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On the Relative Gains from Liberalized Foreign Investment*

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This paper examines whether the multilateral liberalization of trade in capital services could contribute to economic development by reducing the per-capita income gap between source and host countries. A MacDougall-Kemp model is used to consider liberalization both from an initial state where the restrictions on foreign investment are of arbitrary heights, and from an initial Nash equilibrium. It is shown that balanced reductions in barriers to foreign investment will tend to generate relative as well as absolute gains for the host country if other things — such as the technology and labour endowments — are equal across countries.

I. Introduction

Do host countries tend to gain more than source countries from liberalized foreign investment? Could freer trade in capital services act as a stimulus to development that helps to reduce the per-capita income gap between the North and South? During the past decade many Less Developed Countries have shown an increased willingness to re-examine barriers to foreign investment as well as trade. In its appraisal of the Uruguay Round of the General Agreement on Tariffs and Trade, the *Economist* (1993, 59) observed that a "… start has been made on relaxing the rules that restrict cross-border investment." In the

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North American Free Trade Agreement, Mexico has agreed to a more far-reaching process of liberalization with provisions covering portfolio as well as direct investment.[1] Are such steps toward the liberalization of foreign investment likely to be directly beneficial to Developing Countries, or should they be seen as a concessions for gains made elsewhere? The theoretical analysis which will be presented in this paper suggests that host-country status is typically an advantage when the trade in capital services is liberalized.

Ruffin (1984: 255-258) has compared autarky with free trade in capital services in a MacDougall-Kemp[2] model where both the source and host countries produce the same autarky output levels according to identical Cobb-Douglas functions. He finds that the host country will enjoy a larger gain in total, as opposed to per-capita, income from a move from protection to unrestricted foreign investment if (and only if) the capital share parameter is less than one half. Hence, there is some indication that host countries will tend to gain relatively more than source countries when foreign investment is liberalized, but lose relatively more if trade wars are fought over foreign investment.

There is, however, a fundamental objection to Ruffin's analysis even when the restrictive conditions on the degree of initial protection, the technology and the initial outputs happen to be applicable. If the countries have identical technologies and identical outputs in the initial state of protection, it follows that the host country must have a larger labour endowment and a smaller capital endowment than the source country. Thus, if the countries' populations stand in the same relationship as their labour endowment, the liberalization of foreign investment could cause a larger gain in per-capita income in the source country than in the host, even thought the gain in total income is larger for the host than the source. In fact, the numerical example that underlies Ruffin's Figure 3.2 (1984: 256-257) would give rise to precisely this type of conclusion.[3] Hence, there is a need to go beyond

1. As well as exemptions pertaining to telecommunications and social services that apply to Canada and the United States, it is notable that Mexico's constitutional restrictions on foreign investment in its important energy sector remain in force. (For a synopsis of the North American Free Trade Agreement, see External Affairs and International Trade Canada, 1993).

2. See MacDougall (1960) and Kemp (1962).

Ruffin's analysis of the aggregate gains of the host country relative to the source country.

In this paper the comparisons of the gains from liberalized foreign investment are made in per-capita rather aggregate terms. This paper also extends Ruffin's analysis in three other respects. First, the initial restrictions on foreign investment need not be prohibitive and the final state need not be free trade. Liberalization is considered both from an initial state where the restrictions are of arbitrary heights, and from an initial state that is a Nash equilibrium in per-unit taxes on foreign investment earnings. Second, the initial outputs of the two countries need not be equal. Third, the production functions need not be Cobb-Douglas. It will be shown that liberalized foreign investment will *typically* reduce the per-capita income gap between a source and host country in a benchmark situation where the source and host countries are alike in all respects other than their capital endowments. Thus, the host country tends to have a relative advantage from liberalized foreign investment. This relative advantage of the host country does, however, require a *typical* technology where the marginal product of capital always declines at a diminishing rate.

The presentation of the MacDougall-Kemp model in Section II is similar to that of Ruffin (1984). The effects of liberalized foreign investment on the per-capita income gap between the source and host country are examined in Sections III and IV. In Section V the analysis is extended to the situation where the initial state is a Nash equilibrium in per-unit taxes on foreign investment earnings. Finally, concluding remarks are provided in Section VI.

