Is There Anything New about Border Tax Adjustments and Climate Policy?

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In the current session of Congress, a climate change bill sponsored by Representatives Waxman and Markey was passed by the House in June 2009. [1] Part of this bill contains clear language that, in the absence of any multilateral agreement on greenhouse gas (GHG) emissions, the US should unilaterally implement border adjustments such as “carbon tariffs” for US domestic climate policy. The extent of interest from policymakers, the media, and other observers, might lead one to believe that border adjustments for domestic climate policy are a novel regulatory issue.

Whether this is actually the case is the subject of this article, its focus being on four related issues: first, concerns about competitiveness and carbon leakage are discussed in the context of the existing economics literature on trade and the environment; second, World Trade Organization (WTO) rules concerning the use of border tax adjustments (BTAs) are outlined; third, in light of the WTO’s position on trade neutrality and BTAs, some key results from previous economic analysis are laid out and discussed; and fourth, by way of conclusion, some specific issues are noted that add complexity to existing analysis of BTAs.

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Trade and Climate Policy

The inclusion of border measures in climate change legislation is predicated on two concerns: first, there will be a reduction in *competitiveness* of firms in industries most affected by domestic climate policies; second, there will be *carbon leakage*, i.e., energy-intensive industries will relocate to countries with less restrictive climate policies, thereby creating *carbon havens* and generating globally inefficient production of a global bad (WTO/UNEP 2009). Adapting Copeland and Taylor (2004), it is easy to show that concern about carbon leakage is simply a restatement of the pollution haven hypothesis.

Suppose there are two countries in the world, the US and China, the only difference between them being their factor endowments and their climate policies. In all other respects they are identical. Each produces two goods, *A* and *M* under constant returns, using physical capital *K* and human capital *H*. Good *A* is capital-intensive in production, while good *M* is human capital-intensive. In addition, production of good *A* generates GHG emissions *G*, production of good *M* being non-carbon intensive in production. Each country has *n* identical consumers who maximize utility, treating *G* as given. Preferences over *A* and *M* are homothetic, and the utility function is separable with respect to goods and the impact of *G* on climate. *G* can be regulated through a carbon tax τ.

Let the price of good *A* be *p*, and good *M* be the *numeraire*. Assuming perfect competition, and full employment of factors, the output of each good is given as:

(1) $$A = a(p, \tau, K, H)$$

(2) $$M = m(p, \tau, K, H).$$

Relative supply and demand analysis can be used to illustrate how carbon leakage might occur. Given the assumption about preferences, demand for A relative to M, denoted as RD, is independent of income, such that $RD(p) = f_a(p) / f_m(p)$ where $f_a{}'(p) < 0, f_m{}'(p) > 0$, and $RD'(p) < 0$, i.e., an increase in p results in a decrease in the demand for A relative to M. As the US and China are assumed identical, the relative demand curve is the same for each country. Given (1) and (2), and the assumption of constant returns, relative supply, RS, is written as a function of K/H and prices:

$$RS(p, \tau, K/H) = \frac{a(p, \tau, K/H, 1)}{m(p, \tau, K/H, 1)}, \tag{3}$$

where $RS'(p) > 0$, i.e., an increase in p results in an increase in the supply of A relative to M. RS will differ across the two countries depending on differences between relative factor endowments and climate policies.

Suppose that the US is relatively more human capital-abundant than China, $(K/H) < (K/H)^*$, (* referring to China), neither country having implemented climate policy. In figure 1, US and Chinese relative supplies are RS and RS^* respectively, China having a comparative advantage in producing the capital-intensive good A. With trade, the world price is p, where $RS^w = RD$, the US importing the carbon-intensive good, A from China, $A^c/M^c > A/M$, and China importing the non-carbon intensive good M from the US, $A^*/M^* > A^c/M^c$, (c referring to consumption in either country). This result captures the stylized facts - China is shifting to producing and exporting energy-intensive goods such as aluminum (Houser et al. 2008).

If the US introduces stringent climate policy compared to no policy in China, $\tau > \tau^*$ $= 0$, the US relative supply curve shifts up to $(RS)^{\tau}$, the new world price being $(p)^{\tau}$, where $(RS^{w})^{\tau} = RD$. As a result, production of A contracts in the US to $(A/M)^{\tau}$, and expands in China to $(A^*/M^*)^{\tau}$ (the competitiveness effect), with a concomitant increase in US imports and Chinese exports of A, carbon emissions increasing in China (carbon leakage) and declining in the US. Consequently, there is likely to be lobbying in the US for less stringent climate policy, unless action is taken to maintain the competitiveness of US production of A, and thereby prevent carbon leakage.

