“Climate Policy, Carbon Leakage, and Competitiveness: How Might Border Tax Adjustments Help?”

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AAEA Annual Meetings, Pittsburgh, PA, July 23-26, 2011

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Trade and Climate Policy

With no international carbon price, domestic climate policy may affect *competitiveness* of domestic firms

Non-universal application of climate policies also creates potential for *carbon leakage*

Carbon taxes with import tariffs (export subsidies) on traded goods solution to free-riding (Hoel, 1996)

Switch from *origin* to *destination* based taxation system may be *neutral* – principle reflected in WTO/GATT rules on border tax adjustments (BTAs) (Lockwood and Whalley, 2010)

Competitiveness?

Competitiveness and carbon leakage often linked in policy debate, but former is harder to define

Typically thought of in terms of market share and/or firms' profits – a function of market structure, technology and behavior of firms (WTO/UNEP, 2009)

Analyze climate policy and BTAs in context of *strategic trade theory* and application to environmental policy (Barrett, 1994; Conrad, 1993)

Governments may have incentive to shift rents to firms via trade and environmental policies, accounting for tradeoffs between consumers, firms and climate

Which Industries?

Steel, aluminum, chemicals, paper and cement (Houser *et al*., 2009; Monjon and Quirion, 2010)

Carbon leakage already modeled in an oligopolistic setting for steel sector (Ritz, 2009) and cement sector (Ponssard and Walker, 2008)

Previous modeling by McCorriston and Sheldon (2005) treated environmental policy as exogenous in analyzing BTAs in oligopolistic setting

Adapt model of Conrad (1996) to examine extent to which BTAs can be targeted at competitiveness and carbon leakage issues in presence of carbon tax

Basic Model

Home firm facing foreign competitor in domestic market playing Nash game in either output (Cournot) or price (Bertrand)

Home government moves first, pre-committing to emissions tax *t* and border tax adjustment *b*

Price of environmental services function of tax on unabated emissions and unit abatement costs, i.e., environment treated as an input

Home firm minimizes unit costs of using environmental services such that in equilibrium marginal abatement costs equal emissions tax

