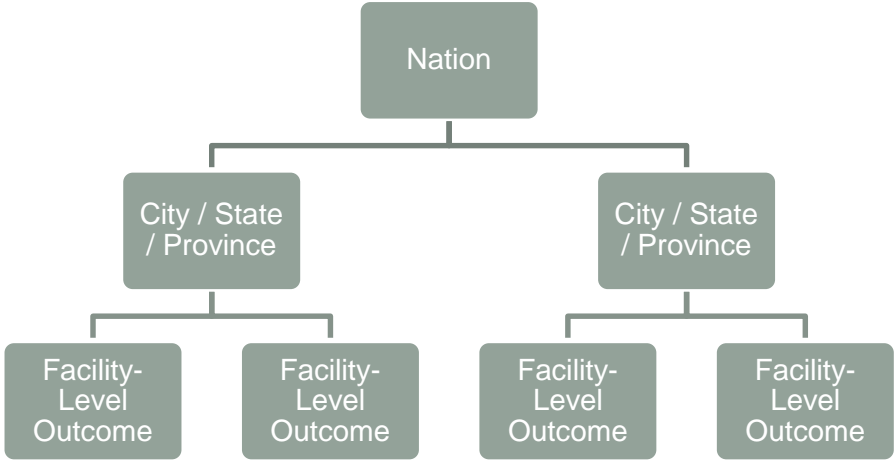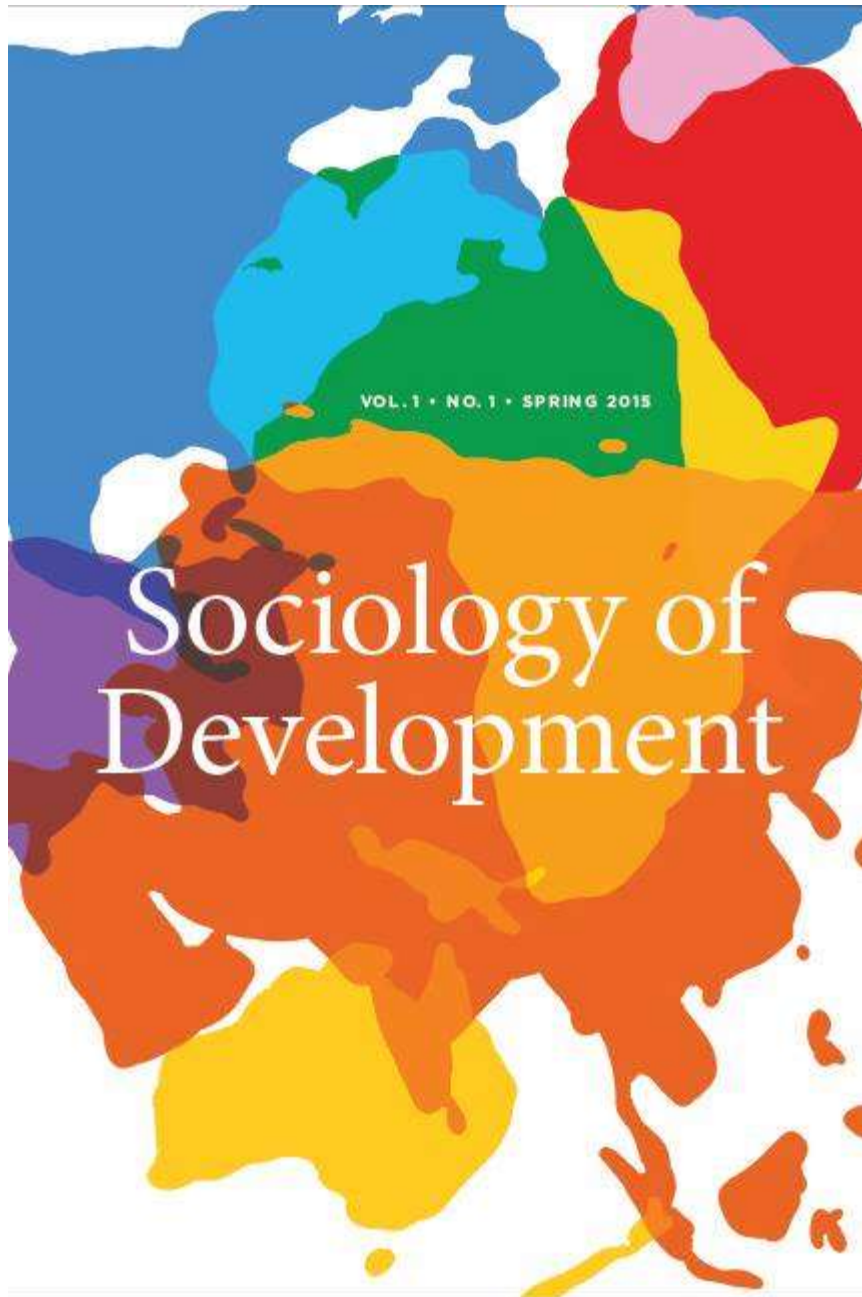
Sociology of Development is an international journal addressing issues of development, broadly considered. With basic as well as policy-oriented research, topics explored include economic development and well-being, gender, health, inequality, poverty, environment and sustainability, political economy, conflict, social movements, and more.

