Firm behaviour and market access in a Free Trade Area with rules of origin

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Abstract. We study a Free Trade Area with Rules of Origin and show that there are two distinct regimes. Comparative statics results for the two regimes are exact opposites and a regime switch occurs when *ROO* become restrictive enough. Consequently, imports into the *FTA* of the intermediate good first fall and then rise while the opposite pattern occurs for imports of the final good and for the price of the domestic input. We also show that tighter *ROO* have opposite effects on the well-being of final versus intermediate good producers and producers inside versus outside the *FTA*. JEL classification: F13, F15.

Comportement de l'entreprise et accès au marché dans une zone de libre échange où existent des règles d'origine. Les auteurs examinent une zone de libre échange (LE) où existent des règles d'origine (RO) et montrent qu'il existe deux régimes distincts. Les résultats en statique comparative sont exactement l'inverse dans l'un et l'autre régime, et il y a renversement quand les RO deviennent suffisamment restrictives. En conséquence, les importations dans la zone de LE du bien intermédiaire chutent d'abord et puis croissent, alors qu'on observe le pattern inverse pour les importations du bien fini et pour le prix de l'intrant de l'intérieur. On montre aussi que des RO plus restrictives ont des effets opposés sur le bien-être des producteurs de biens intermédiaires et de biens finis, et sur celui des producteurs à l'intérieur et à l'extérieur de la zone de LE.

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1. Introduction

In a Free Trade Area *(FTA)* tariff rates among members are zero, although tariff rates set by members on non-members are not necessarily equalized. With differences in tariffs, and in the absence of transport costs, what prevents trade in a product from going through the country with the lowest tariff on it and then being shipped within the *FTA?* The answer is Rules of Origin or *ROO*. A good is eligible for zero tariffs in the *FTA* only if it originates there. *ROO* specify conditions which have to be met for such origin to be granted.

There are large differences in the effects of an *FTA* with and without *ROO*. In the absence of *ROO*, an *FTA* results in large changes in trade flows as trade seeks the lowest tariff entry point into the *FTA*. Goods are then trans-shipped to their final destination in the *FTA*. Of course this results in large tariff revenue transfer effects, since this 'trade deflection' transfers tariff revenue from a good to the country with the lowest tariff entry point.[1] However, in the presence of *ROO*, this simple trans-shipment is not possible. Nevertheless, there is still some trade deflection possible. By shipping domestic production, to its *FTA* partners and meeting domestic demand via imports, the low-tariff country can still attract trade to its ports. This 'trade deflection' results in opposite effects on the tariff revenue, and hence welfare, of member countries. Also, as pointed out by Richardson (1995), it can result in a race to the bottom in setting tariffs.[2]

In this paper we look at how *ROO* affect firm behaviour, market access, and the welfare of the various parties. We consider the short run, where the number of firms is given, but where firms can choose how to use their production capacity. Incurring new investment involves fixed costs and takes time. As a result, if the *FTA* makes serving the partner country profitable, firms will choose to export using existing capacity in the short run and make investment decisions in the long run. It makes sense to look at short-run effects, since this is what short-lived governments are likely to care the most about! Moreover, these short-run effects have not been well studied, while long-run effects have been dealt with elsewhere.

In the long run, the presence of *ROO* tends to attract investment so as to circumvent the *ROO*. Krishna and Krueger (1995) study this using a partial equilibrium model with constant returns to scale, while Krishna (2003b) considers a general equilibrium setting. There is a large literature on *ROO* in law; see for example Vermulst (1994). In economics, a few of the notable papers are Herin (1986), Rosellon (1994), Krishna and Krueger (1995), Schiff (1997),

1 See McGillivray (2000) who argues that this is exactly what happened in the period 1777–89, the Articles of Confederation Period, when British merchants landed their goods in the American state offering the most favourable terms.

2 Richardson assumes 'all intra-FTA production of a good can be sold anywhere in the FTA duty free.' In other words, ROO are automatically met by domestic production. Since meeting them does not involve higher costs, the prices received by producers must be the same across all destinations. In our analysis, there are costs to meeting the ROO, so that producer profits across all destinations are equalized, though prices need not be.

Estevadeordal (2000), and Cadot et al. (2002). See Krishna (2003a) for a survey of the existing work.

This paper builds on Ju and Krishna (2002), which shows that when non compliance is an option, there are two distinct regimes with dramatically different comparative static properties. In the *homogeneous regime* all firms wish to meet the regulation. In the *heterogeneous regime* firms are indifferent between meeting and not meeting the regulation, since their profits are the same in either event. Work prior to that of Ju and Krishna (2002), such as Grossman (1981) and Mussa (1984), neglects the heterogeneous regime.[3] Anson et al. (2003) found that the average *NAFTA* utilization rate by Mexican firms is about 64%, suggesting that not all firms in Mexico choose to meet the *ROO* required by *NAFTA*. This could be due to firm heterogeneity: some firms may find it easier to document origin than others. However, such heterogeneity is not necessary: firms could be ex ante identical but make different choices as in the heterogeneous regime.

This paper differs from that of Ju and Krishna (2002) in a number of ways. First, we focus on a particular application, namely *ROO* in *FTA*s, and examine restrictions that are value based. Such restrictions are typically used in *FTA*s. In contrast, Ju and Krishna (2002) look at physical restrictions, focusing on regime switching when non-compliance is an option. Second, in this paper we examine the effects on trade flows as well as welfare, both aggregate and of particular groups. These results are new. It is similar to Ju and Krishna's (2002) work, since it employs the regime-switching properties they develop.

The effects of *ROO* on market access are summarized in propositions 2 and 3 in section 5. It is shown that when *ROO* become more restrictive, imports from the rest of the world of the intermediate good first fall and then rise. In contrast, imports of the final good as well as the price of the domestic input first rise and then fall. Their turning point is common and occurs at the switch-over between the two regimes. The effects of *ROO* on welfare are summarized in propositions 4 and 5 in section 6. Conflicts between domestic intermediate and final goods producers as well as domestic and foreign producers of the final and intermediate goods in setting *ROO* are predicted, since, when one gains, the other loses.

There are many aspects of *FTA*s that we neglect in this paper. Issues of why they might be created, whether they are stepping stones to global integration or impediments to it,[4] which kinds of *FTA*s are good and which kinds bad all are outside the scope of this paper. The reader is directed to Krueger (1997) for a

3 When firms are indifferent between different options, some firms could choose one option while others choose another. As the restriction becomes more severe, the mix of firms meeting the restriction adjusts, so that profits remain equal for the two options, which in turn makes comparative static effects very different in the two regimes.

