The Relationship between Economic Growth and Environmental Degradation: Exploring Models and Questioning the Existence of an Environmental Kuznets Curve

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Introduction & Motivation

- Does economic growth damage the environment or does the environment improve when a country becomes more economically prosperous?
- No clear-cut answer in the literature
- Environmentalist P.O.V vs. Economist P.O.V.
- Policy implications
- Our study: No clear EKC throughout overall environment

Environmental Kuznets Curve

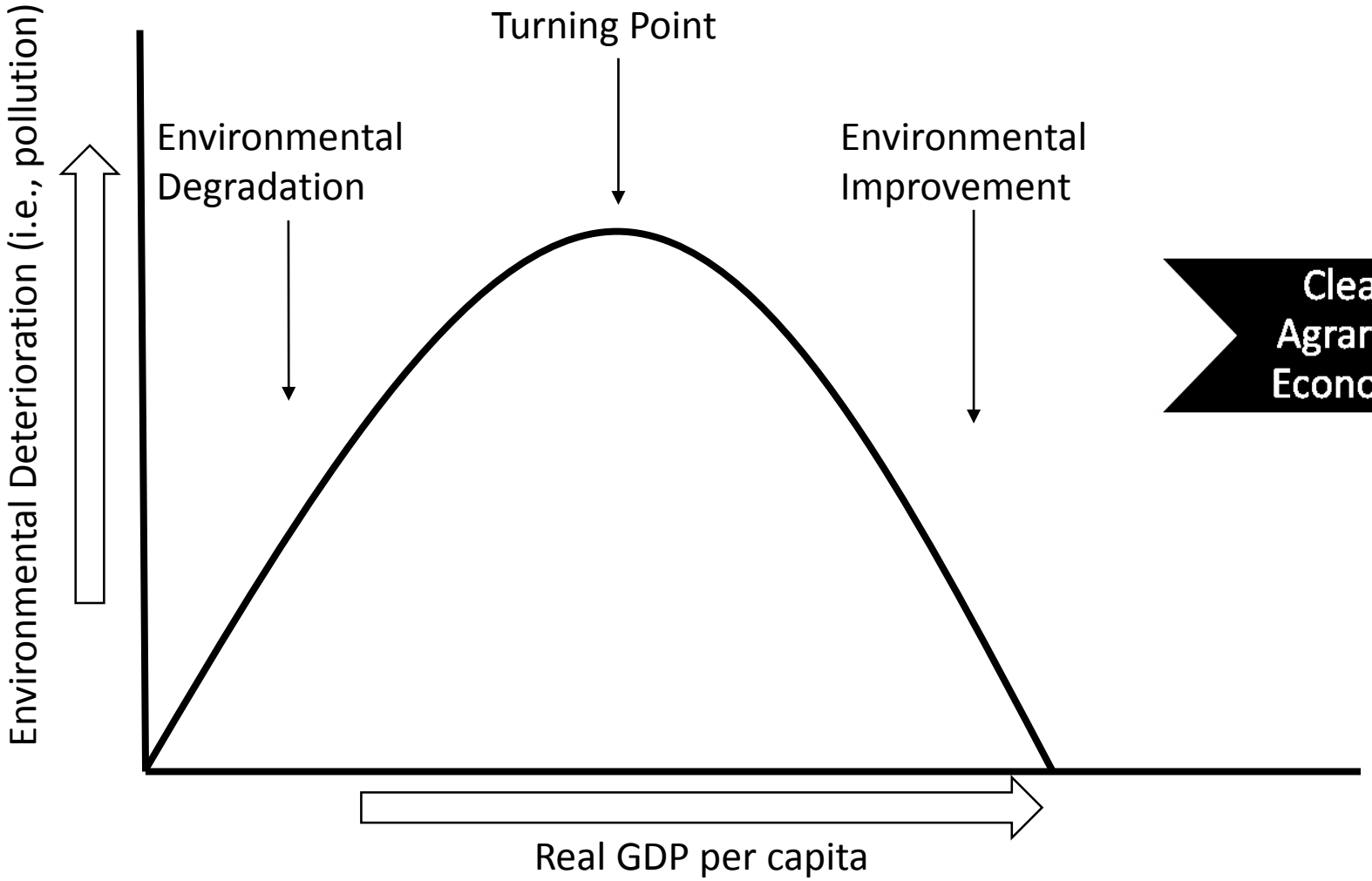
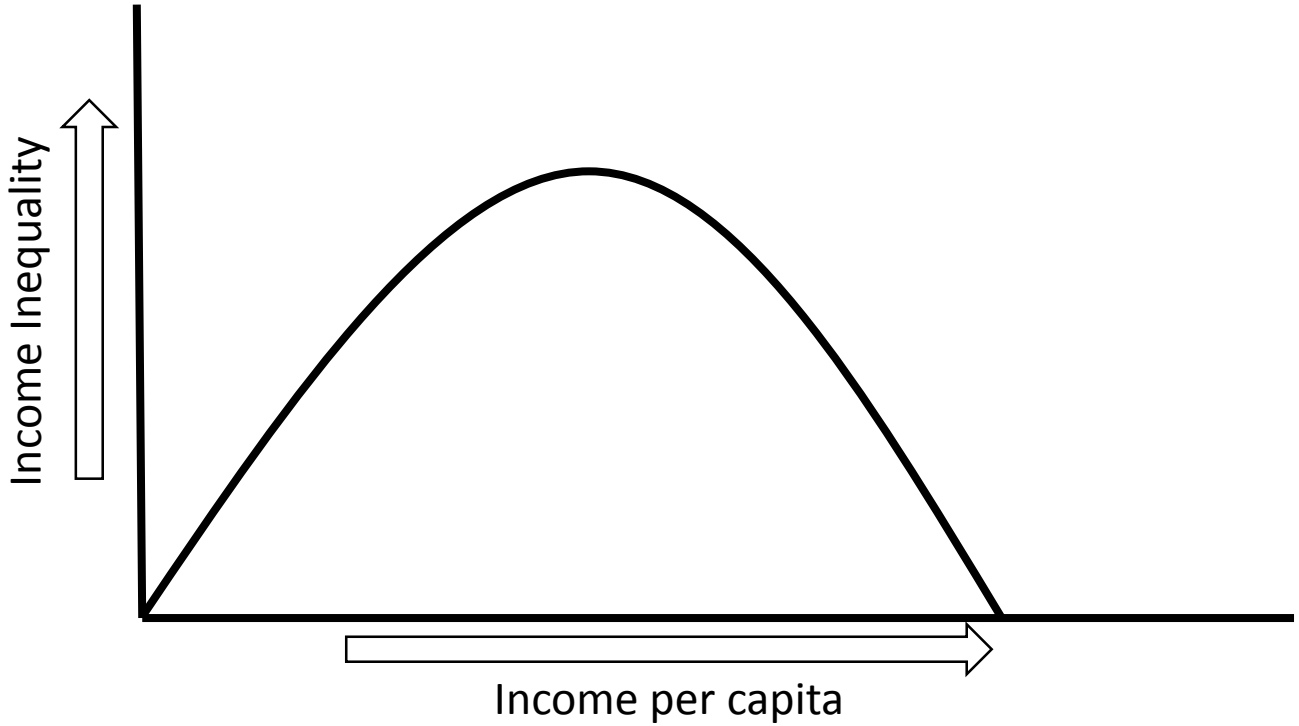