Sociology of Development promotes intellectual diversity within the study of development, with articles from all scholars of development sociology, regardless of theoretical orientation, methodological preference, region of investigation, or historical period of study, and encourages contributions from related disciplines including political science, economics, geography, anthropology, and health sciences.
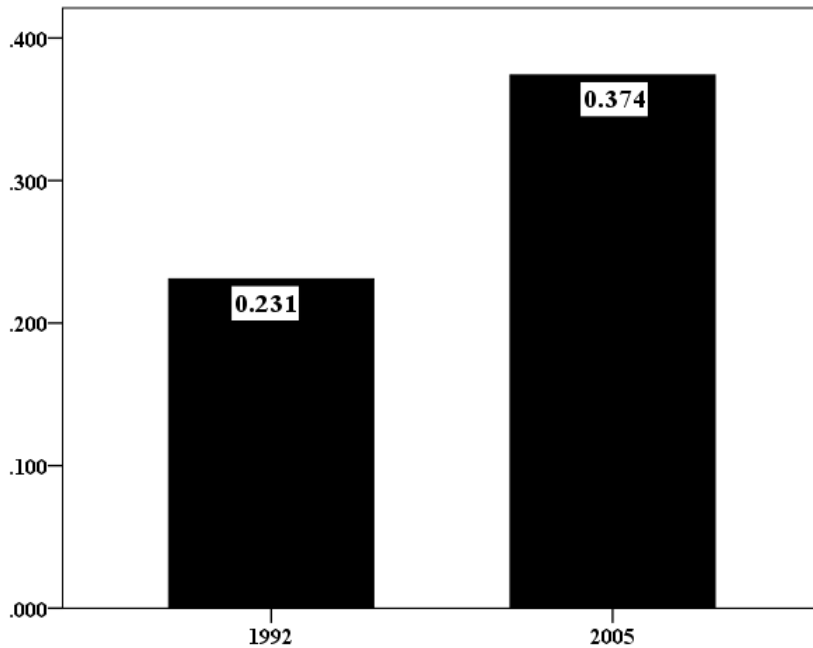
Thanks!