4 Using a median voter model, Philip Levy (1997), shows that in a Heckscher-Ohlin setting a bilateral agreement cannot supplant multilateral free trade, but bilateralism can undermine support for future multilateral liberalization when there are variety benefits from trade. Pravin Krishna (1998), looks at the similar questions using a Cournot model of oligopoly to look at the effect on firm profits.

thoughtful discussion of such issues, to Bhagwati and Panagariya (1996) for a biting criticism of much of the work in the area, and to the work of Bagwell and Staiger (1998) for some fascinating ideas on developing rules which ensure that *FTA*s, when formed, do not result in negative externalities for non members.

2. The model

We want to consider the effects of an *FTA*. The simplest framework in which this can be done is a three-country world. Let the three countries be called *A*, *B*, and *C*. Countries *A* and *B* form an *FTA*, excluding *C*, which can be thought of as the rest of the world. There are two goods, a final good x and an intermediate input z, in addition to a numeraire consumption good. Prior to the *FTA*, both *A* and *B* import the final and intermediate goods from *C*. Of course, the numeraire good is exported by them to *C* so that trade balances. There is no trade between *A* and *B* prior to the *FTA*. However, trade between *A* and *B* will occur in both goods after the *FTA*.

Both *A* and *B* are small countries, so that they take the world price as given. The world price for x is denoted by p_x^w and the world price for z is denoted by p_z^w. Country i has tariffs t_j^i on good j. These are assumed to be specific tariffs. Let p_j^{i0} be the price of good j in Country i, at time $t=0$ ($t=0$ before the *FTA* and $t=1$ after it). $p_j^{i0} = p_j^w + t_j^i$, for $i = A, B$ and $j = x, z$, since both goods are imported.

When *A* and *B* form an *FTA*, their tariffs on each others products are set at zero, while those on imports from the rest of the world are unchanged. *We assume throughout, that neither A nor B can produce enough of the final or intermediate good to meet its FTA partner's excess demand at pre FTA prices.* For the most part we will assume that one country has a higher intermediate good tariff, while the other has a higher final good tariff. For concreteness, we assume $t_x^A > t_x^B$ and $t_z^A < t_z^B$. What happens when one country has higher tariffs on both goods is discussed at the end of section 4. Note that despite the fact that t_x^A exceeds t_x^B, the rest of the world cannot access *A*'s market via simple trans-shipment from *B*, owing to rules of origin. For this reason, prices in *A* and *B* need not be the same even after the *FTA*.

We assume that the *ROO* in the intermediate goods are automatically met when the input is made in the *FTA* but cannot be met if the input is made abroad.[5] As a result, the price of the *FTA*-made intermediate input is equalized in both *FTA* countries. The input imported from outside the *FTA* is called the imported input from here on. Our assumptions so far ensure that this price in both countries is unaffected by the existence of the *FTA* and equals $p_z^w + t_z^A$ and $p_z^w + t_z^B$. The domestically made intermediate input price, denoted by p_z^1, is

5 This removes complications arising from trans-shipment of intermediate goods in the FTA.

equalized in the two countries after the *FTA*, though it need not equal the price of the imported input. This is because the *ROO* in the final good requires a minimum cost share to arise within the *FTA*. Imported inputs cannot contribute to this cost share, while *FTA* made inputs can do so. As a result, even if the price of *FTA*-made inputs exceeds that of the imported inputs, they may still be used in order to meet the *ROO*.

What about the price of the final good after the *FTA*? Final goods can come from *C* after paying the tariff or from a partner *FTA* member free of tariffs if the *ROO* are met. It is not possible for the price of the final good to rise after the *FTA*, owing to the possibility of importing directly from *C*. There will be no incentive for firms in Country *A* to export to Country *B* because $t_x^A > t_x^B$. Since only firms in *C* export to *B*, the price of *x* in *B* stays unchanged. However, firms in Country *B* may wish to export to *A* even if there are additional costs in meeting the *ROO*. Since *B* cannot meet all of *A*'s demand, the price in *A* remains at its pre-FTA price.[6] Similarly, even after the *FTA*, the price of the imported intermediate good in both *A* and *B* remains at its pre *FTA* level.

In section 3 we consider the problem facing firms at given prices. In section 4 we consider the determination of the price of the *FTA* made input, p_z^1. In section 5 we consider the implications of our analysis for market access. In section 6, we investigate what happens to the welfare of various groups as *ROO* become more restrictive. In section 7, we offer some concluding remarks.

3. The firm's problem

Let $F^i(Z, k)$ denote the constant returns to scale (*CRS*) production function for the final good in Country *i*, $i = A, B$, where *k* denotes the capital used, and *Z* the intermediate good used by the firm. In the short run, being considered here, *k* is given, so we suppress it from here on. As firms in *A* do not wish to export to *B*, they do not care about the source of the intermediate good. They use the cheapest source for the input and equate the marginal value product of the input to its price. The supply of a typical firm in *A* after the *FTA* is thus denoted by $x^A(p_x^{A1}, \min\{p_z^{A1}, p_z^1\})$. In equilibrium $\min\{p_z^{A1}, p_z^1\} = p_z^{A1}$.[7] Supply of the final good, as usual in such problems, is positively related to p_x^{A1} and negatively related to p_z^{A1}.

To comply with the *ROO*, a fraction, α, of the variable cost share, must come from the *FTA*-made inputs or

$$\frac{p_z^1 z}{p_z^1 z + p_z^{B1} z^*} \geq \alpha, \tag{1}$$

6 In other words, $p_x^{A0} = p_x^{A1} > p_x^{B1} = p_x^{B0}$.

7 Note that $p_z^{A1} = p_z^{A0} < p_z^{B1} = p_z^{B0}$. Since neither country can supply the excess demand of the other, the price of the *FTA*-made input, p_z^1, cannot be below p_z^{B1} in equilibrium.

where z denotes the *FTA*-made input and z^* denotes the imported input used by a firm.