Figure 1 in Paper

Literature

- Kuznets curve first developed by Kuznets (1955)
- Grossman and Krueger (1991): First empirical study on EKC
- Panayotou (1993): Coined term “environmental Kuznets curve”



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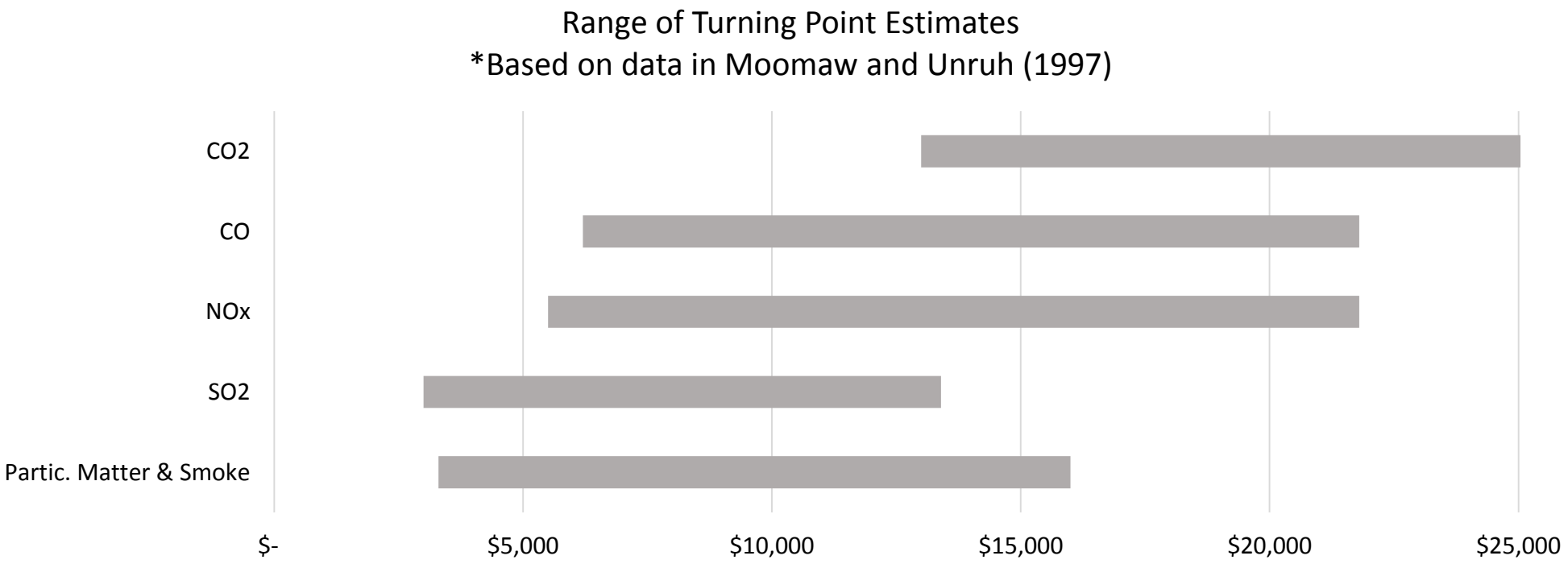
Literature

- No consensual turning point
- “[T]here is no agreement in the literature on the income level at which environmental degradation starts declining” (Dinda, 2004)



Literature

- Lieb (2003): Most studies agree that an EKC exists for
  - SO_2
  - SPM
  - NO_x
  - CO
  - VOC
- Egli and Steger (2007) present evidence for an N-, or possibly M-, shaped curve

Three-Tiered Empirical Approach

- Cross-Sectional
  - $P = \beta_0 + \beta_1 Y + \beta_2 Y^2 + \mu$
  - $P = \beta_0 + \beta_1 log(Y) + \beta_2 log(Y)^2 + \mu$
  - $log(P) = \beta_0 + \beta_1 Y + \beta_2 Y^2 + \mu$
  - $log(P) = \beta_0 + \beta_1 log(Y) + \beta_2 log(Y)^2 + \mu$
- Panel
  - $P_{it} = \alpha + \beta_1 Y_{it} + \beta_2 Y_{it}^2 + \varepsilon_{it}$
  - $P_{it} = \alpha + \beta_1 log(Y_{it}) + \beta_2 log(Y_{it})^2 + \varepsilon_{it}$
- Time-Series
  - Graphical Analysis