Analysis of 13 Central and Eastern European Nations, 1992-2005

Their average CO_2 per capita (metric tons) increased from 5.08 in 1992 to 7.55 in 2005
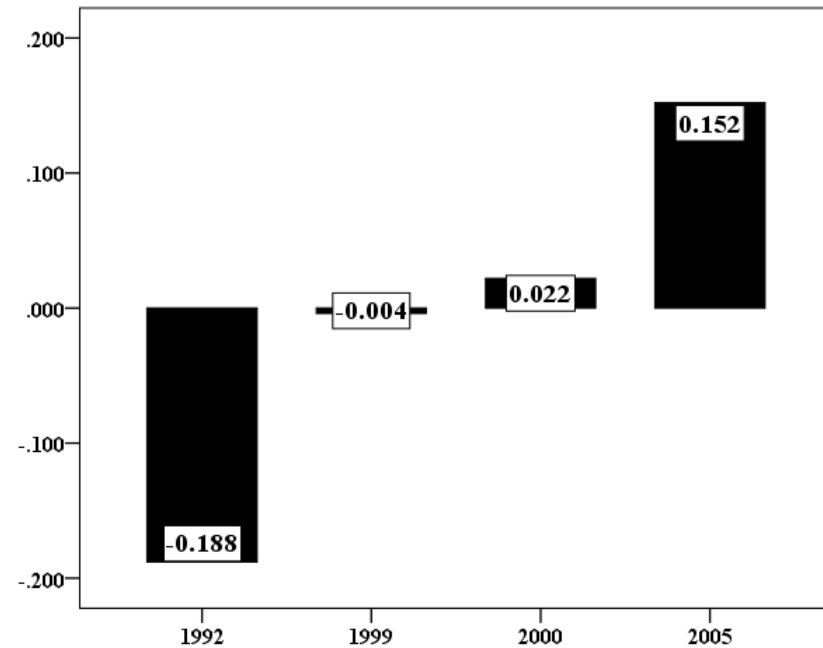
Estimated Effect of GDP Per Capita on Per Capita CO_2 Emissions

For these nations the mean GDP per capita in constant US dollars increased from approximately 1345 in 1992 to approximately 2150 in 2005.
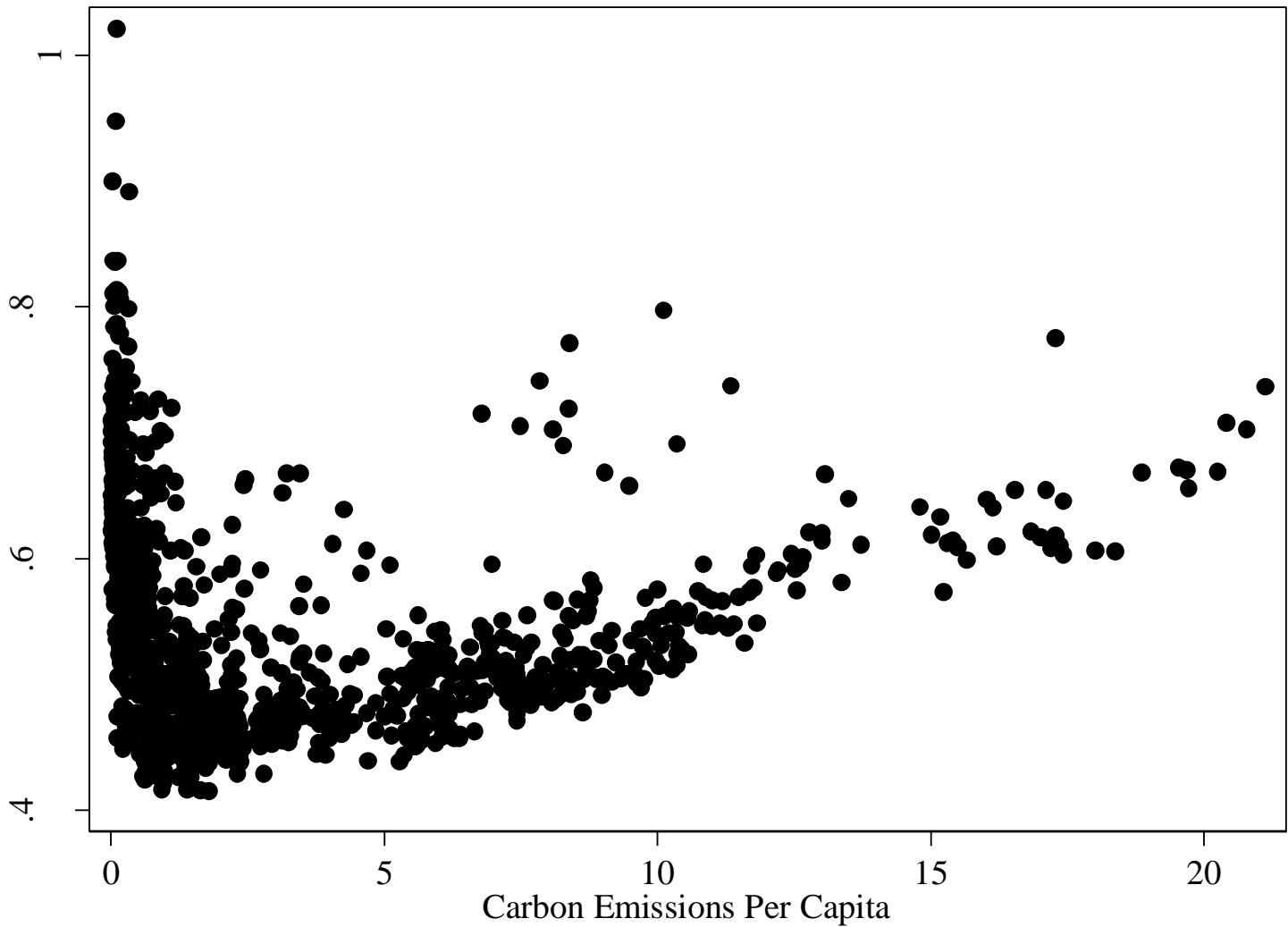
Jorgenson, Clark, and Giedraitis, 2012 (*Society & Natural Resources*)