Firms in B will either meet the *ROO* and export to A or not meet the *ROO* and sell to their home market, depending on what is more profitable.[8] Let $Z(p_x, \min\ (p_z^1,\ p_z^{B1}))$ be the total input demand function for a given firm in B in the absence of any restrictions. What is the effect of *ROO*? For a given p_x, if $p_z^1 \leq p_z^{B1}$ then all firms in B will weakly prefer the *FTA*-made input and the *ROO* are automatically met. The input demand is as if there were no *ROO*. If $p_z^1 > p_z^{B1}$, then firms would prefer to use the imported input, but may choose to use the *FTA*-made one in order to qualify for a higher output price. If *ROO* are met, the firm maximizes

$$p_x^{A1} F^B(z + z^*,\ k) - p_z^1 z - p_z^{B1} z^*,$$

subject to (1). The restriction is met exactly, which gives

$$z^* = \frac{p_z^1(1-\alpha)}{\alpha p_z^{B1}} z. \tag{2}$$

In turn, this yields

$$Z = z + z^* = \left[\frac{p_z^1(1-\alpha) + \alpha p_z^{B1}}{\alpha p_z^{B1}}\right] z. \tag{3}$$

Using (2), we get

$$\begin{aligned} p_z^1 z + p_z^{B1} z^* &= p_z^1 z + \frac{p_z^1(1-\alpha)}{\alpha} z = \frac{p_z^1 z}{\alpha} \\ &= \left[\frac{p_z^1 p_z^{B1}}{p_z^1(1-\alpha) + \alpha p_z^{B1}}\right](z + z^*), \end{aligned}$$

where the second equality comes from inverting (3). This gives profits for a given firm as

$$\Pi(p_x^{A1},\ \phi(\alpha,\ p_z^1)) = p_x^{A1} F^B(Z,\ k) - \phi(\alpha,\ p_z^1) Z. \tag{4}$$

Note that $\phi(\alpha,\ p_z^1) = p_z^1\ p_z^{B1} / p_z^1(1-\alpha) + \alpha p_z^{B1}$ plays the same role as $min(p_z^1,\ p_z^{B1})$ did in the absence of a *ROO*. It is the virtual price of the input when the *ROO* are met. Thus, total input demand is $Z(p_x^{A1},\ \phi(\alpha,\ p_z^1))$. Inverting (3) gives demand for the *FTA*-made input to be

$$z(p_x^{A1},\ p_z^1,\ \alpha) = \psi(\alpha,\ p_z^1) Z(p_x^{A1},\ \phi(\alpha,\ p_z^1)),$$

8 For a firm in B to export to A without meeting the *ROO* will not be profitable.

where $\psi(\alpha,\ p_z^1) = \alpha p_z^{B1}/p_z^1(1-\alpha) + \alpha p_z^{B1}$. It is easy to verify that $\phi(\alpha,\ p_z^1)$ is increasing[9] in α and p_z^1. Note that if α is unity, only the *FTA*-made input is used and $\phi(\alpha,\ p_z^1) = p_z^1$, while if α is zero, $\phi(\alpha, p_z^1) = p_z^{B1}$.

$\psi(\alpha,\ p_z^1)$, which equals $z(p_x^{A1},\ p_z^1,\ \alpha)/Z(p_x^{A1},\ \phi(\alpha,\ p_z^1))$, is the physical share of the *FTA*-made input. It is increasing in α but decreasing in p_z^1.[10] For a given p_z^1, as α, the value restriction becomes stricter, the physical share of the *FTA*-made input rises. However, as the *FTA*-made input price increases, the physical share of the *FTA*-made input falls, since a constant physical share results in a larger value share. An increase in p_z^1 reduces both $\psi(\alpha,\ p_z^1)$ and $Z(p_x^{A1},\ \phi(\alpha,\ p_z^1))$, so that $z(p_x^{A1},\ p_z^1,\ \alpha)$ is decreasing in p_z^1. The effect of increases in α on $z(p_x^{A1},\ p_z^1,\ \alpha)$, the derived demand for the *FTA*-made input, which will be discussed later, is more complicated, since p_z^1 itself changes as α changes.

If $p_z^1 > p_z^{B1}$ and the *ROO* are not met, the firm in *B* will maximize

$$p_x^{B1} F^B(z^*,\ k) - p_z^{B1} z^*.$$

The maximized value of profits, $\bar{\Pi}(p_x^{B1},\ p_z^{B1})$ is a constant, since p_x^{B1} and p_z^{B1} are fixed. The demand for inputs and the outputs by such a firm are $\bar{z}(p_x^{B1},\ p_z^{B1})$ and $\bar{x}(p_x^{B1},\ p_z^{B1})$, respectively.

4. Equilibrium conditions

Demand for the *FTA*-made input from firms in *A* is clear. It is their total demand if $p_z^1 < p_z^{A1} = p_z^{A0}$ and zero otherwise. What does the demand from firms in *B* for the *FTA*-made input look like? Clearly this depends on whether firms in *B* choose to meet the *ROO* or not. Let $\tilde{p}_z^1(\alpha)$ be the price of the imported intermediate input such that firms in *B* are indifferent between meeting and not meeting the *ROO*. Of course, $\tilde{p}_z^1(\alpha)$ will exceed $p_z^{B1} = p_z^{B0}$, since profits from meeting the *ROO* at p_z^{B0} exceed those from not doing so.

Let n^B denote the fixed number of firms in *B*. The total demand for inputs in *B*, assuming the *ROO* is met by all firms in *B*, $n^B Z(p_x^{A0},\ \phi(\alpha,\ p_z^1))$, is depicted by the line *AB* in figure 1. If $p_z^1 < p_z^{A0}$, all firms in *A* and *B* buy only the *FTA*-made input. The demand for the *FTA*-made input is the sum of the total demands for inputs in *A* and *B*, which is depicted by the line *JK*. If $p_z^1 = p_z^{A0}$, firms in *A* are indifferent between buying imported inputs and buying *FTA*-made inputs and the demand for the *FTA*-made input corresponds to the segment *IJ*. If $p_z^{A0} < p_z^1 < p_z^{B0}$, then no firms in *A* buy the *FTA*-made input. However, firms in *B* buy only the *FTA*-made input and the *ROO* are

9 An increase in α reduces the denominator of $\phi(.)$, thus raising $\phi(.)$. Divide the numerator and denominator in $\phi(.)$ by p_z^1 and note that an increase in p_z^1 reduces the denominator, thereby raising $\phi(.)$.

10 As $p_z^1 > p_z^{B1}$, an increase in α raises the numerator and reduces the denominator of $\psi(.)$, thereby raising $\psi(\alpha, p_z^1)$. An increase in p_z^1 raises the denominator and so reduces $\psi(\alpha, p_z^1)$.