Bagwell and Staiger (2001) offer an interesting solution to this problem. Suppose the WTO/GATT consists of a two-stage tariff negotiation game between the US and China, where, before negotiations begin, existing climate policies of each country are noted. At the first stage of the game, bound tariffs are negotiated, implying a set of market access commitments by the two countries. At the second stage of the game, the two countries make unilateral changes to their mix of policies, providing that tariffs do not exceed their bound level, implied market access commitments being maintained.

What happens if the preferred choice of climate policy in the US affects its competitiveness, resulting in an increase in China's market access in energy-intensive goods? In order to maintain its negotiated market access commitments, it would need to raise tariffs on these products above their bound level, which it is unable to do under WTO/GATT rules. Bagwell and Staiger (2001) argue that resolution of this problem lies in providing more flexibility to the current rules by allowing countries to renegotiate their bound tariffs if unilateral changes in their climate policies increase market access.

Border Tax Adjustments and Trade Law

The preceding discussion indicates that the potential for climate policies to have a negative effect on competitiveness is already well-understood in the extant trade and environment literature, and that there is a theoretical argument for allowing adjustment of tariffs to account for such policies. However, the latter principle is already applied in WTO/GATT rules relating to BTAs for domestic excise taxes.

According to WTO/UNEP (2009), a *border tax* (or tariff) is imposed on imported goods while a *border tax adjustment* is the imposition of a domestically imposed excise tax on *like* imported goods. Essentially GATT Article II: 2(a) allows members of the WTO to place on the imports of any good, a border tax equivalent to an internal tax on the like good. However, under GATT Article III: 2, the BTA cannot be applied *in excess* of that applied directly or indirectly to the like domestic good, i.e., they have to be *neutral* in terms of their impact on trade, their objective being to preserve *competitive equality* between domestic and imported goods (WTO 1997). As a consequence, any country imposing a BTA in excess of the domestic tax would be in contravention of GATT Article III.

Initial discussion of the legal status of BTAs arose in the late-1960s when the US expressed concern that its exports to the then European Economic Community (EEC) were subject to an adjustment at the border for value-added tax (VAT), while at the same time VAT-free exports from the EEC were receiving an export subsidy. In the event, no dispute settlement case was initiated through GATT by the US, and there was no negotiation over the issue in the Tokyo Round. In synthesizing analysis of this issue, Lockwood, de Meza and Myles (1994) have shows that movement between an origin and a destination base for VAT would have no real effects on trade, production and consumption.

There is however debate among legal observers as to whether WTO/GATT rules will allow BTAs on specific final goods that embody energy inputs, much of the discussion focusing on the precise interpretation of the relevant GATT Articles (WTO/UNEP 2009). The language contained in GATT Article II.2 (a) is interpreted as restricting BTAs to inputs that are *physically incorporated* into the final good, thereby precluding their application to imported energy-intensive final goods. In contrast, the language contained in GATT Article III.2 is interpreted as allowing BTAs to be applied to *inputs* such as energy used in the production process of the final good. Claims of legal precedent for the latter appeal to the 1987 *Superfund* case involving the US, where a GATT Panel ruled that a BTA levied on imported substances that were the end-products of certain chemicals taxed in the US, was equivalent to the tax borne by like domestic substances, and therefore consistent with GATT Article III.2 (GATT 1987). [2] Ultimately, clarity on this issue can only be settled by a WTO Dispute Settlement Panel.

Trade Neutrality and Border Tax Adjustments

Mattoo et al. (2009) have provided some empirical estimates of the likely impact of BTAs by OECD countries, given a carbon tax designed to reduce emissions by 17% by 2020. Key to the analysis is the assumption concerning the basis for BTAs on final goods, with two choices being modeled: BTAs based *either* on (i) the carbon content embodied in final goods produced in the importing country, *or* (ii) the carbon content embodied in the imported goods, the latter option broadly matching provisions of the Waxman-Markey Bill. Given production in countries such as China is more carbon-intensive than in OECD countries, choice (ii) implies BTAs of up to 25%, with China's exports of energy-intensive goods forecast to fall by 43%. By contrast, choice (i) implies border tax adjustments ranging up to 8%, with China's exports of energy-intensive goods forecast to fall by 6%.

