Pollution Haven Effects (PHE) and the Pollution Haven Hypothesis (PHH)

Jenny Minier
University of Kentucky

April 2022

Distinction

Pollution Haven Effect (PHE)

- An increase in environmental standards reduces exports (or increases imports) of pollution-intensive goods

Pollution Haven Hypothesis (PHH)

- A reduction in trade costs results in production of pollution-intensive goods shifting towards countries with lower environmental standards

PHE vs PHH

Existence of Pollution Haven Effects (PHE) are a necessary, but *not sufficient* condition, for the Pollution Haven Hypothesis (PHH) to hold

- Possible to find empirical evidence for PHE without finding empirical evidence for the PHH
- Example: Copeland and Taylor (1994)

Copeland and Taylor (1994)

Assume production of pollution-intensive goods is *capital-intensive*

- High-income countries tend to have more stringent environmental regulations *and* tend to be capital-abundant
- It is plausible that high-income countries have a comparative advantage in pollution-intensive goods
- If so:
  - An increase in their environmental standards will shift some pollution-intensive production towards lower income countries (PHE holds)
  - But a decrease in trade barriers could shift pollution-intensive production towards higher-income countries (PHH does not hold)

Motivation

National Treatment (Article III): foreign goods must be treated no less favorably than "like" domestic goods

- designed to avoid protectionism in the application of internal regulations
- typically distinguish between "product" and "process"
  - construction materials with asbestos are not "like" construction materials without asbestos (policy can discriminate)
  - construction materials produced in an 8-hour work day are "like" construction materials produced in a 12-hour workday (policy cannot discriminate)

Motivation

Environmental Exception (GATT Article XX): can justify deviations from national treatment if "necessary to protect human, animal or plant life or health"

- US-Shrimp Case: ban on the importation of shrimp that were caught in a manner that endangered sea turtles (process distinction)
- WTO Appellate Body - valid Article XX exception

Appellate Body report

"We do not pass upon the question of whether there is an implied jurisdictional limit to Article XX(g) and, if so, the nature and extent of that limitation. We note only that in the specific circumstances of the case before us, there is a sufficient nexus between the migratory and endangered marine populations involved and the United States for purposes of Article XX(g)."

- Could carbon border adjustment mechanisms receive an Article XX exception?
- If evidence for PHE and carbon leakage: are greenhouse gas emissions like migratory turtles?

Empirical Evidence on Pollution Haven Effects

If a country increases the stringency of its environmental regulations, do its net exports of pollution-intensive goods decrease?

- Main complication: dealing with endogeneity of environmental regulations and trade flows
  - degree of import competition might impact stringency of environmental regulations
  - omitted variables (e.g., increase in income might impact both environmental regulations and trade flows)
  - literature has typically used combination of fixed effects and instrumental variables to address
- Main result: significant evidence for Pollution Haven Effects

Industry-Level Evidence

Heterogeneity in responsiveness to environmental costs

- Ederington, Levinson, and Minier (2005): evidence for PHE in industries with high environmental costs, industries that are footloose, and industries trading with lower-income countries (with more of a differencce in environmental regulation)

Variation in industry-level measures of regulatory stringency (e.g., pollution abatement costs)

- Ederington and Minier (2003): "Is Environmental Policy a Secondary Trade Barrier?" (yes! and if you model it that way, environmental costs have a strong effect on net imports)
- Levinson and Taylor (2008): increase in pollution abatement costs significant component of increased U.S. net imports from Canada and Mexico

Firm-Level Evidence

Variation in firm-level exposure to environmental regulations (e.g., whether firm is located in a region subject to more stringent regulations)

- Cherniwchan and Najjar (forthcoming): variation in Canadian air quality standards reduced firms' probability of export and export volume
- List, Frederiksson, Millimet and McHone (2003): location choice of pollution-intensive firms responds to differences in environmental stringency (NY state)

Country-Level Evidence

Variation in country-level measures of regulatory stringency (e.g., whether a country has made specific emission reduction commitments as a member of an international environmental agreement)

- Aichele and Felbermayr (2015): carbon intensity of imports to Kyoto ratifiers from non-ratifiers increased 3% and embodied carbon imports increased 8%
- Ederington, Paraschiv and Zanardi (2018): ratifying an international environmental agreement leads to a compositional shift toward cleaner exports and away from dirtier exports

Empirical Evidence on the Pollution Haven Hypothesis

Trade costs and trade barriers have declined over the last several decades. Has production of pollution-intensive goods (and thus emissions) shifted toward countries with less stringent environmental regulations?

- Main complication: Decomposition of source of change in emissions
  - Many high-income countries have seen declines in emissions
  - Is this due to cleaner production techniques?
  - Or is it due to off-shoring dirtier production (PHH)?

Decomposition: Scale, Composition and Technique

$$E_{ct} = V_{ct} \sum_i \theta_{ict} z_{ict}$$

where

- V_{ct} is total value of output in country c in time t
- θ_{ict} is share of industry i output in country c in time t
- z_{ict} is emission intensity (emissions/output) of industry i in country c in time t

Scale Effects

$$E_{ct}^{S} = V_{ct} \sum_{i} \theta_{ic0} z_{ic0}$$

- Emissions each year arising from an increase in total economic output (scale effect)
- Holding industry composition and emission intensity constant
- Emissions could fall because we're producing less overall

Composition Effects

$$E_{ct}^{C} = V_{c0} \sum_{i} \theta_{ict} z_{ic0}$$

- Emissions each year arising from a change in the composition of output (composition effect)
- Holding total output and emission intensity constant
- Emissions could fall because we're producing less of the pollution-intensive goods and more of the cleaner goods

Technique Effects

$$E_{ct}^{T} = V_{c0} \sum_{i} \theta_{ic0} z_{ict}$$

- Emissions each year arising from changes in emission intensity (technique effect)
- Holding total output and industry composition constant
- Emissions could fall because we're using cleaner production techniques

Empirical Evidence on the Pollution Haven Hypothesis (PHH)

For the Pollution Haven Hypothesis to hold, we should observe that, as trade has liberalized:

- a *compositional* shift towards lower emissions in high-environmental standard countries and
- a *compositional* shift towards increased emissions in lower-environmental standard countries.

U.S. Decomposition

Decomposition exercises typically find very small compositional changes (i.e., little evidence for PHH). Instead, declines in emissions tend to be primarily explained by technique effects (e.g., cleaner production methods)

- Ederington, Levinson and Minier (2004): U.S. shift toward cleaner manufacturing not driven by trade liberalization
- Levinson (2009): U.S. shift toward cleaner manufacturing not driven by offshoring of dirty industries

These earlier studies were industry-level; what looks like technique effects at the industry level could reflect composition effects at a more disaggregated level

- Shapiro and Walker (2018): use product-level data and find that decreased emissions primarily due to technique effects

Conclusion

Empirical evidence

- Consistent evidence for the existence of Pollution Haven Effects
- Weak or little evidence for the Pollution Haven Hypothesis

Takeaway for WTO: little evidence that trade liberalization leads to environmental "race to the bottom" (no PHH), but substantial evidence that environmental regulations affect trade flows (PHE). Countries are likely to use trade policy to increase effectiveness of environmental commitments.