Toxic Water Emissions and Economic Growth: A County Level Analysis of the USA

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Background

The Environmental Kuznets Curve (EKC) is a specialized economic model that postulates that there exists an inverted U-shape relationship between economic growth and environmental quality: environmental quality will decrease with growing levels of per capita income during early stages of development before hitting a critical peak, after which economic growth increases faster relative to environmental degradation

Introduction

The objectives of this study are to:

- Test whether county level per capita water contamination follow an EKC.
- Identify prominent socio-demographic factors that influence distribution patterns of per capita water contamination.
- Determine if observations are robust to the inclusion of fixed effects time and space effects.

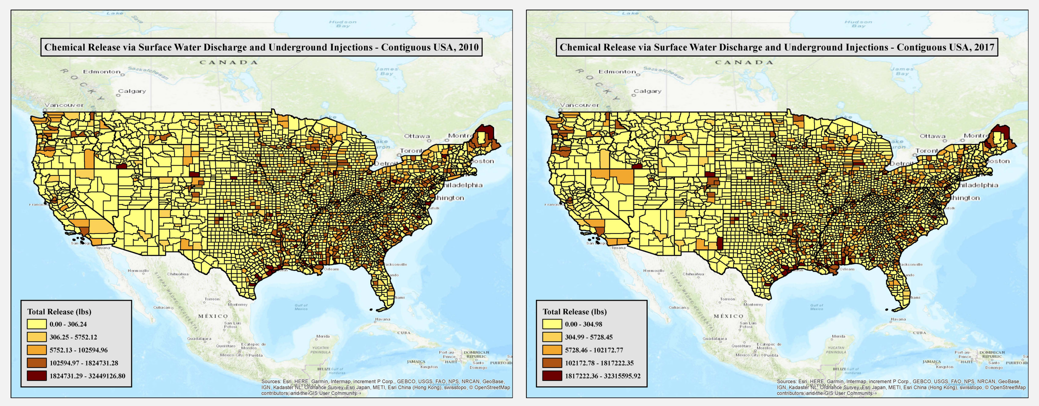

Figure: Per Capita Toxic Water Emissions

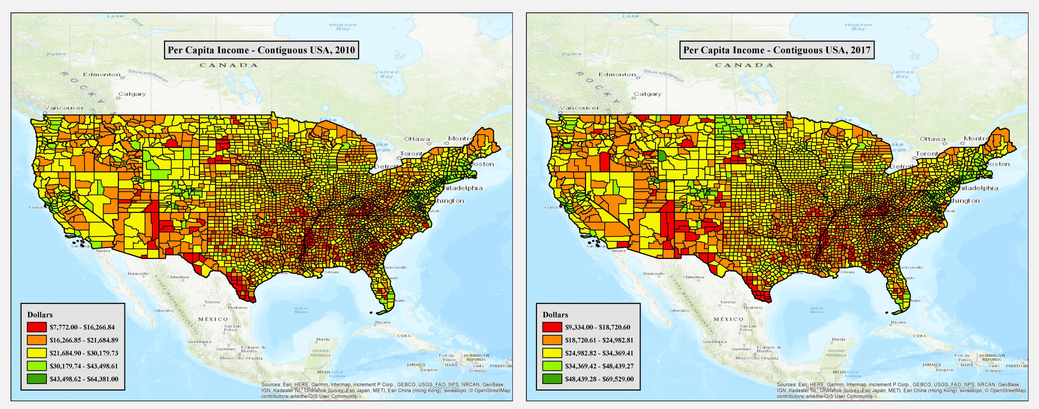

Figure: Per Capita Income

Data

Secondary data was collected from publicly available US records housing information from 2010 to 2017:

- Environmental Protective Agency's Toxic Resources Invent
- National Oceanic and Atmospheric Administration Climate Data Online
- Census Bureau's American Community Survey
- Census Bureau's County Business Patterns

Data is aggregated at the county level.

Theory and Methodology

Grossman and Krueger's (1991) work was among the first that challenged the widely accepted notion that increases in income and pollution shared a monotonic relationship. Empirically, the EKC is constructed to take on the following form:

$$y_{it} = \beta_0 + \alpha + \mu + \beta_1 x_{it} + \beta_2 x_{it}^2 + \beta_4 Z_{it} + \epsilon_{it} \quad (1)$$

Important Result

EKC holds for most years. More precipitation and socio-economic indicators point to greater amounts of per capita emissions. Results are not robust to the inclusion of time and county fixed effects.

Econometric Model

Two OLS models are estimated for this study. The first analyzes whether the EKC relationship holds over individual years from 2010 to 2017.

$$y_i = \beta_0 + \beta_1 M_i + \beta_2 M_i^2 + \beta_4 Z_i + \epsilon_i \quad (2)$$

The second model structures the data as a panel and incorporates time and county fixed effects.

$$y_{it} = \beta_0 + \alpha + \mu + \beta_1 M_{it} + \beta_2 M_{it}^2 + \beta_4 Z_{it} + \epsilon_{it} \quad (3)$$

y is per capita toxic water emissions, M is per capita income, α and β are time and county effects, and Z is a vector of socio-demographic characteristics

Results (Panel Analysis Shown Here)

VARIABLES	TE
M	4.76e-05
	(0.000111)
M2	-1.32e-09
	(1.41e-09)
Inequality	1.185
	(1.173)
PopulationDensity	0.000603*
	(0.000313)
Edu	0.0272
	(0.0424)
Putnam	0.00104
	(0.00163)
Olson	-0.00127
	(0.00477)
Resource	-0.0851
	(0.0555)
Ethnic	-0.0143
	(0.0135)
Precip	-0.0112
	(0.00705)
Temp	0.00238
	(0.0469)
Constant	2.945
	(3.230)
Observations	24,864
Number of ID	3,108
R-squared	0.002

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Discussion

Across individual years, the EKC relationship holds for per capita toxic water emission and per capita income. Greater precipitation levels, as well as higher concentrations of resource-intensive industries and underrepresented minorities are observed to have a positive relationship with per capita water emissions.

Results are not robust to the inclusion of time and county fixed effects. Results do show a positive effect between per capita emissions and a county's population density. Further work could explore whether the same results hold when accounting for county's spatial patterns, as well as determine whether results are similar for other forms of environmental contamination.

Additional Information

This project first started for the WRPI Watershed Management Experiential Learning of USDA Careers Internship Program 2019-2020 and is still in progress.

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