Clearly the basis for BTAs matters, especially if the objective is to prevent carbon leakage. However, WTO/GATT rules on BTAs are not motivated by environmental concerns, but instead are supposed to ensure trade neutrality. Therefore, it is critical in implementing such taxes, that account be taken of the factors influencing the extent to which, a carbon tax on an intermediate-good such as energy is passed through in the price of a final good such as aluminum. Incidence of the carbon tax will be a function of factors such as market structure, the shape of the demand curve for the final good, industry technology, and the nature of competition among firms producing the final good. In addition, the appropriate BTA may be sensitive to whatever the definition of trade neutrality relates to: the *volume* or *market share* of imports.

If both the intermediate and final goods markets are perfectly competitive, the appropriate treatment of imports of the final good is relatively straightforward: an import tax on the final good equal to the level of the carbon tax times the extent to which the intermediate good enters the cost function for the *domestic* final good, would raise marginal costs for the importer by the same amount, and consequently will have a neutral effect on imports of the final good.

Following Poterba and Rotemberg (1995), suppose a final good is supplied by US and Chinese firms under a constant to returns to scale technology, where inputs are labor L and an intermediate good, energy, E. US and Chinese wages are w and w^*, but there is an integrated world market for the intermediate good, its unit price being e, and if both US and Chinese firms supply the US market initially, then their prices are $p = p^*$. Given the technology, the cost function for US producers is $g(e,w)A$, where A is output and $g(.)$ is the unit cost function, and likewise for Chinese producers, $g^*(e,w^*)A^*$, and under perfect competition, final goods prices are equal to unit marginal costs, $p = g$ and $p^* = g^*$. Given the price of energy E is fixed at e, a US carbon tax τ raises its price to $e + \tau$, so that the associated change in marginal cost is $g_e(e,w)\tau = \left(E/A\right)\tau$, the derivative of total cost with respect to the energy input being equal to the demand for energy, implying $g_e(e,w)A = E$, so that rearranging gives $g_e(e,w) = E/A$. As a result, to raise the marginal costs of Chinese firms by as much as that for US firms requires a BTA of $\tau^\beta = (E/A)\tau$, i.e., the BTA is equal to the amount of the carbon tax times the average energy requirement of producing the domestic good.

In the case of energy supply and say aluminum production, it may be reasonable to assume that both markets are oligopolistic. As a result, taxing imported aluminum from China at the same level as the carbon tax imposed on US energy production may have a non-neutral impact on imports of aluminum (McCorriston and Sheldon 2005). Assume a symmetric duopolistic market structure, where a US firm (Chinese firm) chooses output $a(a^*)$ to maximize profits given the output choice of the other firm $a^*(a)$, the US firm purchasing energy inputs from an upstream duopolistic market, which is subject to a carbon tax. Assuming a constant returns downstream technology of one-to-one fixed proportions and a move structure where the US government initially commits to tax policies, the key result is that the size of the BTA relative to the carbon tax is sensitive to the definition of trade neutrality.

In figure 2, suppose US and Chinese aluminum are strategic substitutes, the initial Nash equilibrium being N. If a US carbon tax τ is imposed, the new Nash equilibrium at N^* results in the Chinese firm increasing both its output and profits at the expense of the US firm, i.e., there is a loss of competitiveness. However, in the case of import-volume neutrality, the combination of the carbon tax τ and BTA $\tau^{\beta\prime}$ shifts less output and profits away from the US to the Chinese firm. [3] The carbon tax shifts the US firm's reaction function from RF to RF', output falling to a', and the BTA shifts the foreign firm's reaction function from RF^* to $RF^{*\prime}$, the new Nash equilibrium being N', such that the Chinese firm's output remains at $a^* = a^{*\prime}$. However, even with a trade neutral BTA, the US firm still loses market share, and its profits fall to π', while the Chinese firm's profits increase to $\pi^{*\prime}$. It is important to note that the BTA is assumed to be less than the carbon tax. This is due to the carbon tax not being fully passed through by the US firm producing energy in terms of an increase in the energy costs of the US firm producing aluminum – a result that holds if the derived demand curve for energy is either linear or weakly convex.