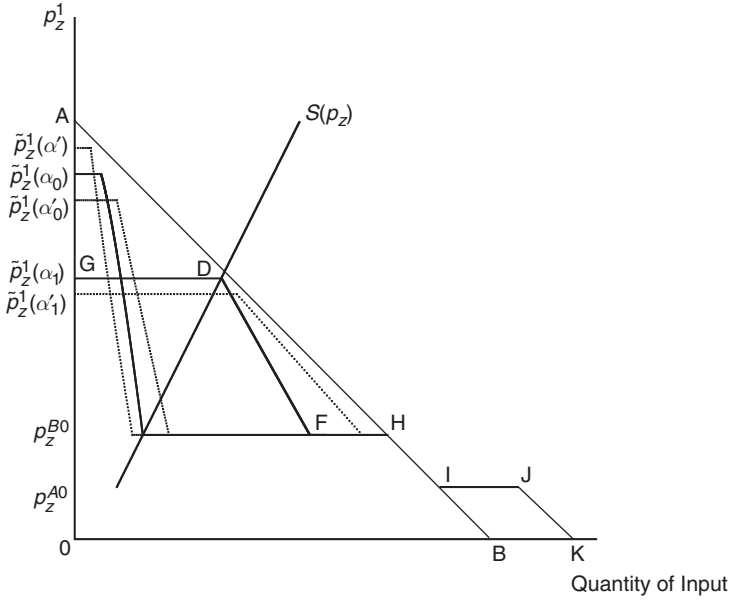

FIGURE 1 Equilibrium of FTA-made input

automatically met. This corresponds to the segment *HI*. If $p_z^1 = p_z^{B0}$, firms in *B* do not care whether or not, they overfulfill the *ROO* and the demand for the *FTA*-made input corresponds to the segment *FH*.

For $p_z^{B0} < p_z^1 < \tilde{p}_z^1(\alpha)$, all firms in *B* choose to meet the *ROO* and sell to *A*. The total demand for the *FTA*-made inputs is $n^B z(p_x^{A0},\ p_z^1,\ \alpha)$, which is downward sloping and corresponds to the segment *DF*.

At $p_z^1 = \tilde{p}_z^1(\alpha)$,

$$\Pi(p_x^{A0},\ \phi\ (\alpha,\ \tilde{p}_z^1)) = \Pi(p_x^{B0},\ p_z^{B0}). \tag{5}$$

At this point, some firms may meet the *ROO*, while others do not – what is termed the heterogenous regime. As a result, total *FTA*-made input demand is anywhere from zero to $n^B z(p_x^{A0},\ \tilde{p}_z^1(\alpha),\ \alpha)$, which corresponds to *GD*.

If p_z^1 rises further, then all firms prefer not to meet the *ROO*, and the *FTA*-made inputs are not demanded at all, which corresponds to the segment *AG*. The total demand for the *FTA*-made input is thus given by the dark line *AGDFHIJK* in figure 1.

Of course, p_z^1 is determined by the intersection of demand and supply for the *FTA*-made input, which we turn to now. Supply of the intermediate input in a country is given by the horizontal sum of marginal costs of the individual suppliers. We make the standard assumption that their marginal costs are increasing in output. The supply of *FTA*-made inputs, $S(p_z)$, is the horizontal sum of

the input supplies in two countries. That is, $z = S(p_z) = S^A(p_z) + S^B(p_z)$. Let n_A^B be the number of firms in B choosing to meet the *ROO* and export to A when the equilibrium is at price $\tilde{p}_z^1(\alpha)$. Since demand is horizontal at this point, n_A^B is determined by supply.[11]

The intersection of demand and supply for the *FTA*-made input cannot occur below p_z^{B0}, as discussed in footnote 7. Thus, the intersection is somewhere along the segment *AGDFH*. The segment *DFH* represents the homogeneous regime, while the segment *GD* represents the heterogeneous regime. As a first step, we examine the behaviour of the *FTA*-made input demand in the two regimes as α rises. We show in the following lemma that the horizontal segment at $\tilde{p}_z^1(\alpha)$, *GD*, shifts down as α rises.

LEMMA 1. $d\tilde{p}_z^1(\alpha)/d\alpha < 0$.

Proof. From (5) it follows that $\tilde{p}_z^1(\alpha)$ is decreasing in α since $\phi(\alpha,\ p_z^1)$ is increasing in α and p_z^1 and $\phi(\alpha,\ p_z^1)$ must be kept constant for (5) to remain true. ■

Now we show that the downward-sloping segment shifts out as α rises, unless the derived demand for the input is very elastic.

LEMMA 2. $d\left[z(p_x^{A0},\ p_z^1,\ \alpha)\right]/d\alpha > 0$ *if* $\varepsilon < \frac{1}{\theta}$, *where* ε *is the elasticity of* $Z(p_x^{A1},\ \phi(.))$ *with respect to* ϕ *defined as a positive number and* $\theta = \alpha(p_z^1 - p_z^{B0})/p_z^1 < 1$.

Proof. Note that $z(.) = \psi(.)Z(.)$ so that

$$\begin{aligned}\frac{d\left[z(p_x^{A0},\ p_z^1,\ \alpha)\right]}{d\alpha} &= \frac{d[\psi(.)Z(.)]}{d\alpha} = Z\left(p_x^{A0},\ \phi(.)\right)\psi_\alpha(.) + \psi(.)Z_\phi(p_x^{A0},\ \phi(.))\phi_\alpha(.)\\ &= Z(.)\phi(.)\frac{1}{\left[p_z^1(1-\alpha) + \alpha p_z^{B0}\right]}\\ &\quad + \psi(.)Z_\phi(.)\phi(.)\frac{\left(p_z^1 - p_z^{B0}\right)}{\left[p_z^1(1-\alpha) + \alpha p_z^{B0}\right]}\\ &= \frac{Z(.)\phi(.)}{\left[p_z^1(1-\alpha) + \alpha p_z^{B0}\right]}(1 - \varepsilon\theta) > 0\end{aligned}$$

if $\varepsilon < \frac{1}{\theta}$ ■

11 n_A^B may not be an integer. If it is not, the marginal firm will engage in both meeting the *ROO* and not doing so. As the production function is constant returns to scale and profits of these two activities are equalized, the firm will use a portion of k to produce for exporting to A and use the rest of k to produce for the home market.