Estimated Effect of % Exports to High Income Countries on Per Capita CO_2 Emissions

For these nations the mean % of exports to HICs increased from approximately 42 percent in 1992 to approximately 60 percent in 2005.
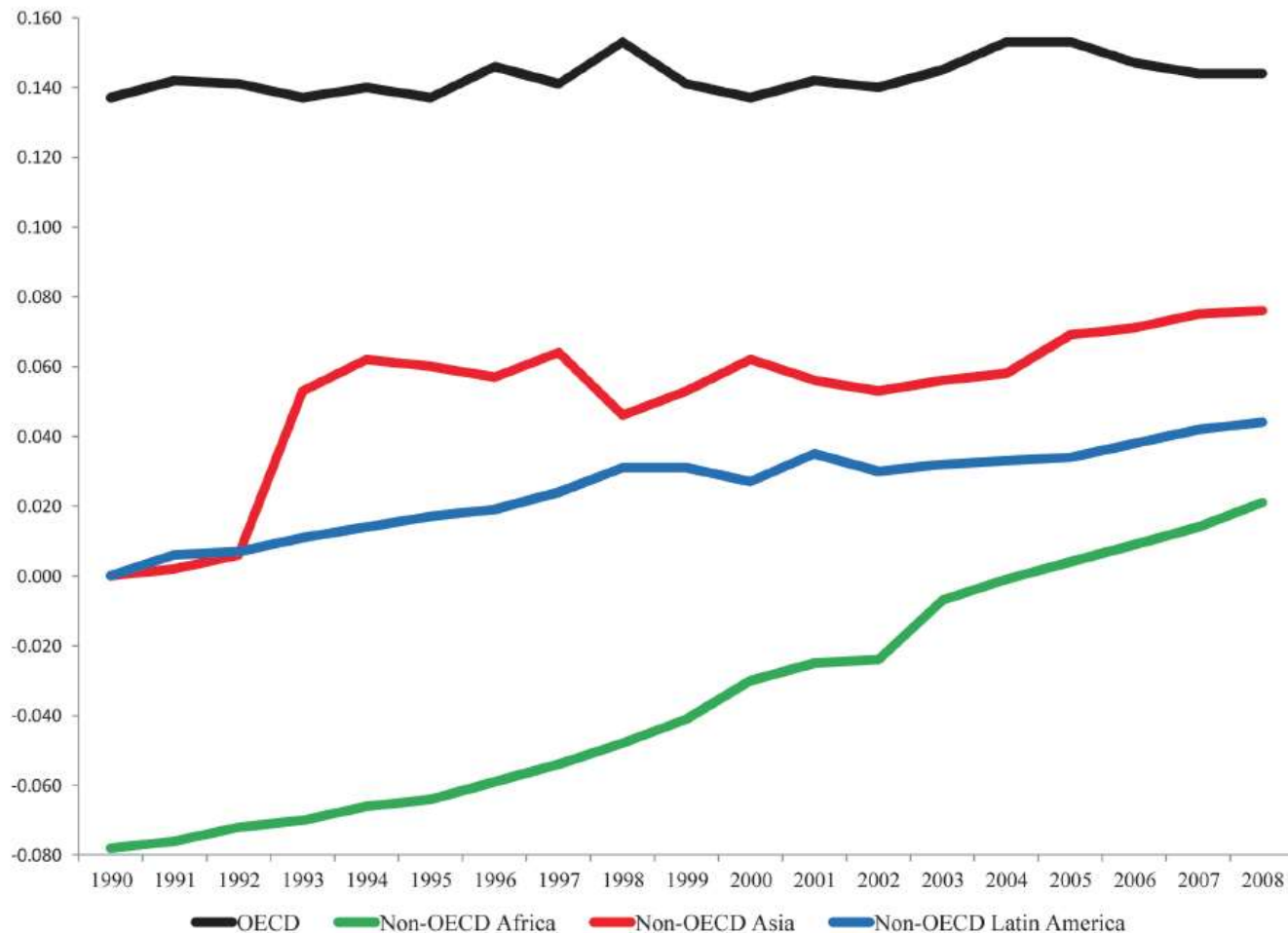
Jorgenson, 2011 (*Human Ecology Review*)

the correlation is -.04; includes sample of 106 Nations (954 total observations)