Cross-Sectional Analysis

- 111 PIR combinations x 4 specifications = 444 Regressions

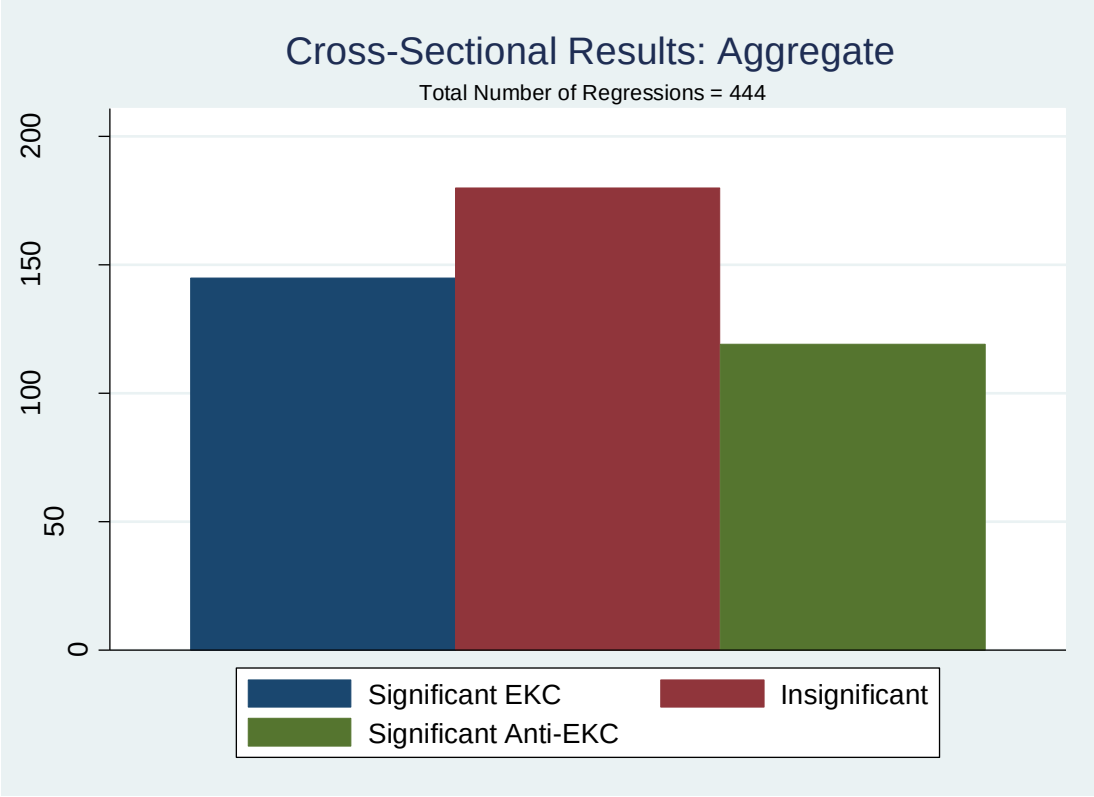