II. The MacDougall-Kemp Model of Foreign Investment

Suppose that two countries, North and South, each produces an

3. In Ruffin's example (1984: 256-257), the distributive parameters attached to capital and labour in the Cobb-Douglas production function are 1/3 and 2/3 respectively, the host's and source's capital endowments are 8 and 2, and the host's and source's labour endowments are 2 and 1. In this case, liberalization from autarky to unrestricted foreign investment yields a total income gain of 0.191 for the source, which is less than that of 0.290 for the host. The per-capita income gain of 0.191 for the source, however, exceeds that of 0.145 for the host.

identical good according to constant-returns-to-scale technologies. Further, North exports capital services to South in exchange for an additional quantity of the single consumer good. The labour endowments of North and South are L and L^* respectively. It will be assumed that each country's population is equal to its labour endowment. The capital endowments of the tow countries are K and K^* and the level of foreign investment (or volume of trade in capital services) is Z. Consequently, $b \equiv L/L^*$ is the ratio of North-to-South labour endowments, and $k \equiv K/L$ and $k^* \equiv K^*/L^*$ are the capital-labour endowment ratios of the two countries. Furthermore, $z \equiv Z/L$ is the ratio of foreign investment to North's labour endowment and $c \equiv (K - Z)/L = k - z$ and $c^* \equiv (K^*+ Z)/L^* = k^*+ bz$ are the capital-labour employment ratios in production for the two countries.

It will be assumed that Southern labour is uniformly "a" times as productive as Northern labour where $a>0$ but, typically, $a\leq 1$. Thus, South's endowment of efficiency units of labour is aL^*, its endowment ratio in units of capital per efficiency units of labour is $k^*/a = K^*/aL^*$, and its employment ratio in units of capital per efficiency unit of labour is $c^*/a = (K^*+Z)/aL^* = (k^*+bz)/a$. It will be convenient to refer to c and c^*/a as the 'effective capital intensities' of North and South respectively. The Northern and Southern technologies will be assumed to be identical when Southern labour is reckoned in efficiency units. The Northern and Southern output levels per efficiency unit of labour are f(c) and $f(c^*/a)$, where $f(0) = 0$, $f'(\cdot) > 0$ and $f''(\cdot) < 0$. Thus, the corresponding per-capita output levels are f(c) and $af(c^*/a)$. Given that all markets are competitive, North's and South's rental rates on capital are: $r = f'(c)$ and $r* = g'(c*) = f'(c*/a)$, and their respective wage rates (per worker) are: $w = f(c) - cf'(c)$, and $w* = af(c*) - c* f'(c*/a)$.

There are, of course, many policy instruments with which national governments, either by design or by accident, directly or indirectly affect the flow of trade in capital services. On the one hand, host countries may use various non-tax measures 'such as quantitative restrictions, judicial or political review procedures, and performance and participation requirements as well as taxes. On the other hand, while source-country governments typically allow some deductibility for foreign taxes paid on capital that is invested abroad, such deductibility is rarely perfect. Thus, capital that is invested abroad is typically penalized relative to that which is invested domestically. Further, it is very important to emphasize that barriers to trade in goods indirectly affect trade in capital services through general equilibrium linkages. For example, the simple structure of the current model makes it clear that Northern tariffs or Southern export taxes on the single final product will restrict foreign investment. In order to simplify the analysis of the liberalization of foreign investment, it will be convenient to summarize all of a country's restrictive measures in the form of an equivalent per-unit tax on foreign investment earnings. Thus, t represents the per-unit tax that is equivalent to all of North's direct and indirect restrictions on foreign investment, while t^* represents the equivalent per-unit tax of South.

The world rental rate on capital, ρ, is defined to be the value at the border of remitted earnings on a unit Northern capital invested in South. In other words, the world rental rate is the return to Northern capital invested in South after the payment of the Southern tax but before the payment of the Northern tax (i.e., South's net payment to North). Southern firms will demand capital from North to the point where South's domestic rental rate minus its tax is driven into equality with the world rental rate (i.e., $r^* - t^* = \rho^*$). North will supply capital to South to the point where the world rental rate net of the Northern tax is equal to North's domestic return to capital (i.e., $\rho - t = r$). Thus, North's inverse supply function and South's inverse demand function for foreign investment can be written as follows

$$\rho = f'(k-z) + t \tag{1}$$

$$\rho = f'\left(\frac{k^*+bz}{a}\right) - t^* \tag{2}$$

The equilibrium level of foreign investment per capita in North is implicitly determined by equating demand and supply (i.e., $f'(k-z) + t = af'\left(\frac{k^*+bz}{a}\right) - t^*$).

$$z = h(t + t^*) \text{ where: } h'(t + t^*) = \frac{1}{f''(c) + \frac{b}{a} f''(\frac{c^*}{a})} < 0 \quad (3)$$

In effect a unit of Northern-owed capital "invested" in South is subject to the taxes — or equivalent restrictive measures — of both countries (i.e., $r^* - [t^* + t] = r$).[4,5] Thus, if either country increases its tax, foreign investment declines.