Jorgenson, 2014, *Nature Climate Change*

Estimated Effect of GDP per capita on the Carbon Intensity of Well-Being, 1990-2008
(consumption-based emissions data)

OECD sample includes 25 nations; Non-OECD Africa sample includes 16 nations;
Non-OECD Asia sample includes 15 nations; Non-OECD Latin America sample includes 13 nations
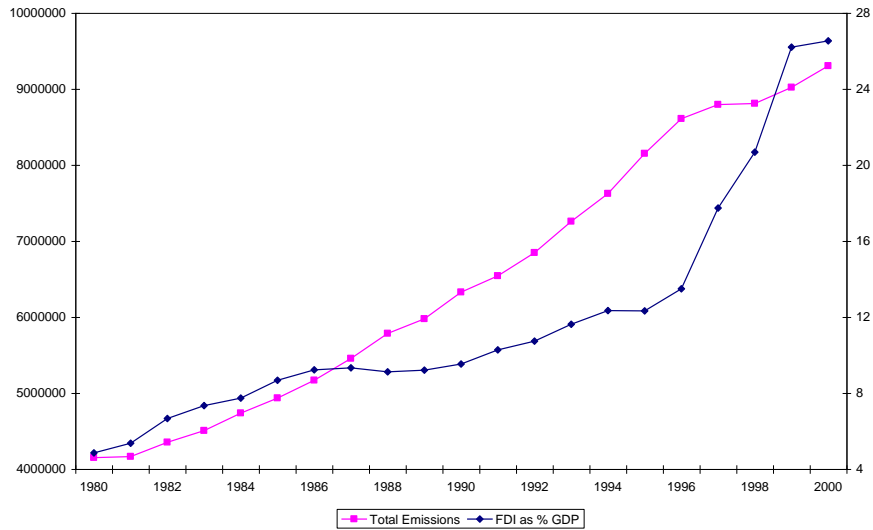
Jorgenson and Givens, 2015, *PLoS ONE*