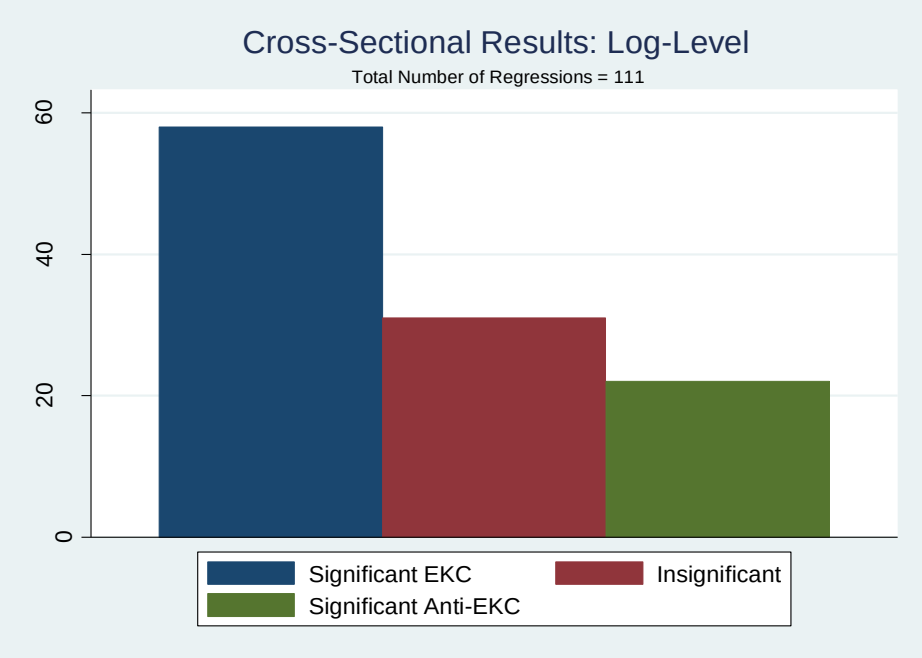
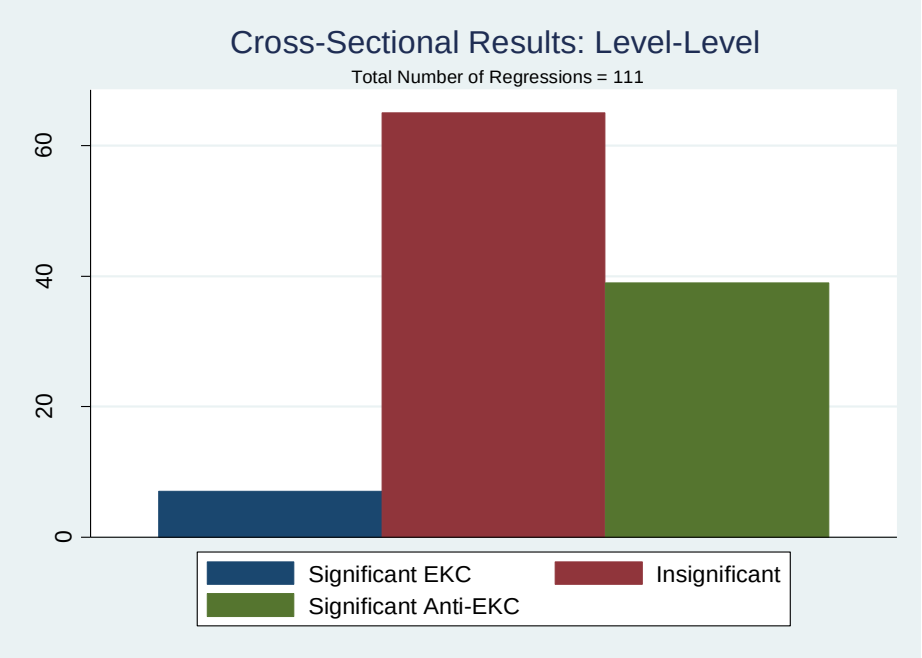
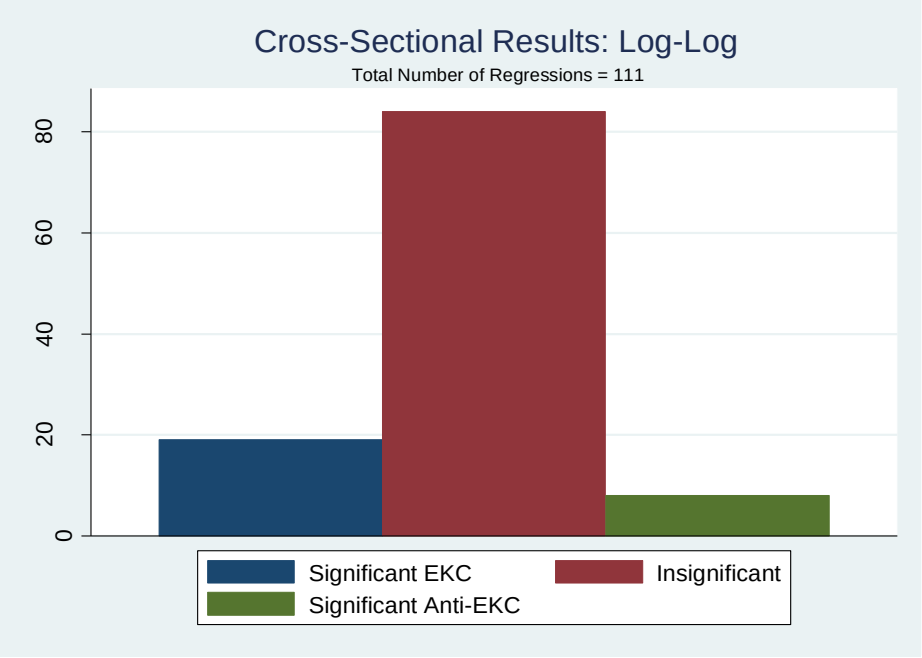


