

Rules of Origin as Commercial Policy Instruments

by

Rod Falvey and Geoff Reed

Department of Economics
University of Nottingham
Nottingham HG7 2RD
United Kingdom

This paper examines the role of Rules of Origin as a commercial policy instrument which targets the input composition of imports. Using a three country, partial equilibrium structure, we demonstrate conditions under which the imposition of a binding Rule will be welfare improving for an importer facing either competitive export suppliers or an export monopolist. We also show that employing Rules of Origin in this way would be complementary to, rather than a substitute for, conventional optimal tariffs.

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I Introduction

The growth of international trade in goods that are not manufactured in a single country has brought into prominence the rules for determining the “origin” of traded products. Governments apply rules to determine the origin of products for two broad reasons. First, to distinguish foreign from domestic products, when imports are not to be granted national treatment. Second, to define the foreign origin of a product and the conditions under which it will be considered as originating in a preference receiving country (hence “preferential” rules). But rules of origin (ROOs) also have wider usage. They play a role in the application of laws relating to marking, labeling, and advertising; duty drawback provisions; government procurement; countervailing duty and safeguard proceedings; and quantitative restrictions, including import prohibitions and trade embargoes.

Where two or more countries have been involved in the manufacture of a product, the general concept applied in formulating ROOs is that the product has origin where the last “substantial transformation” took place¹. In practice there are three main methods of determining whether substantial transformation has occurred:

(1) The Value Added Test: which requires that the last production process has created a certain percentage of value added²;

(2) Change in Tariff Heading Test: which confers origin if the activity in the exporting country results in a product that is classified under a different heading of the customs tariff classification than its intermediate inputs³; and

¹ See Vermulst (1992) and Vermulst et.al. (1994) for a discussion of ROOs and their applications in the major developed trading economies from a legal perspective. Falvey and Reed (1997) consider their economic effects.

² Application of this test requires an analysis of production costs and generally takes one or more of three forms:

- (a) a maximum allowable percentage of imported parts and materials;
- (b) a minimum percentage of local value-added; or
- (c) a minimum percentage of originating parts relative to the total value of parts.

There are many variations between countries in the way this test is applied, and the same facts can lead to different origin determinations in different countries. Indeed there can be variations even within a country, depending on the objective of the law it is intended to implement.

(3) Technical Test: which sets out certain production activities that may (positive test) or may not (negative test) confer originating status⁴.

These tests can be applied singly or in combination, and administrative agencies may depart from these methods when origin is to be determined for reasons other than customs clearance (e.g. antidumping). The upshot is an international regime where governments have considerable discretion in setting ROOs, particularly preferential ROOs.

The interest of economists in ROOs is relatively recent, and has been prompted by the falling importance of MFN tariffs, their replacement by other (discriminatory) interventions, and the expansion of preferential trading arrangements. It has been argued that the manner in which ROOs are defined and applied within these arrangements will play a significant role in determining the protection that they confer and the degree to which trade is distorted as a consequence⁵. The economic analysis of ROOs has been relatively limited, however, particularly analysis within formal models. Partly this reflects a view that they have been relatively unimportant, partly it reflects the complexity of the structures required for their analysis, particularly in a general equilibrium context.

Much of the formal analysis has been concerned with *content protection*, investigating the effects of host government requirements that foreign firms use a certain proportion (measured by quantity or value) of host country inputs in their output in order for it to be sold on the host market. The positive and normative aspects of these policies have now been investigated in a variety of market structures⁶. There is also a literature on trade in *vertically related markets*, which explores the linkages between trade policies in final and intermediate goods markets, again allowing for competitive and imperfectly competitive market structures⁷. Both types of analysis involve the same range of agents as considered below - consumers, final goods producers and intermediate goods

³ This test has the advantages of simplicity and predictability, although the tariff classification system itself was not designed to distinguish “substantial transformations”.

⁴ This test is the best equipped to deal with any specific case, but is also the most easily abused.

⁵ See, for example, Krueger (1993), (1995) and Krishna and Krueger (1993).

⁶ See, for example, Grossman (1981), Dixit and Grossman (1982), Mussa (1984), Vousden (1987), Krishna and Itoh (1986), Davidson et. al. (1987), and Richardson (1991) and (1993).

⁷ See, for example, Spencer and Jones (1989), (1991) and (1992).

producers. The content protection literature is concerned with a policy that “protects” domestic intermediate producers at the expense of domestic consumers and domestic producers of the final good (if there are any). In vertically related markets the focus is the interactions of trade in intermediates and final goods, particularly where one firm or country is an exporter in both markets. In each case the importing country potentially trades both types of goods, and its policy-making authorities are in a position to impose the usual trade restrictions in both. The distinction here is that only the final good is imported by the country whose government is making the policy choice. Any trade in intermediates lies outside its jurisdiction.

Our objective in this paper is not further analysis of ROOs as supporting instruments within a particular policy framework (e.g. a free trade area). Rather it is to explore their potential role as an independent commercial policy instrument. The distinctive feature of ROOs in this respect is that they target the input composition of imported products. Our analysis addresses three main questions. What place, if any, is there for such an instrument in a nation’s commercial policy portfolio? Under what circumstances might an importing country use its ROO to raise domestic welfare? Is a ROO simply a second best alternative to optimal tariff(s), or does it have an independent and complementary role to play?

