Optimal adjustment of environmental policy following agricultural trade liberalization

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Abstract
We use an extended partial equilibrium trade model to derive optimal environmental policy responses to tariff reduction requirements and assess the impact of such policies on the welfare of trading partners. We find that countries which attribute preferential political weights to farmers’ welfare have an incentive to implement environmental policies that deviate from the Pigouvian solution – even if production is not de facto linked to environmental externalities. We clarify the conditions under which trading partners do not gain from unilateral trade liberalization if trade concessions are accompanied by strategic environmental policy changes. We postulate a role for the WTO in overseeing the process of formulating domestic policies to further the multifunctional role of agriculture.
1. Introduction

Trade liberalization and environmental protection have become predominant issues affecting world agriculture at the beginning of this century. While the main goal of freer trade is to enhance international specialization, some countries are concerned that trade liberalization may conflict with non-trade policy objectives and thereby reduce social welfare. Such non-trade objectives include, *inter alia*, environmental protection and landscape preservation, food security, rural development or animal welfare. Some OECD countries argue that their agricultural sectors need to be supported in order to ensure the continuing delivery of such multifunctional, public-good type benefits (Potter and Burney 2002, Latacz-Lohmann and Hodge 2001). European countries emphasize the social functions of maintaining the cultural landscape, providing amenity goods, and safeguarding rural environmental capital (“the European Model of Agriculture”, Swinbank, 1999); Asian countries stress food security and rural viability as key side benefits of agriculture (JMAFF, 1999). Other countries have expressed concern that domestic policies to further the multifunctional role or agriculture might be used as a substitute for conventional border protection (Vasavada and Warmerdam 1998; Freeman and Roberts 1999; Blandford et al. 2003).

The appropriateness of domestic policies targeting non-trade objectives can be judged by their impact on domestic production and international trade flows (Hooker & Caswell 1999; Runge 1999; Latacz-Lohmann 2000). Anderson (2000) stresses that certain multifunctional aspects, such as food safety, food security or rural development are distinguishable from agricultural production and can therefore be detached from agricultural production. Problems arise when domestic policies promote non-commodity outputs which are jointly produced with agricultural commodity outputs, such as the maintenance of cultural landscapes (Hodge

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1 In this paper, we restrict our discussion to the *environmental* aspects of multifunctionality.
2000; Harte and O’Connell 2003). Such policies cannot, by their very nature, be trade-neutral. Edwards and Fraser (2001) propose that agri-environmental policy be evaluated on the basis of social benefit cost analysis and not on effects on production or trade volumes. They argue that any market or trade consequences of efficient, welfare-enhancing agri-environmental policies should not be considered trade-distorting. Such policies are considered “trade-correcting” by Latacz-Lohmann and Hodge (2001) because they efficiently internalize an externality, thereby correcting for a previously existing market failure. In practice, however, few agri-environmental policies are efficient. Policies may be poorly designed because of information deficiencies or asymmetries, or they may be distorted by governments seeking to support farmers’ incomes through policies accommodated within the WTO’s “green box”. The focus of this paper is on the latter aspect: we investigate optimal environmental policy responses to tariff reduction requirements and assess the impact of such policies on the welfare of trading partners. Several authors have shown that large countries have strategic incentives to institute environmental policies that deviate from the Pigouvian tax or subsidy, because they can take advantage of their monopolistic price leverage in the world market (Vandendorpe, 1972; Markusen, 1975; Krutilla, 1991; Rauscher, 1994 and Peterson et. al, 2002).  

