Porter hypothesis vs pollution haven hypothesis: Can an emission tax avoid the pollution haven hypothesis?

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Overview

Introduction

Pollution haven theory (Copeland and Taylor, 2004)

World divided into two parts:

- "North": with environmental policy
- "South": no environmental regulation

PH hypothesis: polluting firms will tend to relocate in countries with weaker regulation.

Porter's hypothesis (Porter, 1991):

A tighter environmental regulation can foster investment in green technology and firms' competitiveness.

Research questions

1. What should we expect firms to do (location + investment) under environmental policy?
2. Which hypothesis (Pollution Havens vs Porter) will prevail given the design of an environmental policy?
3. Under what conditions they will decide to stay and go greener?

Literature Review

Strategic environmental policy:
Markusen et al. (1993), JEEM
Barrett (1994), JPubE
Rauscher (1994), OxEcPap

Porter Hypothesis
Porter (1991), SciAm
Porter and van der Linde (1995) JEcPers (1999) HarvBusRev
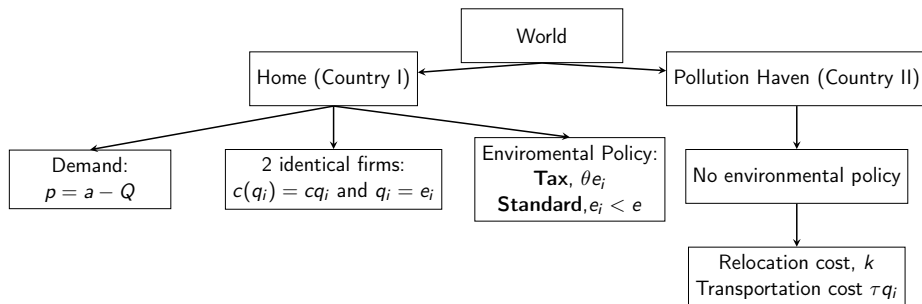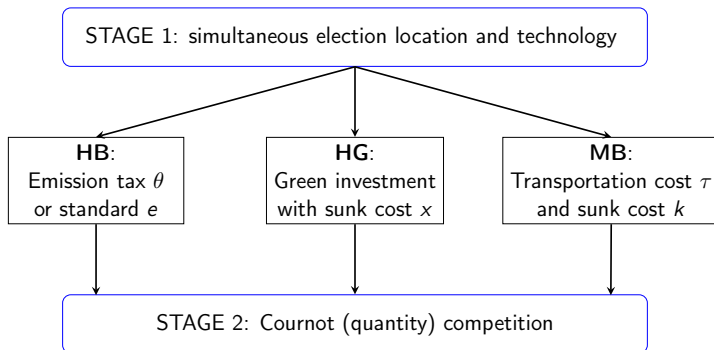André, González and Porteiro (2009) JEEM

Pollution Haven Hypothesis
Copeland and Taylor (1994), Q J Econ
Copeland and Taylor (2004), JEL
Levinson and Taylor (2008) IntEconRev

The model 1/2

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                                    ┌─────────────────┐
                                    │      World      │
                                    └─────────────────┘
                  ┌──────────────────────┐        ┌──────────────────────────────┐
                  │  Home (Country I)    │◄──────►│ Pollution Haven (Country II) │
                  └──────────────────────┘        └──────────────────────────────┘
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Home (Country I):

Demand:
$p = a - Q$

2 identical firms:
$c(q_i) = cq_i$ and $q_i = e_i$

Enviromental Policy:
Tax, θe_i
Standard, $e_i < e$

Pollution Haven (Country II):

No environmental policy

Relocation cost, k
Transportation cost τq_i

Solved by backward induction to find subgame perfect Nash equilibria.

Pay-off matrix first stage

1/2	HG	HB	MB
HG	$\frac{(a-c)^2}{9} - x; \frac{(a-c)^2}{9} - x$	$\frac{(a-c+\theta)^2}{9} - x; \frac{(a-c-2\theta)^2}{9}$	$\frac{(a-c+\tau)^2}{9} - x; \frac{(a-c-2\tau)^2}{9} - k$
HB	$\frac{(a-c-2\theta)^2}{9}; \frac{(a-c+\theta)^2}{9} - x$	$\frac{(a-c-\theta)^2}{9}; \frac{(a-c-\theta)^2}{9}$	$\frac{(a-c+\theta-2\tau)^2}{9}; \frac{(a-c+\theta+2\tau)^2-k}{9} - k$
MB	$\frac{(a-c-2\tau)^2}{9} - k; \frac{(a-c+\tau)^2}{9} - x$	$\frac{(a-c+\theta-2\tau)^2}{9}; \frac{(a-c-2\theta+\tau)^2-k}{9} - k$	$\frac{(a-c-\tau)^2}{9} - k; \frac{(a-c-\tau)^2}{9} - k$

Table: Matrix 1. Firms' net profits with emission tax.