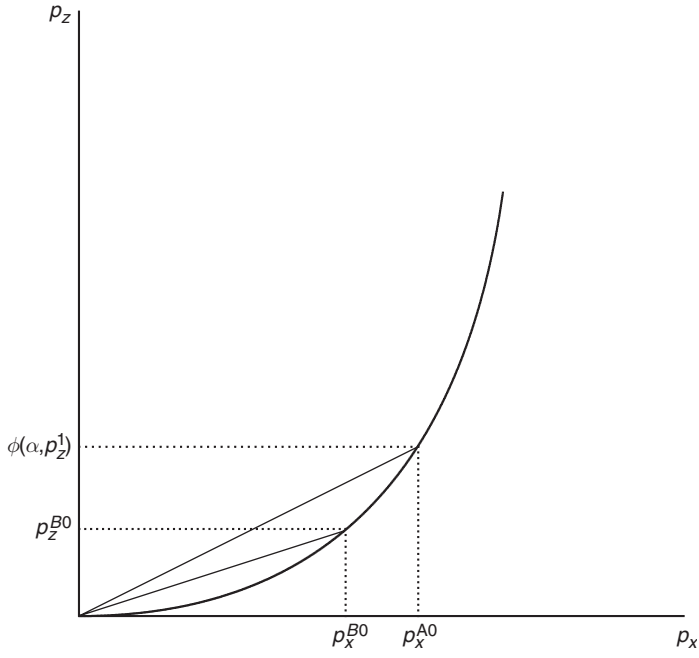

FIGURE 2 Iso profit contour

Now we can turn to the determination of p_z^1 in equilibrium and the effects of a more severe *ROO*. Before doing so however, we will show that in the heterogeneous regime, firms in *B* that export to *A* produce less than firms that sell domestically.

LEMMA 3. *In the heterogeneous regime, the output of firms in B that meet the ROO,* $x(p_x^{A0},\ \phi(.))$, *is less than the output of those that do not,* $\bar{x}(p_x^{B0},\ p_z^{B0})$.

Proof. Profits are quasi convex in prices and increasing in p_x but decreasing in p_z. Hence iso profit contours are upward sloping. Profits are zero at the origin. If input prices remain at zero while the output price becomes positive, profits are unbounded. Thus, all iso profit contours emanate from the origin in (p_x, p_z) space. Firms who meet the *ROO* have profits $\Pi(p_x^{A0},\ \phi(\alpha,\ p_z^1))$, while those who do not meet the *ROO* have profits of $\bar{\Pi}(p_x^{B0}, p_z^{B0})$. Since these profits are equal, the points $\left[p_x^{A0},\ \phi(\alpha,\ p_z^1)\right]$ and $\left[p_x^{B0},\ p_z^{B0}\right]$ lie on the same upward-sloping iso profit contour, and $\left[p_x^{A0}, \phi(\alpha, p_z^1)\right]$ lies above and to the right of $\left[p_x^{B0},\ p_z^{B0}\right]$. By quasi-convexity of profits, all points on the line connecting $\left[p_x^{A0},\ \phi(\alpha,\ p_z^1)\right]$ to $\left[p_x^{B0},\ p_z^{B0}\right]$ yield lower profits than either of them. Hence, this iso profit contour is as depicted in figure 2. The line connecting the origin to $\left[p_x^{A0},\ \phi(\alpha,\ p_z^1)\right]$ is steeper than the line connecting the origin to $\left[p_x^{B0},\ p_z^{B0}\right]$.

Thus, $\phi/p_x^{A0} > p_z^{B0}/p_x^{B0}$. Recall that profit maximization equates the marginal products of the input to ϕ/p_x^{A0} and p_z^{B0}/p_x^{B0} when the *ROO* is met and not met, respectively. As a result, total input usage, and hence output, of a firm meeting the *ROO* is less than that of a firm not meeting the *ROO*, since production function $F(.)$ is concave. ■

We have shown in figure 1 that the entire FTA input demand curve shifts neither out nor in with an increase in α. The segment *GD* shifts down, while the segment *DF* shifts out. Five levels of α, $\alpha' < \alpha_0 < \alpha_0' < \alpha_1 < \alpha_1'$, are depicted in figure 1. Two of these are critical. At $\alpha = \alpha_0$, the intersection of demand and supply occurs at the lower kink of the demand at p_z^{B0}; at $\alpha = \alpha_1$, the intersection of demand and supply occurs at the upper kink of the demand at $\tilde{p}_z^1(\alpha_1)$. In other words, α_0 is the highest value of α such that $p_z^1 = p_z^{B0}$ and α_1 is the smallest value of α such that $p_z^1 = \tilde{p}_z^1(\alpha)$. Now we are ready to prove our first result.

PROPOSITION 1. *For $0 \leq \alpha < \alpha_0$ an increase in α has no effect on the equilibrium. For $\alpha_0 \leq \alpha < \alpha_1$, all firms in B choose to meet the ROO. In this so-called homogeneous regime, assuming that the elasticity of derived demand for the input, ε, falls short of $1/\theta$, an increase in α raises usage and price of the FTA-made input while reducing total input usage and hence total output produced by firms in B. In contrast, when $\alpha_1 \leq \alpha \leq 1$, some firms in B choose to meet the ROO while others choose not. In this so-called heterogeneous regime, an increase in α reduces usage and the price of the FTA-made input but raises total output produced by firms in B.*

Proof. At very low levels of α, such as $\alpha = \alpha'$ in figure 1, very little of the *FTA*-made input is needed to meet the *ROO*, so that the intersection of demand and supply occurs at p_z^{B0} and all firms in *B* meet the *ROO*. As α rises, the downward-sloping segment of demand shifts out till at $\alpha = \alpha_0$ it intersects supply at the lower kink, as depicted in figure 1. As α rises above α_0, say, to α_0', the intersection of demand and supply occurs along the downward-sloping part of the *FTA*-made input demand. As shown in lemma 2, the downward-sloping segment shifts out. As a result, the equilibrium level of p_z^1 and the usage of the *FTA*-made inputs increase. The increases in α and p_z^1 raise the virtual price $\phi(.)$, and therefore, the total input usage and total output fall. Finally, at $\alpha = \alpha_1$, the intersection of demand and supply occurs at the upper kink, as depicted in figure 1. This puts us in the heterogeneous regime. As α rises above α_1, say, to α_1', the intersection of demand and supply occurs at $\tilde{p}_z^1(\alpha)$. As shown in lemma 1, an increase in α reduces $\tilde{p}_z^1(\alpha)$ as well as the total usage of the *FTA*-made input, but, as we will show, it raises the usage of total inputs. ■