The per-capita incomes of the two countries are derived by adjusting their respective per-capita output levels for foreign investment earnings.

$$y = f(k - z) + z\rho \quad (4)$$

$$y^* = af(\frac{k^* + b}{a}) - bz\rho \quad (5)$$

The North-to-South per-capita income gap, $\gamma \equiv y - y^*$ is a simple but useful measure of international inequality or relative welfare.

$$\gamma \equiv f(k - z) - af(\frac{k^* + bz}{a}) + (1 + b)z\rho \quad (6)$$

4. While each unit of Northern capital invested abroad earns the Southern rental rate, r^*, the Southern tax of t^* must be paid before earnings equal to the world rental rate, ρ, are remitted to North. Once these remitted earnings reach North they are subject to the Northern tax, t, leaving a final after tax return of $\rho - t$ or $r^* - t^* - t$ which must be equal to the Northern rental rate, r.

5. Inter-country differences in the effective rate of taxation on capital in general (i.e., through personal and corporate income tax) also affect the location of capital just as differences in consumption taxes can affect inter-country consumption levels for a particular good. Suppose that ψ and ψ^* represent national tax rates on capital income in North and South and t and t^* continue to represent additional taxes (or tax equivalents of quantitative measures) applied to the earnings on foreign investment. In this case, world capital market equilibrium would require that $r^* - \psi^* - (t^* + t) = r - \psi$. Notice that if $t^* = t = 0$, there would be no barriers to trade in capital services and full national treatment. In this paper, we abstract from the taxation of capital in general (i.e., we set $\psi^* = \psi = 0$) in order to focus on the liberalization of trade in capital services per se.

Clearly, the North-South per-capita income gap wold decline in response to some change such as the liberalization of foreign investment if and only if the per-capita income of South increased by a larger amount than that of North.

Suppose for the moment that trade in capital services were completely unrestricted. Since the technologies of the two countries are uniform when reckoned in terms of efficiency units of labour, the two countries would have : (i) equal rental rates, (ii) equal effective capital intensities, and (iii) equal outputs per efficiency unit of labour (i.e., if $t = t* = 0$, then $r = r^*$, $c = c^*/a$ and $f(c) = f(c^*/a)$). Output per-capita must be at least as large in North as South since Northern labour is at least as effective Southern labour (i.e., if $t = t^* = 0$, then $f(c) \geq af(c^*/a)$ since $a \leq 1$). Assuming that North's endowment of capital relative to efficiency units of labour exceeds that of South, foreign investment per-capita in North must be positive (i.e., if $t = t* = 0$, then $z > 0$ given $k > k*/a$). The combination of higher per-capita output in North and remitted foreign investment earnings flowing from South to North dictate that the per-capita income gap must be positive under free trade in capital services (i.e., if $t = t^* = 0$, then $\gamma > 0$).

Since taxes impede foreign investment, a positive total tax wedge would imply that : (i) the rental rate in North will be less than that in South, (ii) the effective capital intensity in North will exceed that in South and (iii) output per efficiency unit of labour in North will exceed that of South if the total tax wedge is positive (i.e., if $t + t* > 0$, then $r < r*$, $c > c*/a$ and $f(c) > f(c*/a)$). The North-South per-capita income gap must remain positive if barriers to trade in capital services exist. The remainder of the paper examines how the world rental rate and per-capita incomes respond to the liberalization of trade in capital.