In adopting this approach we recognise that ROOs are not applied independently in practice, and we are not intending for our results to support any change in this direction. Our primary aim is to gain some understanding of how ROOs might operate (both on their own and in conjunction with optimal tariffs) in a broader context than has been examined to date. We do this through a relatively simple three country partial equilibrium model, involving two exporters of a good (countries 1 and 2) and a single importer (the home country). Production of this good requires an intermediate input and value-added. For simplicity we assume that the good is not consumed in the exporting countries and neither the final good nor the intermediate are produced by the importer. The ROO is then modeled as imposing a constraint on the national origin of the intermediate used with domestic value added in producing the final good. To show that our results are not dependent on a particular market structure, two forms of

competition in the world market are considered - competitive exporters and an export monopoly. One should note that our results do depend on increasing unit costs in the supply of all inputs, however. To the extent that this assumption is only appropriate for the short run this is a short run analysis.

In outline the remainder of this paper is as follows. The next section sets up the model and derives the optimal uniform and discriminatory tariffs. Section III then analyses the welfare effects of imposing a (just) binding ROO, both with and without tariffs. The final section presents our conclusions.

II Optimal Tariffs

II.1 *Competitive Exporters*

Consider the market for a homogeneous final commodity in which there are three participants - the “home” country which is a pure importer of the product and whose inverse demand function is $r(Q)$, where r denotes the consumer price of the product and Q is total consumption; and two pure exporters - countries 1 and 2. Units are chosen so that production of each unit of this product requires one unit of value added (q) and one unit of an intermediate input (x). This intermediate is also produced in the two exporting countries (but not in the importing country) by competitive suppliers with inverse (excess) supply functions $p_j(x_j)$, where p_j denotes the cost of the intermediate from country j ($j = 1, 2$). The inverse supply function of value added to this industry in country j is denoted by $v_j(q_j)$, where v_j denotes the cost of value-added in country j . Intermediates are tradable but value-added is not. We can therefore let q_j denote both the value added and the final output from country j . The market is thus best viewed as composed of firms purchasing (nontraded) value added and (traded) intermediates to produce a final good which is then sold to the home country.

The free trade equilibrium conditions in this competitive market can be written as:

$$v_1(q_1) = v_2(q_2) = v(Q) \quad (1A)$$

$$p_1(x_1) = p_2(x_2) = p(Q) \quad (1B)$$

$$x_1 + x_2 = q_1 + q_2 = Q \quad (1C)$$

$$r(Q) = p(Q) + v(Q) \equiv ac(Q) \quad (1D)$$

Equations (1A) and (1B) require that the competitive producers of the final product purchase inputs from the cheapest source, so that prices of inputs from the two sources are equated; (1C) is a materials balance equation; and (1D) equates consumer price with average cost (ac) which the price taking producers also assume to be their marginal cost. Consumer surplus in the importing country is

$$CS(Q) = \int_0^Q r(Q).dQ - r(Q).Q$$

so that the welfare effect of a change in total imports is

$$\frac{dCS(Q)}{dQ} = -Q.r' \quad (2)$$

where $r' \equiv dr(Q)/dQ < 0$ ⁸.

Since the importing country has monopsony power in this market, it can improve its welfare by taxing imports. We first investigate the optimal uniform tariff, and then consider the possibility of imposing discriminatory taxes. Let t denote a uniform specific tariff. Aggregate home welfare from this market then becomes

$$W = CS(Q) + t.Q$$

with

$$\frac{dW}{dt} = [t - Q.r']. \frac{dQ}{dt} + Q \quad (3)$$

Using (1A)-(1C) we can solve for

$$\frac{dx_1}{dQ} = \frac{p'_2}{P'}, \quad \frac{dx_2}{dQ} = \frac{p'_1}{P'}, \quad \frac{dq_1}{dQ} = \frac{v'_2}{V'}, \quad \frac{dq_2}{dQ} = \frac{v'_1}{V'} \quad (4)$$

where $p'_j \geq 0$; $v'_j \geq 0$; $P' \equiv p'_1 + p'_2$, and $V' \equiv v'_1 + v'_2$. After rewriting (1D) as

$$r(Q) = v(Q) + p(Q) + t = ac(Q) + t \quad (5)$$

we can solve for

$$\frac{dQ}{dt} = \frac{1}{\Omega^c} \quad \text{where } \Omega^c = r' - ac' < 0, \text{ and } ac' = \frac{p'_1 p'_2}{P'} + \frac{v'_1 v'_2}{V'} > 0.$$

Substituting in (3) allows us to solve for

⁸ In the remainder of the paper a $'$ denotes a first derivative.

$$\frac{dW}{dt} = \frac{t - Qr'}{\Omega^c} + Q$$

so that the (implicit) formula for the optimum uniform specific tariff (t^c) in this instance is given by

$$t^c = Q.[r' - \Omega^c] = ac'.Q > 0 \quad (6)$$

In order to interpret this expression, note that the total cost of producing Q in the competitive market is

$$T(Q) = ac(Q).Q$$

from which the corresponding marginal cost is

$$T'(Q) = \frac{dT(Q)}{dQ} = ac(Q) + ac'(Q).Q$$

Thus the last term in this expression, which is the optimum uniform tariff formula, denotes the difference between the marginal cost and the average cost of imports to the importing country, implying that the optimal tax is set so as to equate consumer price with marginal cost.

