Export Diversification, CO_2 Emissions, and the Environment Kuznets Curve: A Country Panal Approach

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A Country Panel Approach

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*All perspectives of this academic paper is solely of the authors. All findings were done in a personal capacity and does not necessarily represent the views of the United States Department of Agriculture.

Introduction

Motivation: Economic Development and Pollutant Emission

- Growing interest in environmental changes
  - Besides being a natural phenomenon, climate change has been closely intertwined with human activity and economic development
- Finding the relationship between economic development and pollutant emission
  - income and pollution are both endogenous variables, and the effect of growth on pollution depends on what causes the growth
- Literature suggests a Kuznets Curve type outcome of pollutant emission (inverted U)
- Environmental deterioration increases as a country develops, but environment improves as economy grows
- Theoretical references include Copeland and Taylor(2013) and Stern, (2004)

Trade Diversification and Pollutant Emission

- Does int'l trade have any impact on country level pollutant emission? (Yes.)
- Does the trade "structure" have an impact on pollutant emission, especially trade diversity?
  - Trade Diversity in markets may hedge trade risk
  - Trade Diversity in products may indicate wider range of technology
  - Trade Diversity is related to Economic Development
- Trade diversification adds a new dimension in understanding the relationship between economic development and pollutant emission

Literature Review of Empirical Studies

EKC “hypothesis”:

- ”Dirty” industries set up in economic infancy, leading to increased CO_2 emissions within country (Selden and Song, 1994; Shafik and Bandyopadhyay, 1992; Song et al., 2008; Jayanthakumaran et al., 2012)
- No meaningful global relationship can be found between income and emissions in OECD countries (Dijkgraaf and Vollebergh, 2001)

Key Questions

- What impact does trade diversification have pollutant emission?
  - If so, does it also have an inverted-U shaped relationship?
- Are there heterogeneous effects between *product* and *partner* diversification?
- Are there any differences based on country income levels?

Methodology and Data

Key Estimation Equations

Trade Diversity and Pollutant Emission

$$Pollutant_{i,t} = \beta \cdot HHI_{i,t} + \epsilon_{i,t} \tag{1}$$

$$Pollutant_{i,t} = \beta_1 \cdot HHI_{i,t} + \beta_2 \cdot HHI^2_{i,t} + \epsilon_{i,t} \tag{2}$$

$$Pollutant_{i,t} = \beta_1 \cdot HHI_{i,t} + \beta_2 \cdot HHI^2_{i,t} + \theta_1 \cdot GDP_{i,t} + \theta_2 \cdot GDP^2_{i,t} + \gamma_i + \epsilon_t + \varepsilon_{i,t} \tag{3}$$

- Panel Analysis using fixed effects
- Robustness checks used (Driscoll/Kraay estimators, CADR, etc.)

Data

World Bank and WITS data

- Numbers of Countries: 125
- Income: GDP per capita, adjusted for inflation
- Pollutant: CO_2 Emissions, metric tons per capita
- Trade Diversity: Herfindahl Index for int'l trade, for product (HS4 level) and partner country
- Timeframe: Years 2000 - 2014

Table 1: Summary Statistics

Variable	Obs	Mean	Std. Dev	Min	Max
CO_2	1867	.2636	.1729	.0152	1.360
GDP	1873	1763	18709	440.4	141947
$HHI_{product}$	1823	.1161	.1607	.003	.987
$HHI_{partner}$	1822	.1541	.1418	.004	.921

Preliminary Results

Baseline Tables

Table 2: All Countries

Variable	(1)	(2)	(3)
GDP	1.419	1.416	1.439
GDP^2	-0.096	-0.096	-0.097
$HHI_{product}$		-0.012	
$HHI_{partner}$			-0.01

Income shows quadratic relationship between CO_2 output Limited impact of Trade Diversity Index on CO_2 emissions

Select Results

Table 3: Results by Income Level using $HHI_{product}$

Variable	Low-income	Low-mid	Upper-mid	Upper
GDP	-5.434	4.259	1.016	3.202
GDP^2	0.398	-0.271	-0.071	-0.182
$HHI_{product}$	0.193	0.188	0.242	-0.107
$HHI^2_{product}$	0.046	-0.026	0.041	-0.013

Countries are group by income, following Gozgor and Can (2016a)
Low Middle Income countries show a significant EKC relationship but Upper-Mid income country have a U shaped relationship - results largely driven by China

Select Results

Table 4: Results by Income Level using $HHI_{partner}$

Variable	non-OECD Upper Income	OECD Members
GDP	4.652	1.599
GDP^2	-0.249	-0.105
$HHI_{partner}$	-0.140	0.392
$HHI^2_{partner}$	-0.048	0.059

Partner Diversity measures have little impact on CO_2 emissions
Heterogeneous impact exists between non-OECD and OECD members

Conclusion and Discussion

Summary

- The impact of trade diversification on pollutant emission shows an inverted-U shaped relationship
  - Economic growth vs. Trade Diversification
- Differences in Product vs. Partner Diversification Effects
  - Product diversification and the ”mix” of sectors
  - Partner diversification, trade agreements, and int’l compliance
- Heterogeneous effect exist between low, mid, and high income countries

Future Extensions

- Trade “Intensity”
- Country Specific Studies: Chinese firms
- Preferential Trade Agreements Information
- Ag-centric Study:
  - Different measure of environmental impact: Land Conversion?
  - Agricultural Products

Thank you.