Ⅲ. Liberalized Trade in Capital Services

In the initial, pre-liberalization equilibrium, the Northern and Southern taxes are t_0, and t_0^* respectively.[6] In this section and the

6. For simplicity, it will be assumed that the combined effect of the initial taxes is not prohibitive. Thus, $z > 0$ in the initial equilibrium.

following section these initial taxes will be treated as parameters that have arbitrary heights. In the Section 5, however, attention will be given to an initial Nash equilibrium where each country has set its per-unit tax at the optimum height. The liberalization of trade in capital services typically involves discrete, rather than infinitesimal, changes in each country's restrictions on foreign investment. In the final, post- liberalization equilibrium the taxes are t_1, and t_1^* where $0 \leq t_1 < t_0$, and $0 \leq t_1^* < t_0^*$. It is useful to define the parameter $\theta \in [0, 1]$ to indicate the degree to which the liberalization of foreign investment has been phased in or implemented.

$$t = t_1 + (1-\theta)(t_0 - t_1) \tag{7}$$

$$t^* = t_1^* + (1-\theta)(t_0^* - t_1^*) \tag{8}$$

When $\theta = 0$ the taxes of the two countries are at their initial heights, when $\theta = 1$ the taxes are at their final heights, and when $0 < \theta < 1$ the tax cuts have only been partially phased in.

Since equilibrium per-capita foreign investment depends on the heights of the two taxes (via equation (3)) which, in turn, depend on the degree to which liberalization has been phased in (via equations (7) and (8)), per-capita foreign investment implicitly depends on the degree of implementation.

$z = \zeta(\theta)$ where:

$$\zeta'(\theta) = \frac{T}{f''(k - \zeta(\theta)) + \frac{b}{a} f''\left(\frac{k^* + b\zeta(\theta)}{a}\right)} > 0. \tag{3'}$$

Here, $T \equiv t_0 - t_1 + t_0^* - t_1^* > 0$ is the total reduction in barriers to foreign investment that has been negotiated. Of course, moves in the direction of liberalization result in tax cuts that encourage additional foreign investment.

Equations (7) and (3′) can be substituted into equation (1), or equivalently, equations (8) and (3′) can be substituted into equation (2), in order to show that the world rental rate on capital also depends on the degree of implementation.

$$\rho = P(\theta) \quad \text{where: } P'(\theta) = \left\{ \frac{t_0 - t_1}{T}\left(\frac{b}{a}\right) f''\left(\frac{k^* + b\zeta(\theta)}{a}\right) - \left(\frac{t_0^* - t_1^*}{T}\right) f''(k - \zeta(\theta)) \right\} \zeta'(\theta) \tag{9}$$

The overall change in the world rental rate associated with the liberalization of foreign investment can be determined as a continuum of infinitesimal comparative static steps.

$$\triangle \rho = \int_0^1 P'(\theta) d\theta = \int_0^1 \left\{ \left(\frac{t_0 - t_1}{T}\right)\left(\frac{b}{a}\right) f''\left(\frac{k^* + b\xi(\theta)}{a}\right) - \left(\frac{t_0^* - t_1^*}{T}\right) f''(k - \xi(\theta)) \right\} \zeta'(\theta) d\theta \tag{10}$$

Equations (3′) and (10) can be substituted into equation (6) in order to show that the North-South per-capita income gap depends on the degree to which foreign investment liberalization has been phased in

$$\gamma = \Gamma(\theta) \quad \text{where: } \Gamma'(\theta) = (1+b)\zeta(\theta)P'(\theta) + \{((t_0 - t_1) - (t_0^* - t_1^*)b)(1-\theta) + (t_1 - bt_1^*)\}\zeta'(\theta) \tag{11}$$

The effect of liberalized foreign investment on the North-South per-capita income gap can also be seen as a continuum of infinitesimal steps which phase in the tax cuts.

$$\triangle \gamma = \int_0^1 \Gamma'(\theta) d\theta = (1+b) z_0 \triangle \rho + (t_1 - bt_1^*) \int_0^1 \zeta'(\theta) d\theta + \int_0^1 (\zeta(\theta) - z_0) \left\{ \left(\frac{b^2}{a}\right) f''\left(\frac{k^* + b\zeta(\theta)}{a}\right) - f''(k - \zeta(\theta)) \right\} \zeta'(\theta) d\theta \tag{12}$$

The derivation of equation (12) is shown in the Appendix. A decline (increase) in the world rental rate caused by liberalization is neither necessary nor sufficient to cause an *automatic* decline (increase) in the per-capita income gap. As well as the terms of trade effect which depends wholly on the change in the world rental rate on capital (i.e., the first term in equation (12), it is necessary to account for the relative effect of the remaining distortions (i.e., the second term) and the incidence of the reductions in world capital market distortions (i.e., the third term).

