

Equilibrium Pollution Taxes in Open Economies with Imperfect Competition

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Introduction

- Opposition to trade liberation
- Possible Strategic Distortion of Environmental Policies
- Lower Environmental Standards
- Competitive Advantage
- Strategic distortions can operate in the opposite direction
- This paper examines the strategic incentives to distort pollution taxes in free-trading economies.

Assumptions

- Imperfect Competition among producers
- Tax choice game is modeled explicitly
- Transboundary pollution

- Two Identical Countries
- x polluting homogeneous good
- Symmetric oligopolistic industry with n firms
- Sunk Cost
- The $2n$ firms compete freely in the two markets
- MPC is θ
- y_i output by a representative firm in country i
- y_i^H and y_i^F
- Y_i total production by country i
- Pollution $Z_i = (Y_i/\theta_i)$
- $\alpha \in [0, 1]$ a fraction of this pollution affects other countries
- Environmental damage: $e_i = e(Z_i + \alpha Z_{-i})$
- The inverse demand for x in each country is $p(X_i)$

Efficient Pollution Taxes

- The planning problem is to set the taxes to maximize global welfare
- Efficient taxes are not first-best
- Industry Equilibrium when all firms face the same tax rate

The problem for the representative firm based in country i is

$$\max_{y_i^H, y_i^F, \theta_i} p(X_i)y_i^H + p(X_{-i})y_i^F - \theta_i y_i - \tau(y_i/\theta_i),$$

- F.O.C:

$$p + yp'/2 = (\theta + \tau/\theta)$$

$$\tau/\theta^2 = 1,$$



$$\begin{aligned} W &= \left[\int_0^X p(\bar{X}) d\bar{X} - pX \right] + [pX - 2tX] + \tau X/t - e((1 + \alpha)X/t) \\ &= \int_0^X p(\bar{X}) d\bar{X} - tX - e((1 + \alpha)X/t), \end{aligned} \quad (8)$$

$$[p - t](\partial X/\partial t) - X = (1 + \alpha)e'[t(\partial X/\partial t) - X]/t^2$$

- RHS is the marginal global damage
- LHS is the marginal abatement cost [(1) welfare cost of the reduce output and (2) increased mg cost of production]
- PCM: $t^2 = e'(1 + \alpha)$

- Taxes rates affect production (foreing and domestic)
- Industry equilibrium

$$p = (t_i + t_{-i}) - Xp'/2n.$$

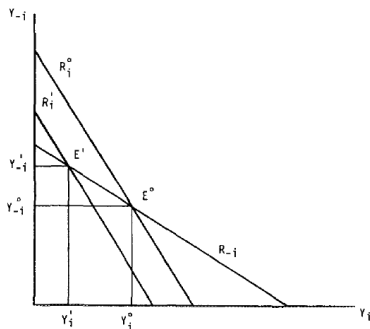


FIG. 1. The effect of a unilateral tax increase by country i .

- Game between National governments:

$$W_i = \left[\int_0^X p(\tilde{X}) d\tilde{X} - pX \right] + [pY_i - t_i Y_i] - e(\alpha Y_{-i}/t_{-i} + Y_i/t_i). \quad (17)$$

It is instructive to rewrite this expression for welfare as

$$W_i = \left[\int_0^X p(\tilde{X}) d\tilde{X} - t_i X \right] + [p - t_i][Y_i - X] - e(\alpha Y_{-i}/t_{-i} + Y_i/t_i). \quad (18)$$

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$$\begin{aligned} \partial W_i / \partial t_i |_{t^*} &= (p - t^*) [(\partial Y_i / \partial t_i) - (\partial X / \partial t) |_{t^*}] \\ &\quad - e' [(\partial Y_i / \partial t_i) + \alpha (\partial Y_{-i} / \partial t_i) - (\partial X / \partial t) |_{t^*}] / t^* \\ &\quad + \alpha e' [t^* (\partial Y / \partial t) |_{t^*} - Y^*] / (t^*)^2, \end{aligned}$$

- Transboundary externality effect and rent capture effect

- The rent can be viewed as compromising two parts

$$[p - t_i][Y_i - X] = [p - 2t_i][Y_i - X] + t_i[Y_i - X].$$

- (1) Profits from net exports and (2) tax revenue earned on net exports
- Two effects:

$$RCE = -(p - t^*)(\partial Y_{-i}/\partial t_i)|_{t^*}.$$

$$PSE = e'(1 - \alpha)[(\partial Y_{-i}/\partial t_i)|_{t^*}]/t^*.$$

TABLE I
 The Direction of Distortions from Efficiency

Effect	Imperfect competition			Perfect competition		
	$\alpha = 0$	$0 < \alpha < 1$	$\alpha = 1$	$\alpha = 0$	$0 < \alpha < 1$	$\alpha = 1$
Rent capture	—	—	—	—	—	—
Pollution shifting	+	+	0	+	+	0
Net strategic Transboundary pollution	—	—	—	0	—	—
Overall	—	—	—	0	—	—

- There are strategic incentives to distort pollution taxes under free trade and benefits of free trade are unlikely to be fully realized in the absence of an accompanying agreement.