Profits from not meeting the *ROO* are fixed, and as a result, so are the profits of meeting it in this regime. Hence, $\phi(.)$ is fixed, so that total input

usage, $Z(p_x^{A1},\ \phi(\alpha,\ p_z^1))$, and output per firm remain unchanged as α rises. Domestic input demand per firm, $z(p_x^{A1},\ p_z^1, \alpha)) = \psi(.)Z(.)$, increases in this heterogeneous regime, since both the increase in α and the decrease in p_z^1 raise $\psi(.)$ while $Z(.)$ is unchanged. However, total *FTA*-made input usage falls as α rises. This can occur only if the number of firms exporting to B, n_A^B, falls. Now lemma 3 shows that firms in B that sell to A produce less than firms that do not. Therefore, the total output of firms in B increases as α rises, since we know that the number of firms selling to A falls as α rises and these firms are replaced by firms selling to B that produce more. ■

So far we have assumed that $t_x^A > t_x^B$ and $t_z^A < t_z^B$. If $t_x^A > t_x^B$ and $t_z^A > t_z^B$, the imported intermediate as well as the final good will be cheaper in B. As a result, the positions of p_z^{A0} and p_z^{B0} must be switched in figure 1, so that firms in A come into the picture along FH and firms in B do so along IJ. If $\tilde{p}_z^1$ exceeds p_z^{A0}, then figure 1 may merely be relabelled, as explained above. The effects of a change in α still remain as described in proposition 1. However, if $\tilde{p}_z^1$ lies below p_z^{A0},[12] there is no demand in Country B for the *FTA*-made input above p_z^{A0}. As a result, the analogue of figure 1 will look a bit different, since there will be no downward-sloping segment above p_z^{A0}.

One might worry that the equilibrium price of the domestic intermediate may fall in Country A. However, our assumption that neither A nor B can produce enough of the final or intermediate good to meet its *FTA* partner's excess demand at pre-*FTA* prices prevents this from occurring. For the rest of the paper, we will maintain the assumption that $t_x^A > t_x^B$ and $t_z^A < t_z^B$.

5. Market access effects

Much of the concern in the popular press regarding preferential trading arrangements has been with the implications of such arrangements on market access. Will arrangements like *EU* or *NAFTA* lead to an increase in trade among member countries and a reduction in trade between the area and the rest of the world? Here we have a few comments to offer.

First, the *FTA* with *ROO* creates trade between countries A and B. A begins to import the final good from B after the *FTA*. Country B also imports the intermediate good from A. Second, it is important to look at the effect on the *FTA* as a whole, as is done here, as well as on each member. This is because compensating flows occur.[13] Third, effects in both final and intermediate good markets need to be considered, since they can work in opposite directions. For example, we will show that market access (of the *FTA* as a whole) in final goods is improved, while that in intermediate goods is reduced when the *ROO* is more than α_1.

12 Recall that $\tilde{p}_z^1$, exceeds p_z^{B0}, but if p_z^{A0} is above p_z^{B0}, it may be that p_z^{A0} exceeds $\tilde{p}_z^1$.

13 For example, if A imports from B, owing to the *FTA* as above, then B must import more from the rest of the world to meet its own demand, which was formerly met by domestic production.

Consider the level and change in imports of final and intermediate goods into the *FTA* as a whole as the *ROO* becomes more restrictive. For $\alpha \leq \alpha_0$, $p_z^1 = p_z^{B0} = \phi(.)$. It is costless to meet the *ROO* and the effect of the *FTA* is just to let firms in *B* sell at a higher price, p_x^{A0}, not p_x^{B0}. Thus, their output rises and so does their input use. As a result, *B* imports more and *A* imports less of the final good from *C*, but the imports of the final good in the *FTA as a whole* fall, since firms in *B* produce more when they sell to *A*.

Final good producers in the *FTA* also use more inputs when $\alpha \leq \alpha_0$. The supply of the input in *B* does not change, since the price of input is unchanged in *B*. However, input producers in *A* produce more, since they sell at a higher price, p_z^{B0}, not p_z^{A0}. Thus, the imports of input into the *FTA* as a whole could rise or fall. Moreover, making the *ROO* more restrictive has no effect in this region, so that imports are unaffected by changes in α.[14]

PROPOSITION 2. *When the ROO are not binding, that is, $\alpha \leq \alpha_0$, imports of the final good into the FTA as a whole fall. Imports of the input into the FTA as a whole could rise or fall. In addition, imports are unaffected by changes in α.*

For $\alpha_0 \leq \alpha \leq \alpha_1$ (the homogeneous regime), the effect of an increase in α on imports into the *FTA* comes only from the behaviour of firms in *B* that sell to *A*. As α rises, so does $\phi(.)$. This increase in the virtual input price reduces their total input use and thus their output. This in turn raises imports of the final good into the *FTA*.

On the intermediate input side, an increase in α shifts the downward-sloping part of the *FTA*-made input demand outward, which raises the use of the the *FTA*-made input. Since total input use in the *FTA* falls, it must be that imports of the intermediate good from *C* fall with increases in α.

For $\alpha_1 \leq \alpha \leq 1$ (the heterogeneous regime), not all firms in *B* prefer to produce for *A*. Some firms choose to produce for the domestic market. Recall that in this case p_z^1 *falls* as α rises, which reduces the use of the *FTA*-made inputs. To see what happens to imports of the intermediate good from *C*, we need to see what happens to output of the final good. If this rises, then total input use must rise as well. Since the *FTA*-made input use has been shown to fall, this means that imports of the intermediate input from *C* must rise.

What happens to output as α rises? The only firms affected are the firms in *B* that choose to meet the *ROO*. As shown in lemma 3, these firms make less output than firms that do not export to *A*. Moreover, as shown in proposition 1, their number falls as α rises, so that total output increases as α rises and as a result, *FTA* imports of the final good from *C* must fall. The imports of intermediate goods into the *FTA* rise, while the imports of the final good fall, with an increase in α.

14 This is the case considered in Bhagwati and Panagariya (1996), since they assume the supply curve of firms is unaffected by *ROO*. They point out the possibility of trade revenue transfers due to trade deflection.