While a uniform tariff raises welfare, the fact that the final product is purchased from two different sources with different supply elasticities suggests further gains if tariffs are made discriminatory. Let t_j denote the tariff levied on the final product from source j . Importing country benefits from this market then become

$$W = CS(Q) + \sum_j t_j q_j$$

and the welfare effects of a change in the taxes are given (in total derivative form) as

$$dW = -Q.r' + \sum_j [q_j dt_j + t_j dq_j] \quad (7)$$

Now the price equals average cost condition (5) must be rewritten as two separate equations

$$r(Q) = v_j(q_j) + p(Q) + t_j \quad j = 1, 2 \quad (8)$$

which, once differentiated, yield a system

$$\begin{bmatrix} A_1 & a \\ a & A_2 \end{bmatrix} \cdot \begin{bmatrix} dq_1 \\ dq_2 \end{bmatrix} = \begin{bmatrix} dt_1 \\ dt_2 \end{bmatrix} \quad (9)$$

where $A_j = r' - p' - v'_j$; $a = r' - p'$ and $p' = p'_1 p'_2 / P'$.

Let $A = A_1.A_2 - a^2 = -V'.\Omega^c > 0$. Then (9) can be solved for

$$A.dq_1 = A_2.dt_1 - a.dt_2; A.dq_2 = A_1.dt_2 - a.dt_1; A.dQ = -[v'_2.dt_1 + v'_1.dt_2]$$

Substituting these into (7) and rearranging yields

$$A.dW = [t_1 A_2 - t_2 a + Qr'v'_2 + q_1 A].dt_1 + [t_2 A_1 - t_1 a + Qr'v'_1 + q_2 A].dt_2$$

which allows us to solve for the optimal discriminatory tariffs (t_j^c) as

$$t_j^c = p'.Q + v'_j.q_j \quad (10)$$

Recalling that $t^c = Q.[\frac{p'_1 p'_2}{p'} + \frac{v'_1 v'_2}{V'}]$, we have

$$\Delta t \equiv t_1^c - t_2^c = v'_1.q_1 - v'_2.q_2 \quad (11A)$$

$$t_1^c = t^c + \frac{v'_1}{V'} \Delta t; t_2^c = t^c - \frac{v'_2}{V'} \Delta t \quad (11B)$$

$$t^c = \frac{v'_2.t_1^c + v'_1.t_2^c}{V'} \quad (11C)$$

Three points, in particular, are worth noting about these results. First, the (marginal share weighted) average tariff conforms to the same implicit formula as the optimum uniform tariff. In this sense the “average level of tax” is the same under the uniform and discriminatory tariff regimes. Second, the difference between the two discriminatory tariffs takes into account differences in value added elasticities only. The more price inelastic of the two value added faces the higher tariff⁹. Again this expression can be interpreted in terms of the difference between marginal and average costs. The average cost of value added from source j is v_j , while its marginal cost is $v_j + q_j.v'_j$. The difference in tariff rates (Δt) thus mirrors the difference in the marginal costs of value added from the two sources. Third, the products from the two sources cannot be distinguished with respect to their intermediate inputs. But in fact the two sources of intermediate supply may have quite different price elasticities, implying that there might be scope for further welfare gains to the importing country if there were some way to tax these two sources differentially. The importing country is not in a position to do this directly, however, since any production and trade in the intermediates takes place entirely outside its borders. But this observation does suggest

⁹ The price elasticity for value added j is $e_j = \frac{v_j}{v'_j.q_j}$, so that when evaluated at $v_1=v_2=v$, we have

$$v.\Delta t = \frac{1}{e_1} - \frac{1}{e_2}$$

a potential role for policies which are able to distinguish the products on the basis of the origin of the intermediates embodied within them.

II.2 An Export Monopoly

We now reconsider the above for the case where the importing country faces an export monopolist. This profit maximising monopolist is assumed to purchase intermediates and value added from the two sources, although it would not matter if the monopolist was directly involved in production of these inputs given that $v_j(q_j)$ and $p_j(x_j)$ are cost functions, and in equilibrium equates the marginal costs of intermediates (mp_j) and value added (mv_j) from the two sources, and then overall marginal cost with marginal revenue (mr). The equilibrium conditions are now

$$mp_1(x_1) = mp_2(x_2) = mp(Q) \quad (12A)$$

$$mv_1(q_1) = mv_2(q_2) = mv(Q) \quad (12B)$$

$$x_1 + x_2 = q_1 + q_2 = Q \quad (12C)$$

$$mr(Q) = mp(Q) + mv(Q) = mc(Q) \quad (12D)$$

where $mp_j = p_j + x_j \cdot p'_j > 0$; $mv_j = v_j + q_j \cdot v'_j > 0$ and $mr = r + Q \cdot r' > 0$. We can use these equations to solve for the optimal uniform and discriminatory taxes in an identical fashion to the competitive case.