We extend previous work by allowing for preferential political weights to be attributed to farmers’ welfare. The analysis thus captures equity considerations which have featured in many recent contributions to the literature on agricultural policy analysis (e.g. Bullock and Salhofer 2003; Gardner 1983, 1995; Paarlberg and Abbot 1986; Abbot and Kallio 1996). We demonstrate that countries which treat farmers’ welfare preferentially have an incentive to

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implement ‘distorted’ environmental policies – even if production is not *de facto* linked to environmental externalities. We then move on to assess the effects of such policy responses on domestic and global welfare. The welfare effects of trade liberalization and *strategic* environmental policy have so far only been studied by Burguet and Sempere (2003). This was within a framework of oligopolistic markets and was based on the restrictive assumption of constant marginal production costs. We extend Burguet and Sempere’s analysis by considering competitive (rather than oligopolistic) markets, allowing for non-constant marginal production costs, and, most importantly, by including political weights on farmer income. We argue that this extension better reflects the characteristics of agricultural markets and agri-environmental policy. We clarify the conditions under which trading partners do not gain from unilateral trade liberalization if trade concessions are accompanied by strategic environmental policy changes and derive conclusions for the WTO process.

The remainder of the paper is organized as follows. Section 2 sets out the model. In section 3 we derive optimal environmental policy responses to trade liberalization, i.e. environmental policy choices that maximize an individual country’s welfare. We then assess the impact on other nations’ welfare of unilateral tariff reductions, when these are accompanied by strategic changes in environmental policy. We first study the welfare economics of marginal trade policy changes (section 4), before considering the abolition of tariffs (section 5). Section 6 concludes.

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3 In the subsequent analysis, we term such policies “strategic” because they take advantage of a large country’s monopolistic price leverage in the world market at the costs of foreign trading partners.
2. The model

We choose a partial equilibrium trade model as the framework of analysis. The model consists of two large countries trading in a single homogeneous agricultural commodity. The advantage of a bipolar trade model is that global welfare effects can be assessed easily, on the assumption that the second country (Country 2) represents the ‘rest of the world’. The home country (Country 1) produces quantity $S_1$ at cost $c_i(s_i)$. Agricultural production in Country 1 generates an environmental externality. The monetary value of that externality is denoted $E_i(S_1)$. $(\partial E_i(s_i)/\partial s_i)$ is positive if the positive environmental effects of agricultural production (e.g. provision of landscape amenities or biodiversity) outweigh the detrimental impacts (e.g. pollution, soil erosion), but is negative otherwise. We assume the marginal social benefit from environmental improvements to be decreasing, and the marginal social cost from environmental degradation to be increasing. Hence, $\partial^2 E_i/\partial s_i^2 < 0$. We further assume that the externality is confined to Country 1 and does not spill over across national boundaries.

The agricultural commodity is also produced in the rest of the world (Country 2). However, in the interest of simplicity, production in Country 2 is assumed environmentally neutral. Country 1 can fix a tariff ($T$), introduce an environmental tax ($t$) or subsidy ($-t$) linked to production, or use a combination of the two. As noted above, these policy instruments are, by assumptions, only available to Country 1, implying that Country 2 is unable to respond to policy changes in Country 1. The home country’s supply $s_i(p_s)$ and demand $d_i(p_d)$ are
defined as functions of domestic supply and demand prices, respectively, whereas Country 2’s supply \( S_2(P_u) \) and demand \( D_2(P_u) \) are determined by the world price. We assume supply and demand curves to be well-behaved and non-concave. Hence, \( \partial S_1/\partial P_{D_1}, \partial S_2/\partial P_{w} > 0 \), \( \partial D_1/\partial P_{D_1}, \partial D_2/\partial P_{w} < 0 \) and \( \partial^2 S_1/\partial P_{D_1}^2, \partial^2 S_2/\partial P_{w}^2 \leq 0 \), \( \partial^2 D_1/\partial P_{D_1}^2, \partial^2 D_2/\partial P_{w}^2 \geq 0 \). Building upon these relationships, social welfare functions are defined for the home country and for the rest of the world. Country 1’s welfare \( (W_1) \) comprises consumer surplus, ‘producer benefit’, tax revenues, tariff revenues and the value of the environmental externality:\(^4\)

\[
W_1(t, T) = \int P_{D_1}(P_{D_1}) dP_{D_1} + \lambda \left( P_{S_1}(P_{S_1}) - C_1(S_1(P_{S_1})) \right) + t S_1(P_{S_1}) + T \left[ D_1(P_{D_1}) - S_1(P_{S_1}) \right] + E_1(S_1(P_{S_1})).
\] \hfill (1)