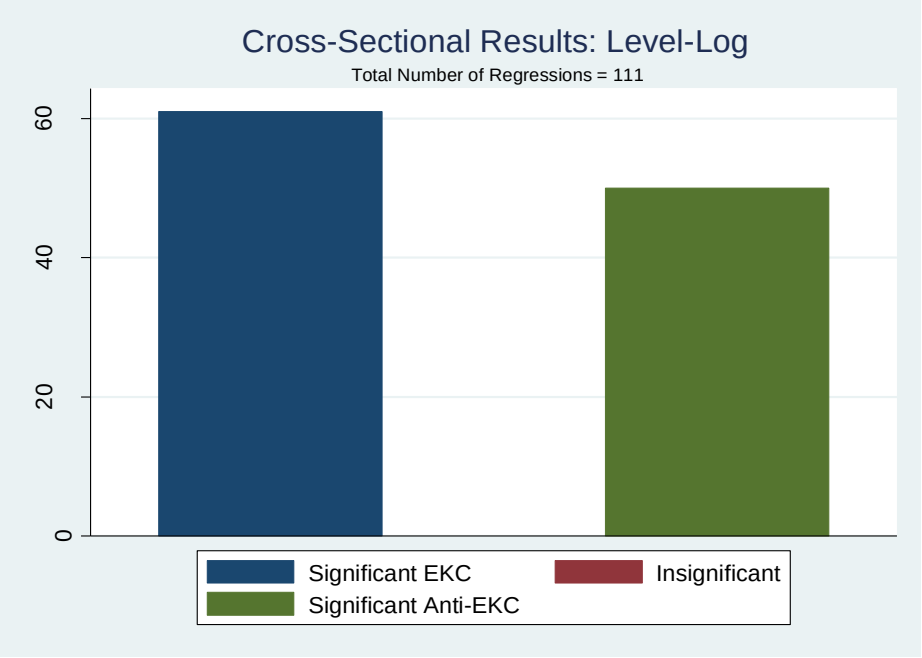
Figure 4 in Paper

Statistically Significant EKC Effect	32.66%
Statistically Significant Anti-EKC Effect	26.80%
Insignificant Effect	40.54%









Figures 5-8 in Paper

Panel Analysis: Meta-Analysis

Transformation	EKC Significant	EKC Insignificant	Anti-EKC Significant	Anti-EKC Insignificant
None	4	3	1	0
Log(real GDP per capita)	3	1	1	3
$\alpha = 0.10$				

Figure 9 in Paper

Panel Analysis: Statistically Significant Indicators

Environmental Indicator (units)	Transformation	Coefficient on Quadratic Term (90% CI)	Turning Point Estimate*
Biodiversity (Indexed 0-100)	None	8.12e-10 (3.91e-11, 1.59e-09)	$88,547
BOD (kg per day per worker)	None	-1.15e-11 (-1.78e-11, -5.22e-12)	$809
	Log(X)	-.0046749 (-.0066406, -.0027091)	$3,393
CO_2 (metric tons per capita)	None	-1.88e-09 (-2.14e-09, -1.63e-09)	$59,309
Other GHG (thousand metric tons of CO_2 equivalent)	None	-3.57e-06 (-5.93e-06, -1.20e-06)	$86,264
NO	Log(X)	-3970.539 (-5185.666, -2755.411)	$19,186
Methane	Log(X)	-7431.878 (-10625.33, -4238.425)	$40,424
**Note: Real GDP per capita is expressed in 2005 USD*			

Figure 10 in Paper

Conclusions & Further Research Warranted

- The existence of an EKC relationship throughout the environment should not be taken as given
- EKC effect clearest in organic water pollution, while CO_2, NO, and methane also seem to follow an EKC
- Anti-EKC effect for PM_{10}
- PIR does not *clearly* follow an EKC path, but we have not addressed what the actual path may be
- In need of more time-series studies
- Exploration of different independent variables