Economics Bulletin

Volume 41, Issue 1

One for All, All for One? Unilateral Policy Choices Reconsidered

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Abstract

Global pollution emissions can, and, may, hinder bilateral trade liberalization. Recognizing the urgency of responding to climate change and trade protections, this paper presents a policy rule unilaterally introduced by "large" nations. I call it the environmental preservation rule. Specifically, domestic taxes and trade taxes are used together to contain the increase in Home consumption pollution. Doing so reduces pollution emissions abroad while increasing market access. This rule helps countries exit from excessive regulation and is good for the climate.

I would like to thank an anonymous referee for helpful comments on an earlier version of this paper.
Citation: Takumi Haibara, (2021) "One for All, All for One? Unilateral Policy Choices Reconsidered", *Economics Bulletin*, Vol. 41 No. 1 pp. 161-166
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Submitted: June 02, 2020. **Published:** March 10, 2021.

1. Introduction

The trade environmental linkage is a complex and multifaceted issue. The standard approach for dealing with this issue would be to implement multilateral trade and environmental rules. The reality is that the presence of contracting costs (see Horn et al. 2010) and distrust of global institutions constitute impediments to global agreements (think of US withdrawal from the Paris Agreement). Inevitably therefore, unilateral action is left to countries. The concern here is that environmental policies adopted in one country can increase pollution emissions in other countries—the phenomenon known as emission leakages. Another concern is that "large" countries may use domestic policies as a secondly trade barrier once border instruments are constrained. Staiger and Sykes (2011) show that importing nations have incentives to distort their consumption taxes to inefficiently high levels to manipulate the terms of trade and to reduce *domestic* pollution externalities[1]. The task of identifying excessive regulation is a difficult one, which is why disguised protections have long worried the World Trade Organization (WTO).

What is left unanswered by the analysis of Staiger and Sykes (2011) is whether and how *global* pollution externalities affect trade agreements. As will be seen, global pollution emissions can, and, may, hinder bilateral trade liberalization. Recognizing the urgency of responding to climate change and trade protections, this paper presents a policy rule unilaterally introduced by "large" nations. I call it the *environmental preservation rule*. Specifically, domestic taxes and trade taxes are used together to contain the increase in Home consumption pollution. Doing so reduces pollution emissions abroad while increasing market access. While there exists a substantial literature on small open economies with production pollution (see Neary (2006) and the literature cited therein), there also exist small open economy models with consumption pollution—e.g., Copeland (2011), Chao et al. (2012), Michael and Hatzipanayotou (2013), Michael et al. (2015), Metcalfe and Beghin (2015), Tsakiris et al. (2019). Krutilla (1991) incorporates consumption pollution into the large country model but abstracts from emissions leakage. None of these authors, though, identify mutually beneficial unilateral policies in large nations with global consumption externalities. The proposed rule helps these nations exit from excessive regulation and is good for the climate.

The remainder of this paper is as follows. Section 2 develops a simple general equilibrium trade model à la Dixit and Norman (1980). Section 3 examines the welfare effects of bilateral or unilateral tax changes. Section 4 concludes the paper.

2. The Model

Consider two "large" countries, a home and the foreign country (denoted as *), which trade two goods, good x and good y. The international relative price of good x is p (note that good y is the numeraire). It is assumed throughout the paper that good x generates pollution; whereas good y does not generate pollution; and the home (foreign) country is the net importer (exporter) of good x. The behavior of a representative household is characterized by the expenditure function $E(p+\tau+t, r, u)$: r denotes global consumption pollution externalities; u denotes the utility level; $p+\tau+t$ represents a consumer price where τ is the consumption tax rate and t is the tariff rate. E_p gives the compensated demand function of good x, and $E_{pp}<0$; E_u equals the reciprocal of the marginal utility of income. The partial derivative of the expenditure function with respect to r ($E_r>0$) gives the household's marginal willingness to pay for pollution reductions (see Copeland 1994). Following the much of the literature,

[1] Relatedly, Levinson (2017) shows that the US automobile fuel economy standards are unfavorable to imported cars and constitute a form of disguised protectionism.

pollution and consumption are assume to be separable, i.e., $E_{pr}=0$; and all income effects fall on the numeraire good, i.e., $E_{pu}=0$.