For import-share neutrality, the new Nash equilibrium is N'', the combination of carbon tax τ and $\tau^{\beta\prime\prime}$ resulting in profits of the US firm increasing to π'', and the profits of the Chinese firm increasing to $\pi^{*\prime\prime}$, their market shares remaining constant along $a^*/(1-a)$.

This result is similar to that when import restrictions are defined in terms of market share (Denicolo and Garella 1999), except that it is the carbon tax and BTA, combined with import-share neutrality that "facilitates" collusion.[4] In terms of political economy, the US firm producing aluminum will lobby for trade neutrality to be defined in terms of market-share as it maintains its competitiveness, and increases its profits, while its Chinese competitor would prefer it to be defined in terms of market-volume where it maintains its competitiveness, and earns higher profits. From a broader welfare standpoint, there is also a trade-off between the benefits of reducing global production of GHGs and the loss to US consumers as firms act more collusively.

Conclusions

In this article, analysis has been presented relating to the impact of border tax adjustments for climate policy on the international competitiveness of energy-intensive industries, and the related problem of carbon leakage. The overall conclusion is that the economic and legal issues are not new. Climate policy, however, presents some possible twists to the analysis, including among others, the following: first, application of border measures is likely to be industry-specific creating the potential for relative price effects; second, for a destination-basis system of taxation to be trade neutral will require border adjustments for both imports and exports; third under a cap-and-trade system, distribution of emission allowances matters - with free allocation, there will be no carbon price on which to base a border adjustment, and even if a domestic carbon price can be generated through a trading scheme, it is likely to fluctuate over time, creating implementation problems for any border adjustment.

Notes

1. In 2009, a climate policy bill was also introduced into the US Senate by Senators Kerry and Boxer, which was recently dropped in favor of a new bill sponsored by Senators Kerry and Lieberman.

2. In 1989/90, a tax was imposed in the US of a range of chlorofluorocarbons (CFCs), and a BTA was also applied to the import of such chemicals, as well as the import of manufactured products that either contain CFCs or use them in their production process (Barthold 1994). To date no WTO ruling has been rendered on this BTA.

3. If the final goods are strategic complements, the Chinese firm would reduce its output in response to the US firm reducing its output. Consequently the appropriate border adjustment would be an import subsidy, which would most likely be politically infeasible.

4. This result also holds if the final goods are strategic complements.

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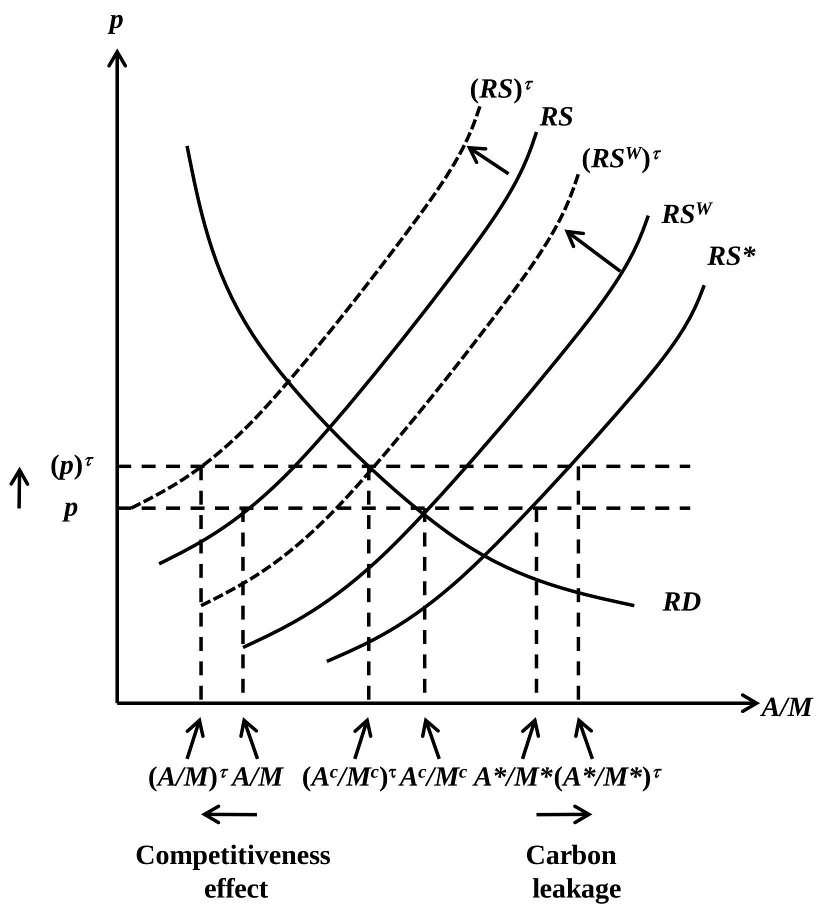