Equations (12A) - (12C) can be solved for marginal output shares of the various inputs¹⁰ - i.e.

$$\frac{dq_1}{dQ} = \frac{mv'_2}{MV'}, \quad \frac{dq_2}{dQ} = \frac{mv'_1}{MV'}, \quad \frac{dx_1}{dQ} = \frac{mp'_2}{MP'}, \quad \frac{dx_2}{dQ} = \frac{mp'_1}{MP'}$$

where $mv'_j = 2v'_j + q_j \cdot v''_j$, and $mp'_j = 2p'_j + x_j \cdot p''_j$ are both assumed to be positive, and $MV' = mv'_1 + mv'_2$, $MP' = mp'_1 + mp'_2$. For the uniform tax (t) rewrite (12D) as

$$mr(Q) = mv(Q) + mp(Q) + t = mc(Q) + t \quad (13)$$

and solve for

$$\frac{dQ}{dt} = \frac{1}{\Omega^m}, \quad \text{where } \Omega^m = mr' - mc' < 0, \quad mc' = \frac{mp'_1 \cdot mp'_2}{MP'} + \frac{mv'_1 \cdot mv'_2}{MV'} > 0$$

¹⁰ These expressions show what happens to inputs as the profit maximizing output increases as a result of an expansion of demand.

and $mr' = 2r' + Q.r'' < 0$. The implicit formula for the optimal tariff (t^m) can then be derived as

$$t^m = Q.[r' - \Omega^m] = Q.[r' - mr' + mc']$$

This formula can be interpreted in an analagous fashion to the competitive case. One difference is that it is now possible for the optimal intervention to be an import subsidy. A necessary condition for this is that the marginal revenue curve be “flatter” than the demand curve (i.e. $0 > mr' > r'$)¹¹. Since this issue is tangential to our purpose, we restrict attention to cases where $t^m > 0$. Again, the optimal uniform tariff is set so that the domestic consumer price equals the marginal cost of imports to the importing country.

To solve for the optimal differential taxes we must now write (13) as

$$mr(Q) = mv_j(q_j) + mp_j(x_j) + t_j \quad (14)$$

which allows us to proceed as before yielding:

$$t_j^m = Q.[r' - mr' + \frac{mp'_1 mp'_2}{MP'}] + mv'_j \cdot q_j \quad (15)$$

$$\text{So that } \Delta t = mv'_1 \cdot q_1 - mv'_2 \cdot q_2 \quad (16A)$$

$$t_1^m = t^m + \frac{mv'_1}{MV'} \cdot \Delta t; \quad t_2^m = t^m - \frac{mv'_2}{MV'} \cdot \Delta t \quad (16B)$$

$$t^m = \frac{mv'_2 \cdot t_1^m + mv'_1 \cdot t_2^m}{MV'} \quad (16C)$$

Exactly the same comments can be made concerning these results as for those in the competitive market.

II.3 Linear Example: The results so far can be illustrated using linear functions. Let

$r = r_0 + r'Q$; $v_j = v_{j0} + v'_j q_j$; and $p_j = p_{j0} + p'_j x_j$, where r_0, v_{j0} and $p_{j0} > 0$; $r' < 0$; v'_j

and $p'_j > 0$. Define $\Delta p_0 = p_{10} - p_{20}$; $\Delta v_0 = v_{10} - v_{20}$; $\bar{p}_0 = \frac{p'_2 \cdot p_{10} + p'_1 \cdot p_{20}}{P'} > 0$

$\bar{v}_0 = \frac{v'_2 \cdot v_{10} + v'_1 \cdot v_{20}}{V'}$; and note $r_0 > \bar{v}_0 + \bar{p}_0$ for a solution to exist.

The outputs in the two cases are then shown in Table 1.

¹¹ See Brander and Spencer (1984).