The level of total consumption externalities is aggregate demand:

$$r=E_p(p+\tau+t,r,u)+E_p^*(p+\tau^*+t^*,r,u^*), \tag{1}$$

where $t^*<0$ represents the export tax imposed by the foreign country. I describe the production side of the economy as the revenue function $R(p+t)$: R_p denotes the output of good *x*, and $R_{pp}>0$.

The home country's budget constraint is as follows:

$$E(p+\tau+t,r,u)=R(p+t)+\tau E_p+tM_p, \tag{2}$$

where $M_p=E_p-R_p>0$ is the volume of import. The first right-hand side term of equation (2) is factor income from private production. The remaining terms indicate consumption tax revenue (τE_p) and tariff revenue (tM_p), respectively: all these revenues are returned to the household in a lump-sum fashion.

The foreign country's budget constraint is:

$$E^*(p+\tau^*+t^*,r,u^*)=R^*(p+t^*)+\tau^*E_p^*+t^*M_p^*, \tag{3}$$

where $M_p^*=E_p^*-R_p^*<0$ is the volume of export.

Finally, the equilibrium of the world demand for good *x* is as follows:

$$M_p(p,\tau,t,r,u)+M_p^*(p,\tau^*,t^*,r,u^*)=0 \tag{4}$$

Differentiating (2), (3) and (4) and using (1) to eliminate *dr* gives the following (see Appendix):

$$\Delta dp=-E_uE_{u^*}^*E_{pp}d\tau-E_uE_{u^*}^*M_{pp}dt-E_uE_{u^*}^*M_{pp}^*dt^*, \tag{5}$$

$$\begin{aligned}\Delta du=&E_{u^*}^*[\Lambda(\tau+t-E_r)E_{pp}+E_{pp}\Pi]d\tau+E_{u^*}^*\{[\Lambda(\tau+t-E_r)E_{pp}+E_{pp}\Pi]-R_{pp}(t\Lambda+\Pi)\}dt\\&+E_{u^*}^*(E_{pp}^*\Pi-\Lambda E_rE_{pp}^*-R_{pp}^*\Pi)dt^*,\end{aligned} \tag{6}$$

$$\begin{aligned}\Delta du^*=&E_u(E_{pp}\Pi^*-\Lambda E_r^*E_{pp})d\tau+E_u(E_{pp}\Pi^*-\Lambda E_r^*E_{pp}-R_{pp}\Pi^*)dt\\&+E_u\{[\Lambda(\tau^*+t^*-E_r^*)E_{pp}^*+E_{pp}^*\Pi^*]-R_{pp}^*(t^*\Lambda+\Pi^*)\}dt^*,\end{aligned} \tag{7}$$

where $\Delta=E_uE_{u^*}^*\Lambda<0^*$ is the determinant of the coefficient matrix. Eq. (6) indicates the welfare effects of changes in domestic and trade taxes. They are indeterminate in general. For instance, a cut in tariff worsens the home country's terms-of-trade and at the same time decreases Foreign pollution via increased *p* (i.e. negative emission leakages). The question then is which approach, unilateral trade liberalization or bilateral trade liberalization, is the appropriate one? To answer this question, consider the terms of trade agreement (i.e., $dp=0$) following Staiger and Bagwell (1999). From (5), we have:

$$\left.\frac{dt^*}{dt}\right|_{dp=0}=-\frac{M_{pp}}{M_{pp}^*} \tag{8}$$

where $dt^*/dt<0$ —here, $dt<0$ ($dt^*>0$) means tariff cuts (export tax cuts). Substituting (8) into (6) and (7) yields:

$$\Delta\left.\frac{du}{dt}\right|_{t-t^*}=\frac{E_{u^*}^*\Lambda[tM_{pp}M_{pp}^*+(E_rE_{pp}^*M_{pp}-E_rE_{pp}M_{pp}^*+\tau E_{pp}M_{pp}^*)]}{M_{pp}^*}, \tag{9}$$

$$\Delta\left.\frac{du^*}{dt}\right|_{t-t^*}=-\frac{E_u\Lambda[t^*M_{pp}M_{pp}^*+(E_r^*E_{pp}M_{pp}-E_r^*E_{pp}^*M_{pp}^*+\tau^*E_{pp}^*M_{pp}^*)]}{M_{pp}^*}. \tag{10}$$