Figure 1. Carbon leakage

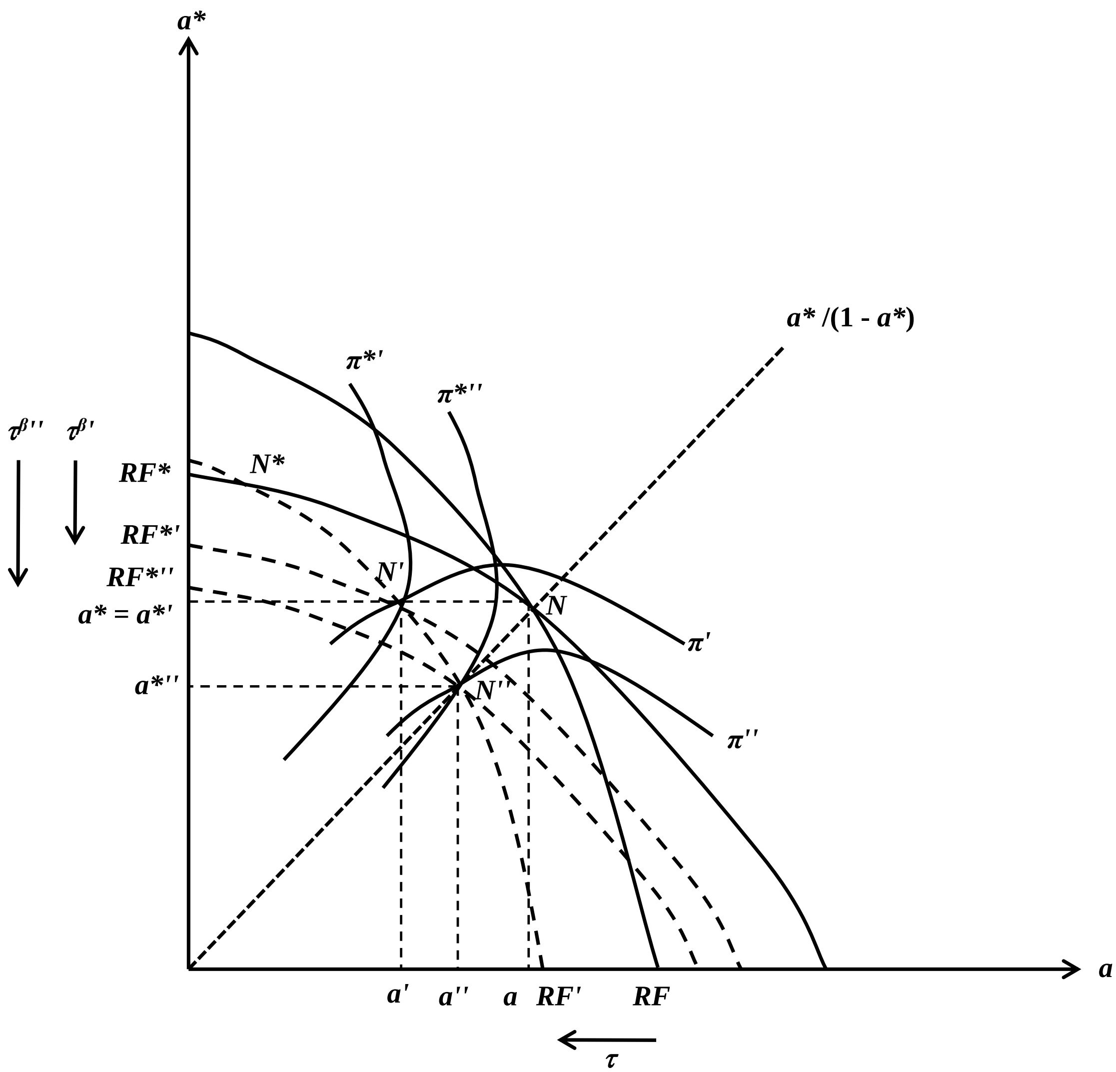

Figure 2. Neutral border tax adjustments