Optimal Carbon Tax – Cournot Case

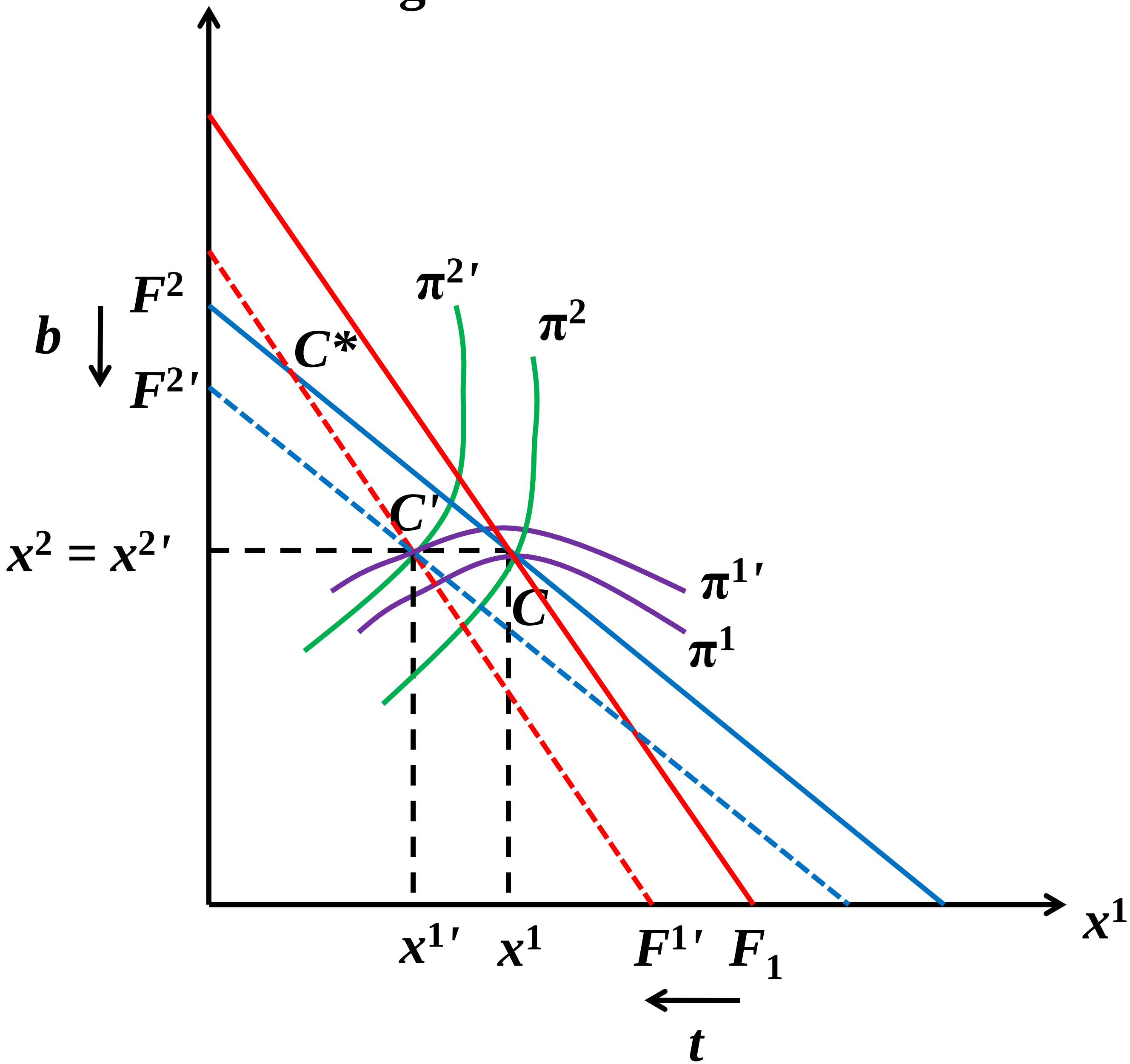
Objective function of home government:

$$max_t w(t) = \int_0^X p(\xi)d\xi - p(X)X + \pi^1(x^1, x^2; t) + t(1 - a^1)e^1 v^1 - d(U^1)$$

Optimal emissions tax:

$$\hat{t} = md^1 \left\{ 1 + \frac{1}{md^1(1-a^1)e^1 v_1^1 (dx^1 / dt)} \left[\frac{p}{\eta} \left(\frac{x^1}{X} \frac{dx^1}{dt} + \frac{x^2}{X} \times \frac{d(x^1 + x^2)}{dt} \right) + md^1 e^2 v_2^2 \frac{dx^2}{dt} \right] \right\}$$