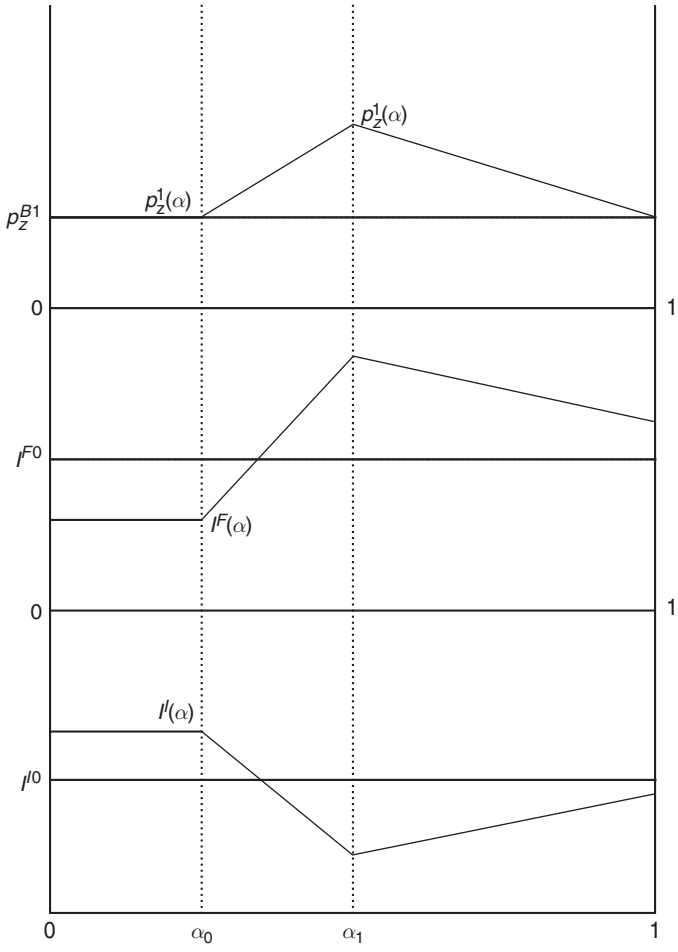

FIGURE 3 Imports of final and intermediate goods

PROPOSITION 3. *For $\alpha_0 \leq \alpha < \alpha_1$, the homogeneous regime, more restrictive ROO reduce the market access of C into the FTA in the intermediate good but improve the market access of C into the FTA in the final good. In contrast, for $\alpha_1 \leq \alpha \leq 1$, the heterogeneous regime, more restrictive ROO improve market access into the FTA for the intermediate good but reduce market access for the final good. The intermediate good market in the FTA is most protected at $\alpha = \alpha_1$, while the final good market in the FTA is most open at $\alpha = \alpha_1$.*

Our results are depicted in figure 3. The lines I^F and I^I trace out the imports of the final and intermediate goods into the *FTA* as a function of α. I^{F0} and I^{I0}

depict pre-*FTA* levels. Note that I^F lies above I^{F0} when $\alpha > \alpha_1$. This is because in this region, the firms in B that export to A produce less than firms that do not! As a result, imports of the final good into the *FTA* in the heterogeneous regime must rise, owing to the *FTA* in this region.

I^I may lie above or below I^{I0} for $\alpha \leq \alpha_0$. It is depicted as being above I^{I0} in figure 3. I^I remains below I^{I0} for $\alpha > \alpha_1$. Even at high α, some firms in B export to A, and these firms produce less of the final good and hence use less of the intermediate input in total. As the price, and hence supply, of the *FTA*-made inputs is higher than before the *FTA*, imports from C must fall.

One way to interpret these results is to note that the *FTA* results in *trade diversion* as firms in B export to A, so that A's imports from the rest of the world fall. However, B's imports from the rest of the world rise by what these firms would have produced had they not produced for export to A. This *trade substitution* counters the trade diversion.

Trade diversion dominates *trade substitution* in the final good market for $\alpha < \alpha_0$, since firms in B who export to A produce more than before the *FTA* and use more inputs doing so. As a result, the total imports of the final good as a whole fall, while the imports of the intermediate good could rise, owing to the *FTA*. From $\alpha = \alpha_0$ to $\alpha = \alpha_1$, as α increases, B exports less of the final good to A so the *trade diversion* effect is weaker. B's own imports of the final good from C do not change, so the *trade substitution* effect maintains the same. As a result, the imports of the final good into the *FTA* from C increase as α increases. In the heterogeneous regime, as α increases, fewer final good producers in B export to A, so the *trade diversion* effect is weaker. However, those final good producers who switch from exporting to A to producing for the domestic market supply more final good to the *FTA* market, so the *trade substitution* effect becomes even weaker than the *trade diversion* effect. As a result, the imports of the final good into the *FTA* from C decrease as α increases.

6. Winners and losers from an *FTA* with *ROO*

In this section we look at two things. First, we look at what happens to the welfare of various groups who are affected by an *FTA* with *ROO*. Second, we identify the most preferred point of producers of final and intermediate goods and show that these points differ, so that conflict between them is likely.

First, note that since the price of the final good is independent of the creation of an *FTA* or the level of *ROO*, welfare is made up of producer surplus and tariff revenue only. Only the profits of the final goods producers in B are affected by an *FTA*. Since they choose to sell to A, their profits must rise from doing so. Intermediate good suppliers are also affected. Any increase in their price raises their producer surplus. Moreover, since the *FTA* leads to more imports of the final good entering through B, B's tariff revenues from the final good rise, while

those of A fall. Tariff revenue from intermediate good imports tends to rise in A, since firms in A use only imported inputs, while it tends to fall in B, since all the *FTA*-made inputs are used by the firms in B. Thus, the net welfare effects in the two countries are ambiguous: some components rise while others fall. In some special cases a clear direction is possible. For example, if there is no tariff on intermediates in both countries, then B gains from an *FTA*, since its firms in final and intermediate sectors gain and its tariff revenue rises.

More important is the fact that intermediate good producers and final good producers tend to have conflicting desires regarding the level of *ROO*. Intermediate good producers are best off at $\alpha = \alpha_1$, since this is where their product price, and hence rents, are maximized. However, final goods producers in B gain the most when they have access to A's markets at the least cost, that is, at any $\alpha \leq \alpha_0$. Thus, these two groups are likely to lobby for different levels of *ROO*.

Next, we show that conflicts will arise in the interests of groups of agents depending on the level of *ROO*. First, as α rises, the interests of final good producers and intermediate good producers in all *FTA* countries move in (weakly) opposite directions. Second, the interests of producers inside the *FTA* and outside the *FTA* for all goods move in (weakly) opposite directions as *ROO* changes.