We first consider the case of a "win-win" bilateral trade liberalization. This result holds under the assumption $E_{pp}^*M_{pp}-E_{pp}M_{pp}^*>0$. To understand why, recall that tariff cuts raise

consumption externalities whereas export tax cuts reduce these externalities[2]. If, for example, Foreign demand responses (supply responses) are greater (smaller) than Home counterparts (i.e., $\left|E^*_{pp}\right| > \left|E_{pp}\right|$ and $R_{pp} > R^*_{pp}$), then a reduction in consumption pollution emissions abroad dominates an increase in Home emissions. But that is not always the case. Bilateral trade liberalization generates a net increase in global emissions under the assumption $E^*_{pp}M_{pp} - E_{pp}M^*_{pp} < 0$. Here, a conflict of interest arises. If Home consumption tax is large enough (i.e., $\tau > E_r$)—say for terms of trade reasons—then bilateral liberalization improves Home welfare. The increased consumption tax revenue from tariff cuts are large enough to offset increased environmental damages. Foreign welfare falls with increased Home emissions. (Note that export tax cuts depress the world price and thereby help increase Home pollution externalities). It implies that emissions leakage could happen when bilateral trade liberalization occurs. Consider next the symmetric case $E^*_{pp}M_{pp} - E_{pp}M^*_{pp} = 0$: i.e., global pollution levels remain unchanged. Even in this special case, however, a conflict of interest arises when initial trade tax levels are negligible: a reduction in export taxes lower Foreign consumption tax revenue.

Thus, the presence of global pollution externalities is not driving the two countries in the same direction (i.e., trade tax cuts). This leads us to consider unilateral intervention. Consumption taxes alone entail emission leakages; whereas tariff cuts alone increase Home emissions and are harmful to the climate. How should design unilateral policies? One approach would be to adjust domestic and trade taxes to fix the volume of imports (i.e., pM_p)—commonly known as the *market access preservation rule* (see Staiger and Sykes (2011)). This approach requires to neutralize the terms of trade externality[3]. Hence, we have:

$$\left.\frac{d\tau}{dt}\right|_{dp=0} = -\frac{M_{pp}}{E_{pp}} < 0. \tag{11}$$

Substituting (11) into (6) and (7) yields:

$$\Delta\left.\frac{du}{dt}\right|_{t-\tau} = \frac{E^*_{u^*}\Lambda R_{pp}E_{pp}(\tau - E_r)}{E_{pp}}, \quad \Delta\left.\frac{du^*}{dt}\right|_{t-\tau} = \frac{-E_u\Lambda R_{pp}E_{pp}E_r}{E_{pp}}. \tag{12}$$

The welfare of the two countries rises under the assumption of $\tau < E_r$. To understand why, recall that τ distorts only the consumer margin, while t distorts both the producer and the consumer margin. Thus the magnitude of increased τ can be greater than that of decreased t to preserve p; i.e., there is thus a net reduction in pollution emissions, permitting a rise in Home and Foreign welfare. Fujiwara (2015) shows that the world price-fixing tariff-tax reform is welfare worsening because when a tariff is reduced, domestic consumption must be over-taxed so as to keep the world price constant. In the presence of global pollution externalities, however, domestic consumption is undertaxed or overtaxed, depending on the magnitude of marginal pollution damage. If consumption pollution is under-taxed (i.e., $\tau < E_r$), then a tariff-tax reform is mutually welfare improving. In the case of excessive taxation (i.e., $\tau > E_r$), Home welfare falls via a significant consumption tax revenue loss.