Table 1: Solutions for the Linear Case

Competitive Exporters	Export Monopoly
Free Trade Outputs	Free Trade Outputs
$x_1^c = \frac{p_2'}{P'} \cdot Q - \frac{\Delta p_0}{P'}; x_2^c = \frac{p_1'}{P'} \cdot Q + \frac{\Delta p_0}{P'};$ $q_1^c = \frac{v_2'}{V'} \cdot Q - \frac{\Delta v_0}{V'}; q_2^c = \frac{v_1'}{V'} \cdot Q + \frac{\Delta v_0}{V'}$	$x_1^m = \frac{p_2'}{P'} \cdot Q - \frac{\Delta p_0}{2P'}; x_2^m = \frac{p_1'}{P'} \cdot Q + \frac{\Delta p_0}{2P'}$ $q_1^m = \frac{v_2'}{V'} \cdot Q - \frac{\Delta v_0}{2V'}; q_2^m = \frac{v_1'}{V'} \cdot Q + \frac{\Delta v_0}{2V'}$
$Q^c = \frac{r_0 - \bar{p}_0 - \bar{v}_0}{\frac{p_1' p_2'}{P'} + \frac{v_1' v_2'}{V'} - r'}$	$Q^m = \frac{r_0 - \bar{p}_0 - \bar{v}_0}{2[\frac{p_1' p_2'}{P'} + \frac{v_1' v_2'}{V'} - r']} = \frac{1}{2} Q^c < Q(t^c)$
Uniform Tax	Uniform Tax
$Q(t^c) = \frac{r_0 - \bar{v}_0 - \bar{p}_0}{2 \frac{p_1' p_2'}{P'} + 2 \frac{v_1' v_2'}{V'} - r'} < Q^c$	$Q(t^m) = \frac{r_0 - \bar{v}_0 - \bar{p}_0}{4 \frac{p_1' p_2'}{P'} + 4 \frac{v_1' v_2'}{V'} - 3r'} < Q(t^c)$
Discriminatory Taxes	Discriminatory Taxes
$q_1(t_j^c) = \frac{v_2'}{V'} \cdot Q - \frac{\Delta v_0}{2V'}; q_2(t_j^c) = \frac{v_1'}{V'} \cdot Q + \frac{\Delta v_0}{2V'}$	$q_1(t_j^m) = \frac{v_2'}{V'} \cdot Q - \frac{\Delta v_0}{4V'}; q_2(t_j^m) = \frac{v_1'}{V'} \cdot Q + \frac{\Delta v_0}{4V'}$
$Q(t_j^c) = Q(t^c)$	$Q(t_j^m) = Q(t^m)$

Note that the optimal discriminatory taxes in the competitive case adjust the value-added mix to that which would be chosen by an export monopolist, for any given level of output. But the level of output with these taxes and competitive suppliers is in fact greater than that chosen by the monopolist in free trade.

III Rules of Origin

III.1 Competitive Exporters

To this point the exact origin of the intermediates used by each of the competitive final goods suppliers has been of no consequence. Intermediates are supplied by competitive firms in the two countries, and final goods producers are simply price takers in the intermediate market. The mix of intermediates supplied is simply that which equates the prices from the two sources. We now investigate the effects of constraining this choice, by requiring that output “originate” in a country before it is exported. The

qualification test is a ROO, and the most convenient form in which to model a ROO in this framework is to write it as specifying a minimum requirement on the ratio of intermediate input of the same national origin as the value added (or, equivalently, the final output). A “stricter” ROO will then require that a larger fraction of the total intermediate used be of the same national origin as the value added. Though ROOs are not typically expressed directly in this form, this must be their impact here. Such a ROO would specify that for final output to qualify as “originating” in country j not only would it need to incorporate value added from j but, in addition, its use of intermediate from j (\bar{x}_j) would need to satisfy a constraint of the form $\bar{x}_j \geq \theta \cdot q_j$ where $1 > \theta > 0$. Suppose that when intermediate use is unconstrained country 1 is the intermediate importer -i.e. $x_1 \ll q_1$ and, consequently, $x_2 \gg q_2$. In this case the output of country 2, which uses only x_2 , clearly meets the constraint, and it is only final goods producers in country 1 that are directly constrained¹².

Our objective here is to determine if there are circumstances under which the imposition of a (just) binding constraint of this form could raise welfare in the importing country. To do this we need to restructure the model to incorporate a ROO constraint. We begin by considering the unconstrained value of θ in a competitive market, which will depend on the level of output and is therefore written as $\theta^c(Q) = x_1/q_1$. Note that θ^c also measures the ratio of the average shares of these two inputs

(i.e. $\theta^c = [x_1/Q]/[q_1/Q]$). Since $\frac{dq^c(Q)}{dQ} = \frac{1}{q_1} \left[\frac{dx_1}{dQ} - q_1 \cdot \frac{dq_1}{dQ} \right]$, we have that

$$\text{sign } \frac{dq^c(Q)}{dQ} = \text{sign } [\tilde{q} - q^c] \quad (17)$$

where $\tilde{q} = \left[\frac{p'_2}{p'} \middle/ \frac{v'_2}{V'} \right]$ is the corresponding ratio of the marginal shares of the two goods in output.

¹² Note that we impose the ROO as a binding constraint and do not give exporters the opportunity to accept or reject it. Output from either country that does not meet its relevant ROO is denied admittance to the home market. In practice where a product does not meet the origin criterion for its last location of production, origin will be given to another country in the case of nonpreferential ROOs or to no country where preferential agreements are concerned. See Vermulst (1992)