Distributional goals of agricultural policy are accounted for in expression (1) through differential political weights \( (\lambda) \) attached to agricultural producers’ benefits. The welfare function thus captures equity considerations which have featured in many recent contributions to the literature on agricultural policy analysis (e.g. Bullock and Salhofer 2003). Country 2’s social welfare function \( (W_2) \) comprises consumer surplus and producer benefit:\(^5\)

\[
W_2(t, T) = \int P_{D_2}(P_{D_2}) dP_{D_2} + P_u S_2(P_u) - C_2(S_2(P_u)).
\] \hfill (2)

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\(^4\) This is not to say that we advocate production subsidies or taxes for internalising multifunctional non-market effects. The provision of environmental public goods is best addressed by an agri-environmental policy targeting the supply of the desirable outputs. However, modelling such first-best policies requires one to have perfect knowledge of the transformation function mapping inputs (e.g. land management changes) into outputs (a vector of environmental attributes). Even if we knew this (complex) transformation function, incorporating it into our trade model would make the analysis intractable. Hence, abstracting from the complexity of first-best policy design, we model agri-environmental policy as a subsidy/tax linked to production. The optimal subsidy/tax rate is equal to the marginal social value/costs attached to the environmental effects.

\(^5\) We define the ‘producer benefit’ as the difference between total revenues and total costs, which differs from ‘producer surplus’ measuring the difference between total revenues and variable costs.

\( \bar{T}_{D_1} \) denotes the equilibrium domestic demand price.

\( \bar{T}_{w} \) denotes the equilibrium world price.
We assume Country 1 to be a net importer and Country 2 to be a net exporter and impose the trade equilibrium condition that excess demand in Country 1 equals excess supply in Country 2:

\[ D_1(P_h) - S_1(P_h) = S_2(P_w) - D_2(P_w) \]  \hspace{1cm} (3)

Transportation and transaction costs are neglected in the interest of simplicity. The margin between the home country’s demand price \( P_{h1} \) and the world price \( P_w \) is thus determined solely by the tariff rate. The differential between domestic supply \( (P_s) \) and demand prices is determined by the environmental tax/subsidy rate. We further assume perfect competition, implying that supply prices equal marginal production costs both at home and abroad:

\[ P_w = \partial C_1 / \partial S_1 = P_{h1} - T \hspace{1cm} \] 
\[ P_s = \partial C_1 / \partial S_1 = P_{h1} - t \]  \hspace{1cm} (4)

3. Optimal environmental policy response to trade liberalization

We begin by formally deriving the set of trade and environmental policies that maximizes Country 1’s welfare in the absence of international trade agreements. We term this the “first-best policy set” since it is derived under the assumption that Country 1 can make simultaneous use of the tax/subsidy and the tariff instruments in maximizing domestic welfare. It will serve as benchmark for assessing the welfare effects of trade liberalization and strategic environmental policies.

The first-order condition for an interior maximum is obtained by taking the partial derivatives of the domestic welfare function \( W_1 \) with respect to the tax and tariff rates, setting
these equal to zero and solving simultaneously \( \partial W_i/\partial t = \partial W_i/\partial T = 0 \). Taking this rule and applying the constraints in equations (3) and (4) to simplify the result, we obtain:\(^7\)

\[
\frac{\partial W_i}{\partial t} = \frac{\partial S_i}{\partial P_s} \frac{1}{\alpha + \beta} \left( \frac{\partial E_i}{\partial S_i} + t \left( \frac{-\partial D_i}{\partial P_s} + \beta \right) \right) \left( (\alpha + \beta) - \lambda \left( \frac{-\partial D_i}{\partial P_s} + \beta \right) \right)^{-1} S_i + \beta \lambda = 0 \tag{5}
\]