As an alternative approach is to neutralize Home pollution externalities. I call it the *environmental preservation rule*: domestic and trade taxes are delivered to preserve the level

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[2] From (1) and (9), we obtain: $\left.\frac{dr}{dt}\right|_{t-t^*} = -\frac{(E^*_{pp}M_{pp} - E_{pp}M^*_{pp})}{M^*_{pp}}$

[3] Let us define market access $M \equiv pM_p$ (see Kreickemeier and Raimondos-Møller 2008). Totally differentiating M keeping in mind that $dp = 0$ leads to: $dM = -p(E_{pp}d\tau + M_{pp}dt)$. Then we obtain (14) by $dM = 0$.

of Home dirty consumption[4]. Thus, unlike tariff cuts alone, all countries do not suffer from increased Home pollution externalities. Totally differentiating $\bar{x} = E_p(p+\tau+t,r,u)$ yields:

$$\left.\frac{d\tau}{dt}\right|_{dx=0} = -\frac{M^*_{pp}}{(M^*_{pp} - R_{pp})} < 0. \tag{13}$$

Compared to (11), the magnitude of increased τ can be smaller than that of decreased t. The reason: tariff cuts raise the world price and thereby attenuate the demand increase. Thus a small consumption tax rate will suffice to restore the original level of x. A net increase in p could be a result. From (13) and (5), we have:

$$\left.\frac{dp}{dt}\right|_{t-\tau} = \frac{-E_u \Lambda R_{pp} R^*_{pp} E_{pp}}{\Delta(M^*_{pp} - R_{pp})} < 0. \tag{14}$$

$$dr = \underbrace{E_{pp}dp + E_{pp}d\tau + E_{pp}dt}_{dx=0} + E^*_{pp}dp. \tag{15}$$

Home emission levels remain unchanged but the level of r falls—because increased p (from $dt < 0$) lowers emissions abroad. Of particular note, the level of global pollution emissions unambiguously goes down, unlike the previous case of bilateral trade liberalization. And unlike consumption taxes used in isolation, emissions leakage do not occur.

Now consider the welfare effects. From (13), (6), and (7) we have:

$$\Delta\left.\frac{du}{dt}\right|_{t-\tau} = \frac{-E^*_{u^*}\Lambda R_{pp}(E_r E^*_{pp} + M_p + tM^*_{pp})}{(M^*_{pp} - R_{pp})}, \tag{16}$$

$$\Delta\left.\frac{du^*}{dt}\right|_{t-\tau} = \frac{-E_u \Lambda R_{pp}[(E^*_r - \tau^*)E^*_{pp} + M^*_p - t^* M^*_{pp}]}{(M^*_{pp} - R_{pp})}. \tag{17}$$

Home welfare improves if environmental gains are large enough to dominate the terms of trade loss (i.e., $E_r E^*_{pp} + M_p < 0$). Note: gains from decreased climate change-induced infectious diseases are substantial. Foreign welfare rises under $\tau^* < E^*_r$ (recall that the consumption tax rate on the exported good tends to be very small). Summing up, we have the following proposition.

Proposition: *Suppose that marginal global pollution damages are very large in both countries. Then:*
(i) The market access preservation rule is mutually-welfare improving.
(ii) The environmental preservation rule is mutually-welfare improving if Home country prioritizes emissions reductions abroad over terms of trade gains.

The first part of the proposition contradicts the result of Fujiwara (2015), whereby a world-price fixing tariff-tax reform is welfare worsening. But the second part of the proposition does not conflict with this literature. Our results show that, contrary to conventional wisdom, the domestic government need not impose consumption taxes to undo the terms of trade loss from tariff cuts. This suggests that domestic policies do not necessarily become a secondary trade barrier when tariffs are lowered by trade agreements[5].

I do not attempt to rank the reforms reported in the proposition: rankings are circumstance-dependent (see Bhagwati and V.K. Ramaswami 1963). Remember: Home welfare falls with the market access preservation rule when (i.e., $\tau > E_r$). The environmental preservation rule assumes nothing regarding Home consumption tax levels: because this rule reduces Foreign pollution emissions while neutralizing Home consumption effects. Excessive regulation on

[4] This is an application of a consumption-neutral tax reform of Haibara (2012).
[5] Ederington (2010) provides a comprehensive review of an environmental policy as a secondary trade barrier.