Estimated Effect of Income Inequality on the Carbon Intensity of Well-Being, 1990-2008
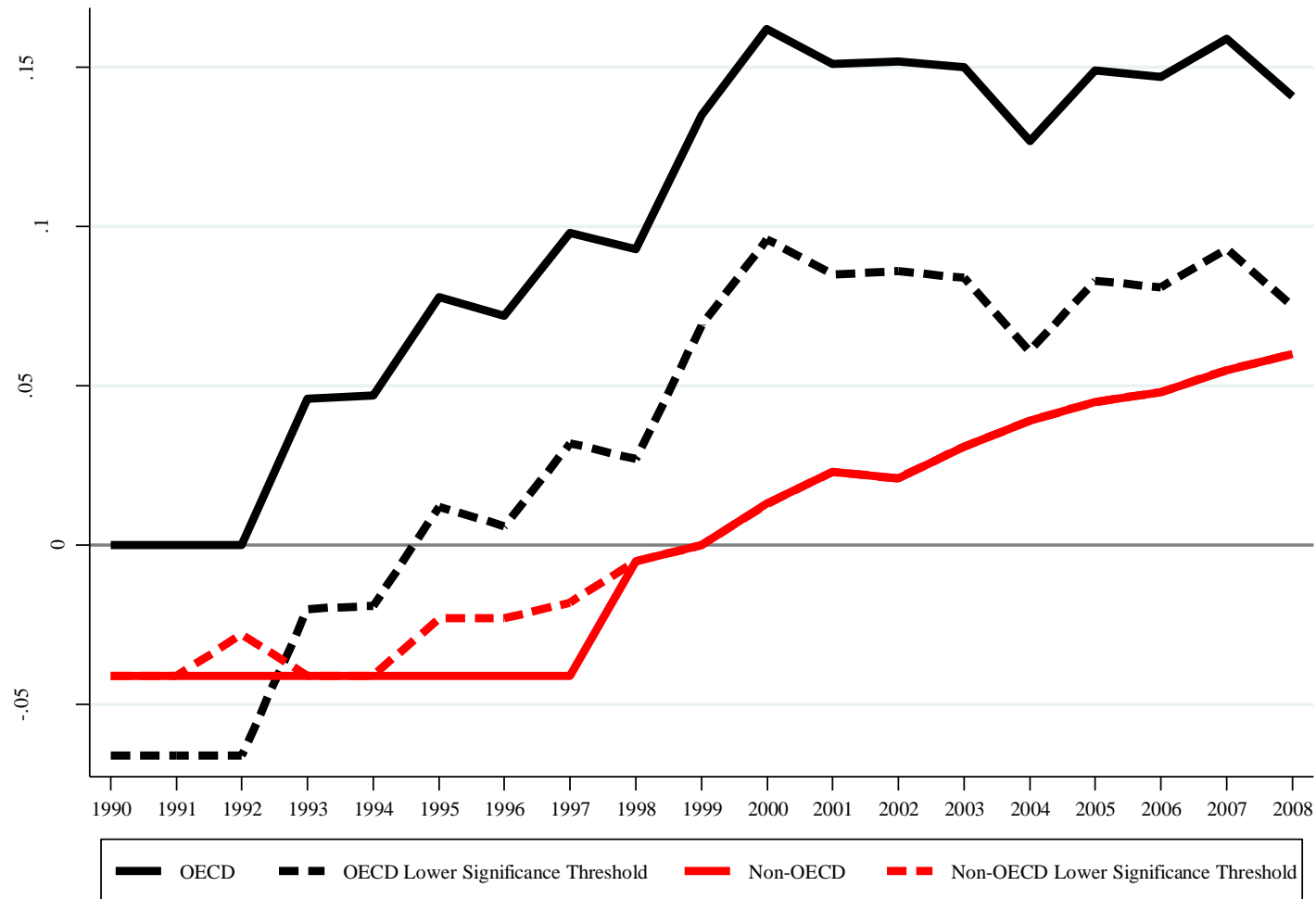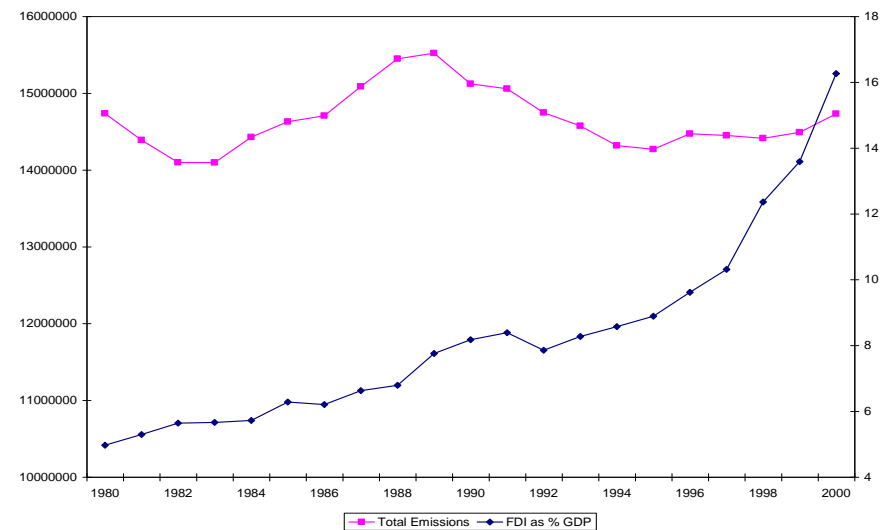