and

\[
\frac{\partial W_i}{\partial T} = \frac{\beta}{\alpha + \beta} \left( \lambda S_i - D_i \right) + \frac{(\alpha + \beta) X_i}{\beta} + \left( \frac{\partial E_i}{\partial S_i} \right) S_i - T \alpha = 0 \tag{6}
\]

where \( \alpha = \partial S_i/\partial P_s - \partial D_i/\partial P_s \), \( \beta = \partial S_i/\partial P_w - \partial D_i/\partial P_w \) and \( X_i = S_i - D_i \).

Simultaneously solving equation (5) and (6) yields:\(^8\)

\[
t^{**} = -\frac{\partial E_i}{\partial S_i} + (1 - \lambda) S_i \left( \frac{\partial S_i}{\partial P_s} \right)^{-1} \tag{7}
\]

and

\[
T^{**} = -X_i/\beta \tag{8}
\]

Equations (7) and (8) constitute the first-best policy set. Equation (8) shows that the first-best tariff \( T^{**} \) is identical to Bhagwati and Ramaswami’s (1963) optimal tariff of international trade theory. The optimal tariff is determined by Country 1’s trade flow \( X_i \) and the price responsiveness of foreign excess supply \( \beta \). As Country 1 is, by assumption, a net importer \( X_i < 0 \), its optimum tariff will be positive \( (T^{**} > 0) \), and it will increase with the country’s influence on the terms of trade.

The first-best environmental policy (equation 7) is the Pigouvian tax/subsidy rate \( -\partial E_i/\partial S_i \) if farmers’ benefits are attributed the same political weight as those of consumers and taxpayers \( \lambda = 1 \). However, if policy design is influenced by equity considerations \( \lambda \neq 1 \),

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\(^7\) For deriving equation (5) and (6) we make use of the requirements \( \partial X_i/\partial t = -\partial X_i/\partial t \) and \( \partial X_i/\partial t = -\partial X_i/\partial t \), which can be obtained from equation (3).
the environmental tax/subsidy rate deviates from the Pigouvian solution. Note that, by contrast, the tariff is not affected by either the environmental externality or political weights. Having established this benchmark, we now turn to the question of how the optimal environmental policy changes if Country 1 faces tariff reduction requirements. With a given tariff rate being imposed exogenously, the home country can only vary its environmental tax/subsidy rate to maximize its welfare. The second-best environmental tax/subsidy schedule \( t^*(T) \), denoted by one asterisk in the subsequent exposition, can be obtained by solving equation (5) for \( t \):

\[
t^*(T) = (1-\lambda)S_1 \left( \frac{\partial S_1}{\partial P_S} \right)^{-1} \frac{\partial E_1}{\partial S_1} + \left( X_1 + T\beta \left( \frac{\partial D_{St}}{\partial P_{St}} + \beta \right) \right)^{-1}
\]  

(9)

It is obvious from equation (9) that the second-best environmental policy deviates from the first-best solution in (7). However, because equations (7) and (9) are evaluated at different points, a direct comparison of first-best and second-best policies is difficult. We thus pursue a different route by analysing how marginal changes of the optimum tariff rate affect optimal environmental policy choices. This can be gauged by taking the derivative of equation (9) with respect to \( T \):

\[
\frac{\partial t^*(T^*)}{\partial T} = \frac{\beta}{(\alpha + \beta)} \left( 1-\lambda \right) \left( 1-S_1 \frac{\partial^2 S_1}{\partial P_S^2} \left( \frac{\partial S_1}{\partial P_S} \right)^{-2} - \frac{\partial^2 E_1}{\partial S_1^2} \frac{\partial S_1}{\partial P_S} \right) + \left( \frac{2\alpha\beta + \beta^2}{(\alpha + \beta)^2} \right) - \frac{X_1 \partial T}{\partial T} \left( - \frac{\partial D_{St}}{\partial P_{St} + \beta} \right)^{-1}
\]