The existence of a binding ROO (for which we impose the constraint as an equality) implies a changed structure of equilibrium conditions as follows:

$$r(Q) = v_2(q_2) + p_2(x_2) \quad (18A)$$

$$v_2(q_2) - v_1(q_1) = \theta \cdot [p_1(x_1) - p_2(x_2)] \quad (18B)^{13}$$

$$x_1 + x_2 = q_1 + q_2 = Q \quad (18C)$$

$$x_1 = \theta \cdot q_1 \quad (18D)$$

We can now use these conditions to determine the effects of tightening a ROO that is just on the verge of binding initially (i.e. where $p_1=p_2$). We begin by examining its effects on the input mix at a given total output level. Using (18B) - (18D), and recalling $p_1=p_2$ initially, allows us to solve for

$$\frac{dq_1}{dq} = -\frac{dq_2}{dq} = -\frac{q \cdot P' \cdot q_1}{\Phi} \leq 0; \quad \frac{dx_1}{dq} = -\frac{dx_2}{dq} = \frac{V' q_1}{\Phi} \geq 0$$

where $\Phi = V' + q^2 \cdot P' \geq 0$. The implications of this “tightening” of the constraint for the average cost of producing the final good can then be determined using (18A)

$$\frac{d[v_2 + p_2]}{dq} = v'_2 \cdot \frac{dq_2}{dq} + p'_2 \cdot \frac{dx_2}{dq} = [q \cdot v'_2 \cdot P' - p'_2 \cdot V'] \cdot \frac{q_1}{\Phi} \quad (20)$$

Imposing a tighter ROO can *reduce* average cost if $[q \cdot v'_2 \cdot P' - p'_2 \cdot V'] < 0$, which is the same as (17) the condition for the ratio x_1/q_1 to rise as output rises in a competitive market. We conclude that if the ratio of these marginal shares exceeds the ratio of their average shares, imposing a (just) binding ROO of this form at the competitive equilibrium will reduce average cost and hence lead to an increase in aggregate output. From (2) such an increase in output leads to a rise in the importing country’s consumer surplus.

The key to understanding this outcome is to recognize that the competitive solution *does not* choose the combination of intermediate inputs and value added that minimizes total costs. Firms treat the price (average cost) of each input as its marginal cost, and select an input combination where the prices of inputs from the two sources are equated (i.e. $p_1=p_2, v_1=v_2$) rather than their marginal costs ($mp_1=mp_2, mv_1=mv_2$). The result is an equilibrium where the final good price equals average cost, but the latter is higher than necessary to produce this output. Imposing a binding ROO

¹³ This condition comes from equating the constrained costs from the two sources, i.e. $v_2(q_2) + p_2(x_2) = v_1(q_1) + \theta \cdot p_1(x_1) + [1-\theta] \cdot p_2(x_2)$

changes the input mix at both levels (for any given total output), increasing the share of x_1 in intermediates and reducing the share of q_1 in aggregate value added. If this rearrangement leads to a fall in average (and marginal) cost then output will rise, the consumer price will fall, and consumer surplus will increase as a consequence.

In the *linear case* the actual cost minimizing input combinations are the monopoly solutions for the corresponding outputs, so that from Table 1 we have

$$q_1^m - q_1^c = \frac{\Delta v_0}{2V'}; \quad x_1^m - x_1^c = \frac{\Delta p_0}{2P'} \text{ etc. In this case the competitive and cost minimising}$$

input combinations differ by a constant whose sign is determined by the relative price-intercepts on the two sources. Thus if $\Delta p_0 > 0$, intermediate input x_1 (x_2) is used less (more) than it should be to minimize total intermediate costs, while if $\Delta v_0 > 0$, less (more) value added is being drawn from country 1 (2) than it should be to minimize total value added costs in the competitive equilibrium. Here

$$q^c = \frac{V'}{P'} \cdot \left[\frac{p'_2 \cdot Q - \Delta p_0}{v'_2 \cdot Q - \Delta v_0} \right] \text{ and } \text{sign} \{q \cdot v'_2 \cdot P' - p'_2 \cdot V'\} = \text{sign}\{p'_2 \cdot \Delta v_0 - v'_2 \cdot \Delta p_0\} \text{ which}$$

is independent of the output level. A sufficient condition for the imposition of a just binding ROO to raise welfare is that $\Delta v_0 < 0$ and $\Delta p_0 > 0$, as then too much value added and too little intermediate are being drawn from source 1 relative to the cost minimizing combination. In these circumstances the ROO shifts the balance in a cost minimizing direction in both markets.

Where the importing country imposes a uniform import tariff the preceding analysis will continue to apply. The uniform tariff does not, in itself, compensate for the failure of the competitive market to choose the cost minimizing input mix. Hence imposing a (just) binding ROO, in addition to a uniform tariff, can be welfare improving under the same condition relating marginal and average shares.

Where the importing country imposes differential tariffs on imports “originating” from the two sources, the situation is slightly different. For one thing the presence of a ROO seems more natural since determining origin is important for determining which tax is

to apply. To investigate the welfare implications of a ROO in this case, we combine (18A) through (18D), including the presence of differential taxes, into

$$r(q_1+q_2) - v_1(q_1) - \{\theta.p_1(\theta.q_1) + [1-\theta].p_2(q_2 + [1-\theta].q_1)\} = t_1 \quad (21A)$$

$$r(q_1+q_2) - v_2(q_2) - p_2(q_2 + [1-\theta].q_1) = t_2 \quad (21B).$$

Totally differentiating these equations with respect to q_1 , q_2 , and θ , we have system