OECD sample includes 22 nations; Non-OECD sample includes 41 nations

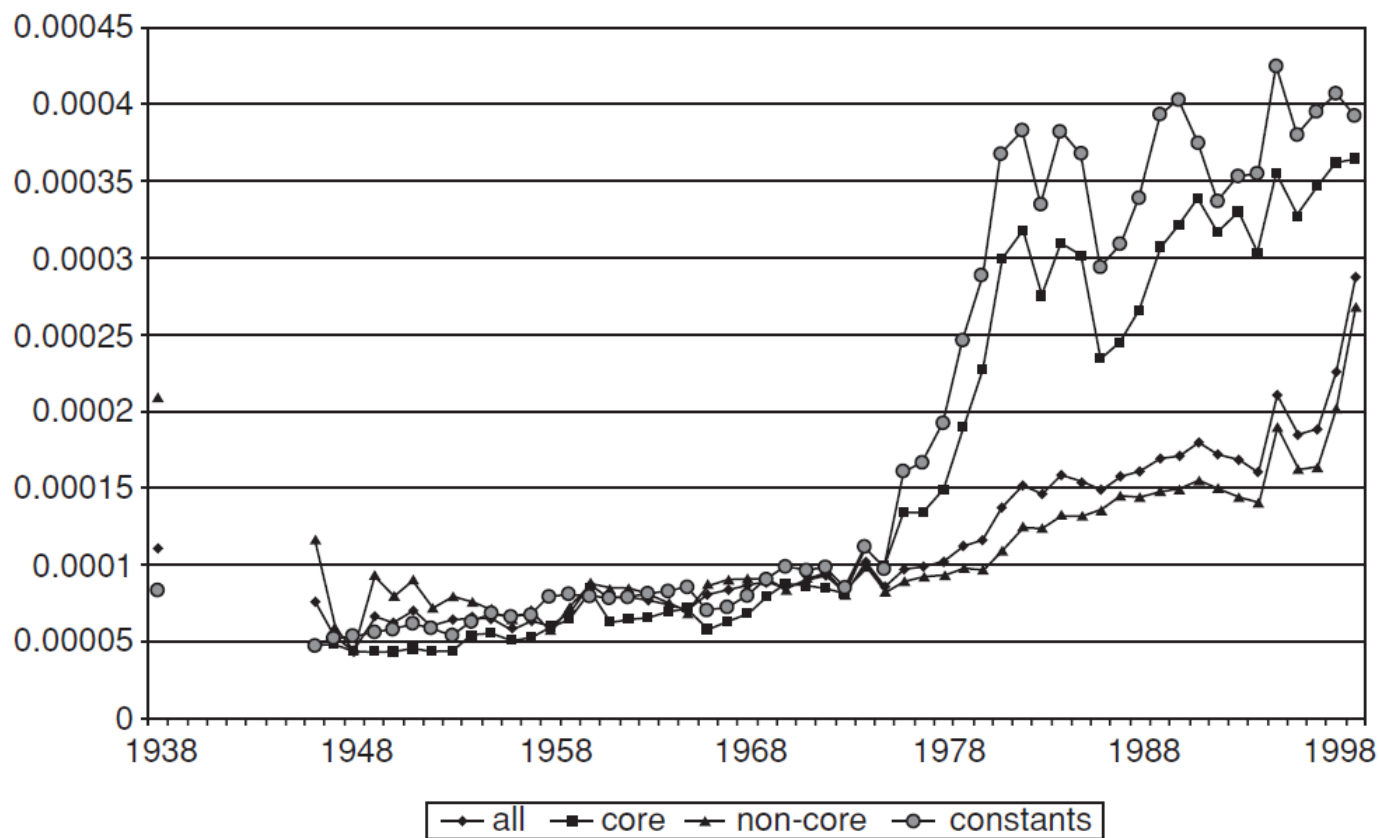Jorgenson, 2015, *Journal of Environmental Studies and Sciences*