(10)

Since \( \partial \beta / \partial T > 0 \), equation (10) assumes a positive value for \( \lambda \leq 1 \) and \( X_1 \leq 0 \), otherwise the sign is ambiguous. This suggests that a large importing country which attributes a low weight to farmers’ income (\( \lambda \leq 1 \)) has an incentive to reduce (increase) the environmental tax (subsidy) rate as it commits to tariff reductions. Conversely, if farmer income receives preferential treatment by policy makers (\( \lambda > 1 \)), as is the case in most countries emphasizing the multifunctional character of agriculture, there might be an incentive for those countries to

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8 See Appendix for the second-order conditions for an interior maximum.
tighten their environmental standards by increasing (lowering) the environmental tax (subsidy) rate as they commit to tariff reductions. This seems paradoxical, given that farmers would generally benefit from low (high) environmental taxes (subsidies). However, it is important to note that equation (10) considers the relative change of \( t \). Equation (9) indicates that the absolute value of the environmental tax (subsidy) rate will be generally lower (higher) the higher the political weight attached to farmer income. Notice also from expression (9) that, even if production is not linked to environmental externalities \( \partial E_i / \partial S_i = 0 \), a large country facing tariff reduction requirements may still introduce a production tax or subsidy which it may choose to label ‘environmental’, even if there are de facto no environmental externalities.

4. Welfare effects of marginal trade policy changes

Having established optimal environmental policy responses to tariff reductions, we now turn to the question of how trade liberalization affects Country 2’s welfare if Country 1 offers tariff concessions while simultaneously adjusting its environmental policy. We begin by considering marginal trade policy changes before moving on, in the next section, to a consideration of full trade liberalization involving abolishment of tariffs.

A welfare improvement in the rest of the world (Country 2) as a result of unilateral trade liberalization requires the marginal welfare change induced by a tariff increase to be negative \( \left( dW_2(t^{**},T^{**})/dT < 0 \right) \), given that Country 1 is a net importer \( (X_1 < 0) \) and operates a positive tariff \( (T^{**} > 0) \). Taking the total differential of Country 2’s welfare function, we obtain:

\[
\frac{dW_2(t^{**},T^{**})}{dT} = \frac{\partial W_2(t^{**},T^{**})}{\partial T} + \frac{\partial W_2(t^{**},T^{**})}{\partial t} \frac{dt}{dT} .
\]
Since the first-order condition for a domestically optimal environmental policy remains unchanged as Country 1 gradually opens up to freer trade, the derivative $d t / d T$ can be derived from the equality condition:

$$
\frac{\partial W_1(t^{**}, T^{**})}{\partial t} = 0
$$

(12)

Taking the total differential of equation (12), we obtain:

$$
\frac{dt}{dT} = -\frac{\partial^2 W_1(t^{**}, T^{**})}{\partial T \partial t} / \frac{\partial^2 W_1(t^{**}, T^{**})}{\partial t^2}.
$$

(13)

Substituting (13) into (11) yields:

$$
\frac{dW_2(t^{**}, T^{**})}{dT} = \frac{\partial W_2(t^{**}, T^{**})}{\partial t} - \frac{\partial W_1(t^{**}, T^{**})}{\partial t} \frac{\partial^2 W_1(t^{**}, T^{**})}{\partial T \partial t} / \frac{\partial^2 W_1(t^{**}, T^{**})}{\partial t^2}.
$$

(14)

The partial derivatives of $W_2$ with respect to $t$ and $T$ can be obtained from equation (2), given the constraints in equations (3) and (4):

$$
\frac{\partial W_2}{\partial t} = -\frac{\partial S_1}{\partial P_i} \frac{X_1}{(\alpha + \beta)}
$$