Figure 1. BTA – Cournot Case



Optimal Carbon Tax – Bertrand Case

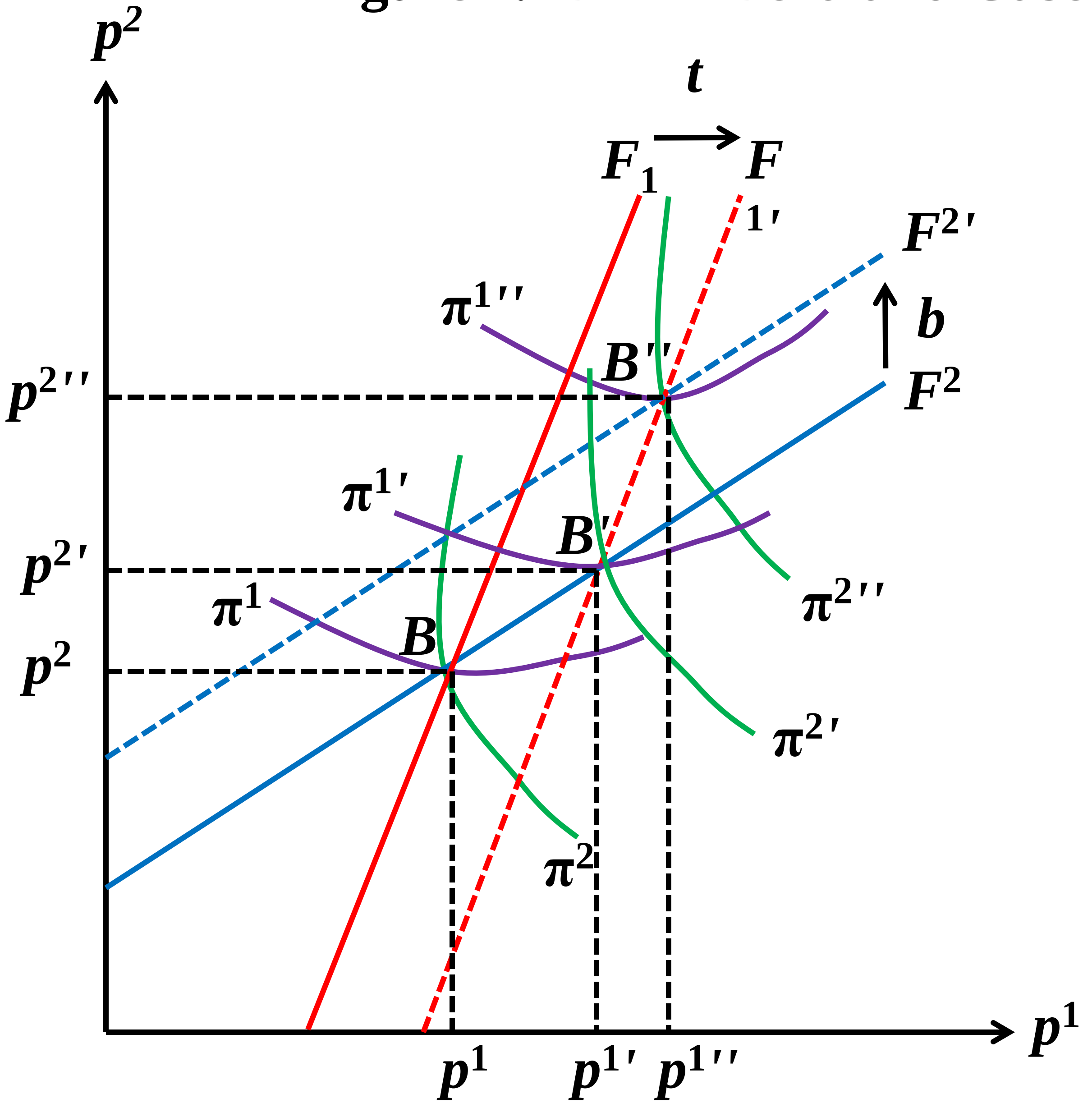
Objective function of home government:

$$\max_t w(t) = \int_{p^1}^{\bar{p}^1} [x^1(\xi, p^2) + x^2(\xi, p^2)] d\xi + \pi^1(p^1, p^2; t)$$
$$+ t(1 - a^1) e^1 v^1 - d(U^1)$$

Optimal emissions tax:

$$\hat{t} = md^1 \left\{ 1 + \frac{1}{md^1(1-a^1)e^1 v_1^1 (dx^1/dt)} \left[2\frac{\eta^{x^1 p^2}}{\eta^{x^1 p^1}} \frac{p^1}{p^2} \frac{dp^2}{dt} X + \frac{dp^1}{dt} X + md^1 e^2 v_2^2 \frac{dx^2}{dt} \right] \right\}$$

Figure 1. BTA – Bertrand Case



Conclusions

Optimal emissions tax adjusted in presence of BTA

With BTA, carbon leakage prevented under Cournot, and negative carbon leakage under Bertrand

Competitiveness issue not resolved under Cournot with BTA, and facilitates collusion under Bertrand

Deadweight loss an issue in presence of emissions tax and BTA under Cournot and Bertrand

Need to extend model to vertical market structure with an intermediate input (electricity) also subject to emissions tax