Solved by backward induction: SPNE.

Figure: Equilibrium actions in stage 1 with a tax
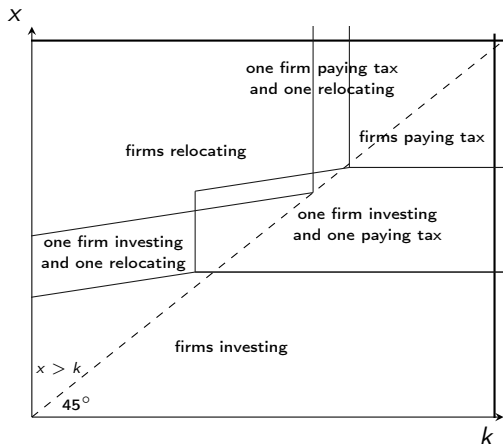
Main results:

- All strategies are an equilibrium for $\{x; k\}$.
- Asymmetric equilibrium in a symmetric game.
- Win-win solution though $x > k$.

Pay-off matrix first stage

1/2	HG	HB	MB
HG	$\frac{(a-c)^2}{9} - x; \frac{(a-c)^2}{9} - x$	$\frac{(a-c-e)^2}{4} - x; \frac{e(a-c-e)}{4}$	$\frac{(a-c+\tau)^2}{9} - x; \frac{(a-c-2\tau)^2}{9} - k$
HB	$\frac{e(a-c-e)}{2}; \frac{(a-c-e)^2}{4} - x$	$e(a-c-2e); e(a-c-2e)$	$\frac{e(a-c-e+\tau)}{2}; \frac{(a-c-e-\tau)^2 - k}{4} - k$
MB	$\frac{(a-c-2\tau)^2}{9} - k; \frac{(a-c+\tau)^2}{9} - x$	$\frac{(a-c-e-\tau)^2}{4} - k; \frac{e(a-c-e+\tau)}{2} - k$	$\frac{(a-c-\tau)^2}{9} - k; \frac{(a-c-\tau)^2}{9} - k$

Table: Matrix 1. Firms' net profits with standard.

Solved by backward induction: SPNE.

Figure: Equilibrium actions in stage 1 with a standard
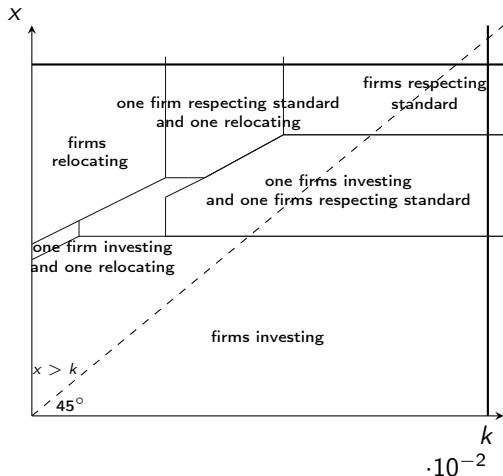
- Similarity with tax case
- Win-win solution though adverse conditions
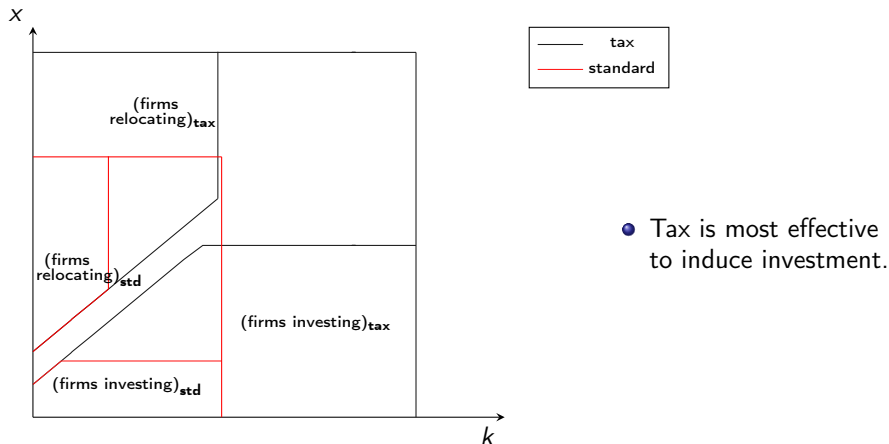
Figure: Equilibrium comparison for each policy

- Tax is most effective to induce investment.

Conclusion and upcoming developments

Environmental policy can encourage green investment and discourage relocation:

- In a full symmetric framework, there are asymmetric equilibria
- Win-win equilibrium can arise in apparently adverse conditions.
- A tax renders a «win-win» solution more often than a tax, but also more incentives to relocate.

As upcoming developments

- Complete the comparison of the possible equilibria taking into account also the asymmetric ones.

Thank you for your attention!