(15)

and

$$
\frac{\partial W_2}{\partial T} = \frac{\alpha X_1}{(\alpha + \beta)}
$$

(16)

Making selective use of equations (3), (4), (7), (8), (15), (16), equation (11) can be rearranged as:

$$
\frac{dW_2(t^{**}, T^{**})}{dT} = \frac{\frac{\partial D_1}{\partial P_i} X_1 (\varphi + (1 - \lambda) \phi)}{\left(-\frac{\partial D_1}{\partial P_i} + \beta \left[\frac{\partial S_1}{\partial P_i} \right]^2 \frac{\partial^2 S_i}{\partial P_i^2}\right) + \frac{X_1}{\beta} \frac{\partial \beta}{\partial t} (\alpha + \beta) + \beta \frac{\partial S_1}{\partial P_i}}
$$

(17)

where $\phi = \left(\frac{\partial D_1}{\partial P_i} + \beta \left[1 - S_1 \left(\frac{\partial S_1}{\partial P_i} \right)^2 \frac{\partial^2 S_i}{\partial P_i^2}\right]\right) > 0$ and $\varphi = \alpha + \beta - \frac{\partial S_1}{\partial P_i} \left(-\frac{\partial D_1}{\partial P_i} + \beta \right) \frac{\partial^2 E_i}{\partial S_i^2} > 0$.
Assuming supply and demand curves to be well-behaved and convex, then $\partial \beta / \partial t < 0$. This given, equation (17) assumes a negative value for any $X_1 < 0$ and $\lambda \leq 1$, but the sign of (17) is ambiguous for any $\lambda > 1$. This formally proves the proposition that trading partners will unambiguously gain from unilateral trade concessions if and only if the country offering these concessions does not attach a higher weight to the welfare of domestic producers than to that of groups in society. This finding holds even if the country acts strategically in setting its domestic policies following trade liberalization. If however farmers’ welfare does attract a preferential weight ($\lambda > 1$), as is the case in most countries favouring multifunctional agriculture, trade concessions do not necessarily enhance the welfare of trading partners if these concessions are accompanied by strategic environmental policy changes.

5. Welfare effects of full trade liberalization

We now turn to assess the welfare effects of discrete (rather than marginal) trade policy changes. How does abolishment of tariff policy in Country 1 affect the rest of the world’s welfare? We begin by assuming that Country 1 faced no trade policy restrictions and acted strategically in setting its trade and environmental policies. The first-best policy set $(T^{**}, t^*)$ derived in section 3 thus represents the appropriate benchmark. We denote Country 2’s resultant welfare $w_2^{**,**} = W_2(t^*, T^{**})$. After a tariff ban $(T^* = 0)$, Country 1 has an incentive to adjust its environmental tax/subsidy rate to $t^*(T^*)$, leaving Country 2 with welfare $w_2^{*,*} = W_2(t^*(T^*), T^*)$. The welfare implications for Country 2’s can thus be written as:

$$w_2^{*,*} - w_2^{**,**} = \int_{T^*}^{T^{**}} \left[ \frac{\partial W_2(t^*(T^*))}{\partial t} dt + \frac{\partial W_2(t^*(T^*))}{\partial T} dT \right]$$

For solving the integrals in (18) one needs to specify the functional form of supply, demand and environmental externality relationships. For mathematical convenience, we choose linear demand and supply functions. We further assume a constant relationship between
marginal environmental quality and domestic supply changes.\(^9\) Making selective substitutions of expressions (15) and (16), expression (18) can be rearranged as:

\[
W_2^{*\rightarrow o} - W_2^{*\rightarrow *\rightarrow o} = \frac{X_i(t^*, T^*)^2 - X_i(t^{**}, T^{**})^2}{2\beta} \quad (19)
\]