Home dirty-good consumption need not occur under the environmental preservation rule.

Differentiating market access ($M \equiv pM_p$) we obtain:

$$\left.\frac{dM}{dt}\right|_{t-\tau} = M_p(1-\varepsilon)\left(\frac{dp}{dt}\right)_{t-\tau}, \tag{18}$$

where $\varepsilon = -pM_{pp}/M_p > 0$ (i.e., price elasticities). Unlike the market access preservation rule, M rises[6] when $\varepsilon < 1$. The environmental preservation rule can thus avoid protectionism. With this rule, trade liberalization policies adopted in one country mitigate emissions leakage—an important difference with Markusen (1975) and carbon border tax adjustments[7]. The proposed rule is especially helpful for developing countries vulnerable to a terms of trade deterioration and decreased market access (note that these countries are subjected to developed countries' environmental tariffs)[8]. The bottom line: unilateral policies, if well designed, are good for the climate and international trade.

3. Conclusions

Bilateral trade liberalization can increase global pollution externalities. This issue is not limited to one country but to all countries; i.e., "All for one" is neither appropriate nor possible. The environmental preservation rule implemented by one country unambiguously reduces global pollution emissions without jeopardizing—indeed, while improving—market access; i.e., "One for all" is possible. This rule is a win-win, helping importing countries exit from a "disguised barrier to trade" (i.e., excessive regulation on Home dirty-good consumption). The results obtained here may require some radical rethink of unilateral policy adjustments and are a timely intervention in the current debate about environmental trade restrictions and its causes (e.g., EU carbon border tax).

Appendix

$$\begin{bmatrix} E_u & 0 & \Pi \\ 0 & E^*_{u^*} & \Pi^* \\ 0 & 0 & \Lambda \end{bmatrix}\begin{bmatrix} du \\ du^* \\ dp \end{bmatrix} = \begin{bmatrix} (\tau + t - E_r)E_{pp} \\ -E^*_r E_{pp} \\ -E_{pp} \end{bmatrix} d\tau + \begin{bmatrix} (\tau + t - E_r)E_{pp} - tR_{pp} \\ -E^*_r E_{pp} \\ -M_{pp} \end{bmatrix} dt$$

$$\begin{bmatrix} -E_r E^*_{pp} \\ (\tau^* + t^* - E^*_r)E^*_{pp} \\ -E^*_{pp} \end{bmatrix} d\tau^* + \begin{bmatrix} -E_r E^*_{pp} \\ (\tau^* + t^* - E^*_r)E^*_{pp} - t^* R^*_{pp} \\ -M^*_{pp} \end{bmatrix} dt^*,$$

where

$\Pi = M_p + (E_r - \tau)E_{pp} + E_r E^*_{pp} - tM_{pp}$,

$\Pi^* = M^*_p + (E^*_r - \tau^*)E^*_{pp} + E^*_r E_{pp} - t^* M^*_{pp}$, and $\Lambda = M_{pp} + M^*_{pp}$.

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[6] A consumer-price tariff-tax reform increases market access in small open economies (see Kreickemeier and Raimondos-Møller (2008). This result holds in the presence of pollution externalities (see Chao et al. (2012). What has been lacking is a mutually beneficial tariff-tax reform in "large" economies with consumption pollution externalities.

[7] Keen and Kotsogiannis (2014) characterize the optimal trade and emission tax policy in large open economies with production pollution. Tsakiris et al. (2019) obtain the optimal trade and consumption tax policy in small open economies with consumption pollution. The optimal trade policy reflects the difference in the carbon tax (or the pollution per unit of consumption) between the two countries—so called Border Tax Adjustment (BTA) measures. The environmental preservation rule does not consider such differences, nor does it require trade restrictions.

[8] See Copeland (2012) on this point. He argues that export taxes or voluntary export restraints applied to carbon-intensive production in non-coalition countries may be preferable to environmental tariffs.

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