$$\begin{bmatrix} B_1 & b \\ b & B_2 \end{bmatrix} \cdot \begin{bmatrix} dq_1 \\ dq_2 \end{bmatrix} = \begin{bmatrix} [q.P' - p'_2].q_1 d\theta \\ -p'_2.q_1 d\theta \end{bmatrix} \quad (22)$$

where $B_1 = r' - v'_1 - q^2 p'_1 - [1-q]^2 . p'_2 < 0$; $B_2 = r' - p'_2 - v'_2 < 0$;

and $b = r' - [1-q] . p'_2 < 0$. Here $q_1.d\theta$ denotes the increase in x_1 , and corresponding reduction in x_2 , required to meet the ROO at the initial final output mix. This results in an increase in the cost of x_1 of $p'_1.q_1 d\theta$ and a reduction in the cost of x_2 of $-p'_2.q_1 d\theta$. This implies a fall in the cost of intermediates to the q_2 producer, and a change in the cost of intermediates to the q_1 producer of $\{q.p'_1 - [1-q].p'_2\}.q_1 d\theta$. In principle the latter may be positive or negative depending on whether θ is greater or less than p'_2/P' - i.e. on whether the initial (unconstrained) share of x_1 in intermediate use in the production of q_1 is greater or less than its marginal share in total intermediate output. Clearly if the cost of intermediates to *both* producers falls, then total output increases, but the latter can happen even if the cost of intermediates to q_1 rises, as shown in (15) above.

We can solve this system for the changes in final outputs (and total output). Let $B \equiv B_1.B_2 - b^2 > 0$ ¹⁴. Then after solving we find

$$B \cdot \frac{dq_1}{d\theta} = \{q.B_2.P' + [v'_2 + q.p'_2].p'_2\}q_1 > \text{ or } < 0$$

$$B \cdot \frac{dq_2}{d\theta} = \{q.p'_1.p'_2 + p'_2.v'_1 - r'.q.P'\}q_1 > 0$$

To determine the welfare effects of these output changes at the optimal discriminatory tariffs, these solutions can be substituted in

$$dW = -Qr'.[dq_1 + dq_2] + t_1^c.dq_1 + t_2^c.dq_2$$

¹⁴ Substituting and rearranging

$B = -r'[V' + q^2 P'] + [v'_2 + p'_2].[v'_1 + q^2 p'_1] + v'_2 p'_2 [1-q]^2 > 0$

where t_j^c is as defined in (10)¹⁵. Using (11B) we can rewrite this as

$$dW = [t^c - Q.r'].dQ + \frac{\Delta t}{V'}.[v_1'dq_1 - v_2'dq_2]$$

One can then show that

$$v_1'dq_1 - v_2'dq_2 = -q P'V'[t^c - Q.r'] \cdot \frac{q_1 dq}{Q.B}$$

$$dQ = [p_2'V' - q v_2'P'] \frac{q_1 dq}{B}$$

where the latter is as expected from (20) above. Substituting these in (11) and rearranging, we have finally

$$\frac{dW}{dq} = [t^c - Q.r'].V'P' \cdot \left[\frac{p_2'}{P'} - \frac{x_1}{Q} \right] \frac{q_1}{B}$$

Thus whether imposing a (just) binding ROO will raise or reduce welfare when there are optimal discriminatory taxes on final outputs in place depends on whether the marginal share of x_1 in output (p_2'/P') exceeds or is less than its average share

(x_1/Q)¹⁶. This can be compared with the condition for a (just) binding ROO to raise

welfare with no (or uniform) taxes - i.e. $p_2'/P' > q v_2'/V'$. The discriminatory tariffs, which are targeted at differences in value added elasticities, have effectively neutralized the role of the latter in determining the welfare effects of the ROO. Now the ROO can be focused on intermediates only, in particular increasing the output of that intermediate whose share of the market increases as output expands.

In conventional terms, given the existence of discriminatory taxes, a preferential ROO would be imposed to determine output from the country subject to the smaller tax. The case considered above would fit this pattern if the country with the more elastic supply

¹⁵ The envelope theorem implies that the welfare effects of any adjustments in taxes will be second order small.

¹⁶ In the linear case, $\text{sign} \left\{ \frac{p_2'}{P'} - \frac{x_1}{Q} \right\} = \text{sign} \left\{ \frac{\Delta p_0}{P'} \right\}$. Imposing a just binding ROO will be

welfare improving if $\Delta p_0 > 0$, which implies that the use of x_1 is below the cost minimizing level at the current output.

of value added (e.g. $v'_1 \cdot q_1 < v'_2 \cdot q_2$), is an intermediate importer (e.g. $x_1 < q_1$), but has a rising share of the intermediate market (e.g. $p'_2/P' > x_1/Q$).

III.2 *Export Monopoly*

The potential role of the ROO in reducing average costs in a competitive market should not carry over directly to a monopolised market. The monopolist chooses an input mix that minimises total (and average) costs for each level of output. Yet there remains scope for a ROO to affect marginal cost as we now demonstrate.