Given the linearity assumption for demand and supply functions, we can write

\[
X_i^{*} - X_i^{**} = \frac{\partial X_i}{\partial t}(t^*(T^*) - t^{**}) + \frac{\partial X_i}{\partial T}(T^* - T^{**}) \quad (20)
\]

where \(X_i^{*} = X_i(t^*, T^*)\) and \(X_i^{**} = X_i(t^{**}, T^{**})\)

and

\[
S_i^{*} - S_i^{**} = \frac{\partial S_i}{\partial t}(t_i^*(T^*) - t^{**}) + \frac{\partial S_i}{\partial T}(T^* - T^{**}) \quad (21)
\]

where \(S_i^{*} = S_i(t^*, T^*)\) and \(S_i^{**} = S_i(t^{**}, T^{**})\).

Making use of equations (3), (4), (20), (21) and the mathematical expressions for \(T^{**}, T^o, t^*(T^o)\) and \(t^{**}\), we obtain:

\[
X_i^{*} = \left(\beta(1 - \lambda)(S_i^{*} - S_i^{**}) + (2\alpha + \beta)X_i^{**}\right)^{-1}\left(\frac{\partial D_1}{\partial P_s} + \beta \right) \left(\frac{\partial D_1}{\partial P_s} - \alpha + 2\alpha\beta + \beta^2\right)^{-1} \quad (22)
\]

and

\[
S_i^{*} - S_i^{**} = \frac{\partial S_i}{\partial P_s}\left(X_i^{**} - X_i^{*}\right)^{-1}\left(\alpha + \beta\right) \left(1 - \lambda\right) \left(\frac{\partial D_1}{\partial P_s} + \beta\right)^{-1} \quad (23)
\]

Substituting (22) and (23) into equation (19) yields:

\(^9\) Although demand functions are more likely to be convex than linear, they have been used in theoretical studies by, among many others, Rhode and Stegeman (2000), Tanaka (2001), Rath and Zhao (2001) and Gonzalez-Maestre and Lopez-Cunat (2001).
where \( \sigma = \left( \alpha + (\alpha + \beta) \beta \left( -\frac{\partial D_1}{\partial P_{\lambda_1}} + \beta \right)^{-1} \right) > 0 \).

Expression (24) shows that the difference in Country 2’s welfare following a tariff ban in Country 1, \( W^{w} - W^{w} \), is unambiguously positive if \( \lambda \leq 1 \). Thus, provided that no preferential weights are attributed to farmers’ welfare, a tariff ban will unambiguously enhance trading partners’ welfare, even if a country acts strategically in setting its domestic policies following trade liberalization. We have thus formally proven that, given \( \lambda \leq 1 \), an optimal tariff policy is generally more trade distorting than strategically distorted environmental policies. This is plausible because social welfare gains for one country, through terms of trade improvements, are generally achieved at the expense of welfare losses for the rest of the world. Such terms of trade improvements are maximized by an optimal tariff.

The more interesting finding, however, is that the direction of welfare change in Country 2 following a tariff ban by Country 1 is generally ambiguous if Country 1 attaches preferential political weights to farmers’ welfare. This is in accordance with the findings in the previous section which considered marginal tariff reductions. We can thus conclude with confidence that trade concessions on highly protected agricultural markets in large industrial countries do not necessarily enhance the welfare of trading partners if these countries are free to distort their environmental policies. This conclusion holds under the proviso that the country opening up to trade had previously operated an optimal tariff as per equation (8), which may or may not be an appropriate reflection of reality.
6. Conclusions

We have derived optimal environmental policy choices in response to tariff reduction requirements and have assessed the impact of such policies on the welfare of trading partners. The analysis was based on a partial-equilibrium trade model which allowed for differential political weights to be attributed to farmers’ welfare. The study was motivated by the ongoing debate about the multifunctional role of agriculture and fears expressed in that debate that countries might use multifunctionality as a pretext for introducing trade-distorting domestic policies as a substitute for conventional border protection.