PROPOSITION 4. *All producers inside the FTA gain from the FTA with ROO. As α rises, the interests of final good producers and intermediate good producers in all FTA countries move in (weakly) opposite directions.*

Proof. First note that profits of the producers of the final good in A, $\pi_x^{B1}(\alpha)$, are unaffected by the *FTA* and the severity of *ROO* and are depicted by a horizontal line in figure 4. For $\alpha \leq \alpha_0$, it is costless to meet the *ROO* and all final good producers in B export to A at a higher price, p_x^{A1}. Thus, their profits rise. Intermediate good producers in B obtain the same profit as before, since $p_z^1 = p_z^{B1} = p_z^{B0}$. However, because all intermediate good producers in A export to B for the higher price, p_z^{B1}, they gain. Making the *ROO* more restrictive has no effect on p_z^1 and hence on their profits in this region.

For $\alpha_0 \leq \alpha \leq \alpha_1$, as α rises, so does p_z^1 and $\phi(.)$. The increase in the virtual input price $\phi(.)$ reduces the profits of final good producers in B, $\pi_x^{B1}(\alpha)$, though they must remain better off than before the *FTA*, since they could always just sell in B. However, the increase in p_z^1 raises profits for intermediate producers in A and B.

For $\alpha_1 \leq \alpha \leq 1$, the profits of firms in B are constant at π_x^{B0}. Recall that in this case p_z^1 falls as α rises, so profits of intermediate good producers in the *FTA* are decreasing in α. p_z^1 is still higher than p_z^{B1} in this entire region implying that profits of intermediate good producers in both countries, $\pi_z^{B1}(\alpha)$ and $\pi_z^{A1}(\alpha)$, are higher than that before the *FTA*. ■

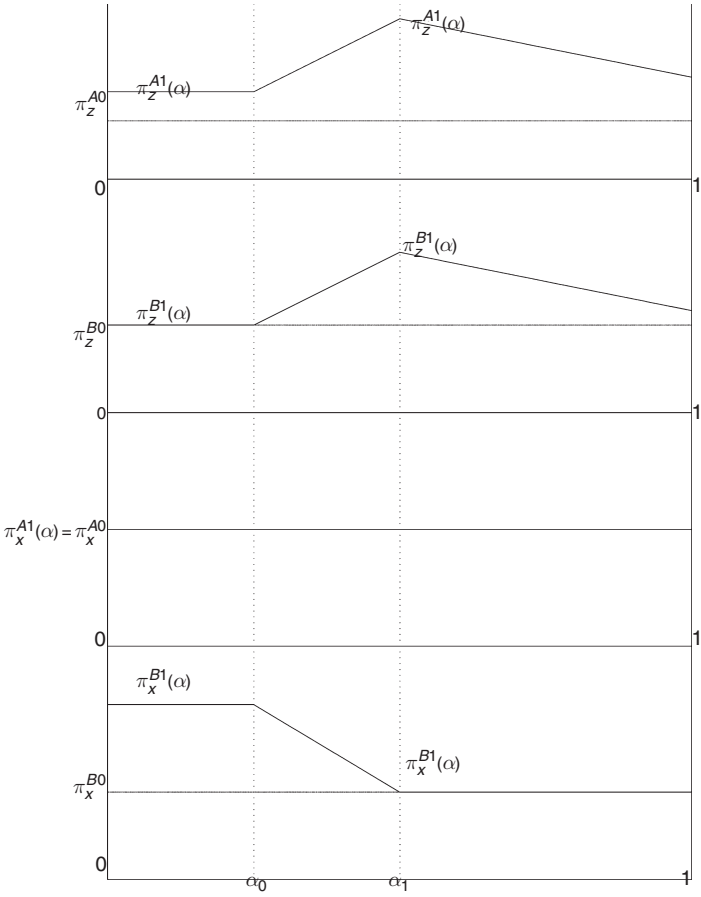

FIGURE 4 Profits of final and intermediate good producers

It is worth noting that there is no conflict between final goods producers in the *FTA* or between intermediate good producers in the *FTA*. If producers of a good in *A* gain, producers in *B* cannot lose and vice versa.[15] Note that since all producers gain from such *FTAs*, an increase in tariff revenues post *FTA* is sufficient for an increase in welfare.

PROPOSITION 5. *The interests of producers inside the FTA and outside the FTA for all goods move in (weakly) opposite directions as ROO changes.*

15 If final or intermediate good price in *A* was allowed to change, there could be conflicts between final (intermediate) good producers in different *FTA* countries.

Proof. Since the prices received by non-*FTA* producers of final and intermediate goods are fixed, their profits track imports into the *FTA*. The result now follows from a comparison of figures 3 and 4. ■

7. Conclusion

Much of the concern felt about regional trading areas has been that they will exclude non-member countries from their markets by setting higher tariffs; see, for example, Krugman (1991) and Bond and Syropoulos (1996). In this paper we show that with *ROO*, market access may well rise, owing to an *FTA*!

We believe that the model developed here has an internal structure that makes it suitable for a number of other purposes, such as market access requirements, where preferential treatment is given to foreign firms that meet a certain requirement, such as using at least a given share of domestic inputs. Other examples could be penalties if certain kinds of worker do not make up a given fraction of the workforce.

It is assumed in this paper that all markets are perfectly competitive. Imperfectly competitive markets in FTAs have been studied in the literature. Lopez-de-Silanes, Markusen, and Rutherford (1996) use a quantity competition model to examine effects of *NAFTA* on the North American auto industry. Assuming that foreign firms rely much more on imported inputs than do domestic firms, so that *ROO* are binding on foreign firms but not on home firms, they argue that *ROO* are anti-competitive, reducing overall final output of the industry and shifting rents to domestic firms. Ishikawa, Mizoguchi, and Mukunoki (2003) use a price competition model to study the effect of an *FTA* with *ROO* on market segmentation. They argue that the *FTA* removes the ability to price discriminate for domestic firms, since they automatically obtain domestic origin, but it allows foreign firms to price discriminate, since the *ROO* segment markets within the *FTA*. Thoenig and Verdier (2003) develop a partial equilibrium duopoly model in which oligopolistic firms can choose to meet or not meet the *ROO*. The regime switching between meeting and not meeting *ROO* results in non-standard comparative statics. The behaviour of imperfectly competitive firms in *FTA*s with *ROO* seems a fruitful topic for future research.

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