The existence of a binding ROO in the monopolised market implies an analagous change in the equilibrium conditions to:

$$mr = mv_2 + mp_2 \quad (23A)$$

$$mv_1 - mv_2 = \theta.[mp_2 - mp_1] \quad (23B)$$

$$x_1 + x_2 = q_1 + q_2 = Q \quad (23C)$$

$$x_1 = \theta \cdot q_1 \quad (23D)$$

For a given total output level, we can again solve for the changes in the input composition following the imposition of a just binding ROO from (23B)-(23D), obtaining:

$$\frac{dq_1}{dq} = -\frac{dq_2}{dq} = -\frac{q \cdot MP' \cdot q_1}{\Phi_m} < 0; \frac{dx_1}{dq} = -\frac{dx_2}{dq} = \frac{MV' \cdot q_1}{\Phi_m} > 0$$

where $\Phi_m = MV' + q^2 \cdot MP' > 0$. The impact on marginal cost can then be determined

$$\frac{dMC}{dq} = \frac{d[mv_2 + mp_2]}{dq} = [q \cdot mv'_2 \cdot MP' - mp'_2 \cdot MV'] \frac{q_1}{\Phi_m}$$

Imposing a just binding ROO can then be shown to *reduce* a monopolist's marginal cost at this level of output if $q \cdot mv'_2 \cdot MP' - mp'_2 \cdot MV' < 0$, which can again be shown to be the condition for $dq^m/dQ > 0$. Although this outcome is analagous to that in the competitive case, the interpretation here is slightly different. In the former case the importing country exploited the failure of the competitive exporters to minimise their average costs, which they also treated as marginal costs. Here the export monopolist minimises total (hence average) costs at each level of output, but this does not necessarily minimise the corresponding marginal cost. In the circumstances illustrated above, a just binding ROO could reduce marginal cost, and it is the equation of

marginal cost with marginal revenue that determines output, price and consumer surplus. Hence the possibility that a ROO could raise importing country welfare in a monopolised market¹⁷.

A ROO will result in a welfare improvement under a uniform tax in the same circumstances. Where the importing country imposes differential tariffs on imports “originating” from the two sources, we can proceed analogously to the competitive case using the similarity of the structure to present the results without extensive derivation. Equations (21A) and (21B) are replaced by

$$mr(q_1+q_2) - mv_1(q_1) - \{\theta \cdot mp_1(\theta \cdot q_1) + [1-\theta] \cdot mp_2(q_2+[1-\theta]q_1)\} = t_1 \quad (24A)$$

$$mr(q_1+q_2) - mv_2(q_2) - mp_2(q_2+[1-\theta]q_1) = t_2 \quad (24B)$$

Which implies a system

$$\begin{bmatrix} E_1 & e \\ e & E_2 \end{bmatrix} \begin{bmatrix} dq_1 \\ dq_2 \end{bmatrix} = \begin{bmatrix} [q \cdot MP' - mp'_2] \cdot q_1 \cdot dq \\ -mp'_2 \cdot q_1 \cdot dq \end{bmatrix}$$

which is identical to that for the competitive market (22) with

r' replaced by mr' , v'_j replaced by mv'_j , and p'_j replaced by mp'_j . This system can then be solved for

$$\frac{dW}{dq} = [t^m - Q \cdot r'] \cdot MV' \cdot MP' \cdot \left[\frac{mp'_2}{MP'} - \frac{x_1}{Q} \right] \cdot \frac{q_1}{E}$$

where $E > 0$. Whether a just binding ROO will raise or reduce welfare when the importing country faces an export monopolist and there are optimal discriminatory taxes on final outputs again simply depends on whether the marginal share of x_1 in output ($\frac{mp'_2}{MP'}$) exceeds or is less than its average share ($\frac{x_1}{Q}$).

IV Conclusions

Rules of origin have grown in significance with the spread of preferential trading arrangements and the increasing importance of contingent, selective trade measures. In general ROOs perform a supporting role to other policy instruments, defining the

¹⁷ By extension a ROO could perform the same function in other market structures under the appropriate conditions.

products to which these instruments will or will not be applied. Most economic analyses of ROOs has correspondingly taken place in frameworks involving a range of policies in which it is easy for the effects of the ROO to become obscured.

Our objective in this paper has been to examine the potential commercial policy effects of the ROO itself. Its distinguishing feature as a policy instrument is its ability to target the input composition of inputs, and we demonstrated circumstances under which its use could lead to an improvement in the importing country's terms of trade. In a competitive market this came about through the final goods exporters' inability to take account of the difference between average and marginal costs in purchasing their inputs. In a monopolised market, the exporter minimises total (and average) costs, but a ROO may reduce marginal costs. We also demonstrated that while their potential benefits occur through terms of trade effects, ROOs are complementary to rather than substitutes for tariffs on final outputs. When used in combination discriminatory tariffs can focus on differences in the elasticity of supply of value added while ROOs are targeted at the composition of intermediate inputs.

Finally, it is important to recall the qualifications that were made in the introduction. Our aim here has been to deepen our understanding of the role of ROOs in economic models and analysis, not to suggest new and wider applications for them in practice. Although the potential distortions created by ROOs have been recognised, they warrant greater analysis. Only when they are better understood can they be better regulated.

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