Our analysis suggests that such allegations may be justified to the extent that countries which attribute preferential political weights to farmers’ welfare have an incentive to implement tax or subsidy schedules that substantially deviate from the Pigouvian solution. Environmental tax (subsidy) rates will be generally lower (higher) the higher the political weight attached to farmer income. More importantly, the incentive to implement such policies exists even if production is not *de facto* linked to environmental externalities.

Finally, we have proven that trading partners will unambiguously gain from unilateral trade concessions if and only if the country offering these concessions does not attach a higher weight to the welfare of domestic producers than to that of other groups in society. If, by contrast, the country offering trade concessions treats farmers’ welfare preferentially, as is the case in most countries supporting the concept of multifunctional agriculture, trade liberalization does not necessarily enhance the welfare of trading partners if these concessions are accompanied by strategic domestic policy changes. These findings do not conflict with Edwards and Fraser’s (2001) proposition that any market or trade consequences of efficient, welfare-enhancing agri-environmental policies should not be considered trade-distorting. We argue that such ideal policies are unlikely to be forthcoming in practice.
Countries opening up to free trade have an incentive to institute distorted policies, which are not necessarily welfare-enhancing.

Two policy conclusions flow from these findings. First, if a country does not necessarily gain from tariff concessions offered by another country which is free to adjust its domestic environmental policies, the country should negotiate package deals, i.e. tariff reductions combined with domestic policy commitments. One may postulate a role for the WTO to oversee the process of domestic policy formulation to ensure that the gains from trade liberalization are not impaired by strategically motivated adjustments to domestic policies. This postulate is reinforced by the second conclusion: Given the incentive to implement domestic policies even if there are de facto no externalities, it seems important that the WTO establishes guidelines for distinguishing genuine policy from disguised protectionism. This may not be an easy task given that the level of demand for environmental, and particularly multifunctional, benefits is difficult to measure. Latacz-Lohmann and Hodge (2001) suggest that the level of activity (membership, budget, etc.) of non-government organizations may provide evidence of legitimate concern for some issues. Non-market valuation may also have a role to play in this process, although it cannot be sufficiently reliable and encompassing to offer the sole basis for judgement. Furthermore, domestic policies should have clearly defined objectives and should be targeted to achieve the stated objectives. We concur with Edwards and Fraser (2001) that the Green Box is the appropriate place in which to locate efficient domestic policies to enhance the multifunctional role of agriculture. The challenge will be to tell them apart from disguised protectionism.
References


Appendix: Second-order conditions for the first-best policy set

\[
\frac{\partial^2 W(u^*, T^*)}{\partial t^2} = -\frac{\partial S_i}{\partial P_s} \frac{1}{(\alpha + \beta)^2} \left\{ \alpha + \beta - \frac{\partial S_i}{\partial P_s} \left( -\frac{\partial D_i}{\partial P_s} + \beta \right) \frac{\partial^2 E_i}{\partial S_i^2} \right\} < 0
\]

(a)

\[
\frac{\partial^2 W(u^*, T^*)}{\partial T^2} = \frac{\partial^2 W_t(u^*, T^*)}{\partial T^2} - \frac{\partial^2 W_t(u^*, T^*)}{\partial T \partial t} < 0
\]

(b)

\[
\frac{\partial^2 W(u^*, T^*)}{\partial t \partial t} > \frac{\partial^2 W_t(u^*, T^*)}{\partial T \partial t}
\]

(c)

\[
\frac{\partial^2 W(u^*, T^*)}{\partial T \partial t} = \frac{\beta}{(\alpha + \beta)} \left\{ \frac{\partial S_i}{\partial P_s} \frac{\alpha X_i}{\beta} + \frac{1}{(\alpha + \beta)} \left( -\frac{\partial D_i}{\partial P_s} + \beta \right) \frac{1}{\frac{\partial^2 E_i}{\partial S_i^2}} \frac{\partial S_i}{\partial P_s} \right\}
\]

(d)