Manufacturing FDI and Total CO_2 Emissions in 37 Developing Countries

Manufacturing FDI and Total CO_2 Emissions in 13 Developed Countries

Weighted investment income debits 1938–1999

These measures are on debits on investment income coded from the International Monetary Fund *Balance of Payments Yearbooks*. Investment income includes the repatriated profits on direct investment and dividends on portfolio investment. Investment income is a common proxy for estimating the total book value of foreign investment, because there is a general profit rate that averages around 10% and so the profit can be used as a proxy.

"Debits" means that investors abroad were paid profits and dividends by their holdings in the country. In principle, if we had data on the whole world, the sum of credits should equal the sum of debits.

Chase-Dunn et al., 2007, *Frontiers of Globalization Research*

Table 1
Fixed effects regression predicting within country per capita carbon dioxide emissions, 1989–2004

Variables	Model 1	Model 2	Model 3
Exports to World	2.37 (0.90)**	—	−0.81 (1.72)
Exports to U.S.	—	12.1 (4.8)**	14.04 (5.33)**
Population density	0.52 (0.23)*	−0.35 (0.36)	−0.33 (0.36)
GDP	0.08 (0.19)	−0.02 (0.60)	−0.03 (0.78)
Kyoto	299.7 (55.3)**	268.4 (69.8)**	307.1 (72.5)**
FDI	0.51 (1.98)	−2.06 (2.72)	−.073 (3.03)
Intercept	2051 (43.9)	2928 (106.1)	2896 (118.4)
R^2 (within)	0.03	0.03	0.03
Nation-years	2668	1608	1535
Wooldridge test (F, p)[a]	1.96, 0.16	1.98, 0.16	1.91, 0.17

[a] Null hypothesis: no first-order autocorrelation.
* $p < .05$.
** $p < .01$.

Stretesky and Lynch, 2009, *Social Science Research*

Estimated Effects of Various Factors on Per Capita CO_2 Emissions for 44 Developing Countries, 1965 - 2005

Givens, 2014, *Overcoming Global Inequalities*