IV. Liberalization with Arbitrary Initial Barriers

The assumptions on the following menu are useful in assessing how the world rental rate and the per-capita income gap respond to the liberalization of foreign investment.

A1 : The North and South have identical constant-returns-to-scale technologies when Southern labour is measured in efficiency units.

A2 : The common inverse demand function for capital per efficiency unit of labour is convex over all of the relevant domain (i.e., $f'(c)$ is convex or $f'''(c)>0\ \forall\ c\in(k^*/a,\ k)$).

A3 : North is endowed with at least as many efficiency units of labour as South (i.e., $b/a\geq 1$)

A4 : North is endowed with at least as many physical units of labour as South (i.e., $b\geq 1$).

A5 : The tax reduction by North is at least as large as that by South (i.e., $t_0-t_1\geq t_0^*-t_0^*$).

A6 : The final tax for North is at least as low as that for South (i.e., $t_1\leq t_1^*$).

Assumption 1 and the limiting cases in Assumption A3-A6 (where the weak inequalities hold with equality) establish a benchmark situation where North and South are equivalent in all respects except for their capital endowments and foreign investment status (i.e., $k>k^*$ and $z>0$).[7]

7. When the restrictions given in A3 and A4 hold with equality, it follows that labour in North and South is equally productive (i.e., a = 1). Furthermore, when the restrictions given in A5 and A6 hold with equality, it follows that initial

Assumption A2, which implies that the marginal product of capital always declines at a diminishing rate, is relatively, but not completely, innocuous. The Appendix shows that only one of the five possible sign patterns of third derivatives of constant-returns- to-scale production functions has the marginal product of capital diminishing at an increasing rate. The Appendix also indicates that if the production function has a constant elasticity of substitution, σ, which is greater than one half, this is a sufficient, but certainly not necessary, condition for marginal additions to per-capita output from small increases in the capital intensity to decline at a diminishing rate. Hence, with a Cobb-Douglas production function where $\sigma = 1$, Assumption A2 must be met.

If other things are equal, there is a tendency for the liberalization of foreign investment to cause the world rental rate to decline or move in favour of South.

Proposition 1: Given Assumptions A1-A3 and A5, the world rental rate must fall in response to the liberalization of foreign investment.

The North-South per-capita income gap also tends to decline or move in favour of South if other things are equal.

Proposition 2: Given Assumptions A1-A6, the liberalization of foreign investment must reduce the per-capita income gap between North and South and, thereby, increase the per-capita income of South by more than that of North.

The following lemma assists in the proofs of these propositions.

Lemma 1: Given Assumptions A1 and A2, North operates at a strictly flatter point than South on the common inverse demand function for capital per efficiency unit of labour in all situations where the implementation of liberalization is incomplete and at as least as flat a point in the situation where the implementation is complete (i.e., $0 > f''$

Northern and Southern taxes are of equal height (i.e., $t_0 = t_0^*$).

$(c) > f''(c^*/a)\ \forall \theta \in [0, 1)$ and $0 > f''(c) > f''(c^*/a)$ for $\theta = 1$).

The proof of Lemma 1 is to be found in the Appendix.

Proposition 1 arises because Lemma 1, in conjunction with Assumption A3 and A5, implies that the integral in equation (10) must be strictly negative. The proof of Proposition 2 is also straightforward. The first term in equation (12) must be negative according to Proposition 1. Assumptions A4 and A6 are important for Proposition 2 even though they were not required for Proposition 1. In particular, Assumptions A4 and A6 are sufficient to guarantee that the second term in equation (12) is negative. Assumptions A3 and A4 and Lemma 1 are sufficient to establish that the third term is negative.

Why does the host country tend to be at an advantage when foreign investment is liberalized and other things are equal? Lemma 1 indicates that North initially operates at a flatter point than South on the common inverse demand function for capital per efficiency unit of labour. In other words, North confronts a relatively inelastic excess demand function (for capital relative to efficiency units of labour) from South, while South faces a relatively elastic excess supply function from North. Hence, North relinquishes more market power than South in the course of the liberalization of foreign investment and South's per-capita income increases by more than that of North.[8]

Of course other things are not always equal and the effects of the liberalization will depend on other considerations as well as a country's host-versus-source status. These other considerations are easily understood. Assumptions A3 and A4 suggest that countries with smaller endowments of labour (in terms of either efficiency or physical units) tend to have a relative advantage in the liberalization. This small country advantage from liberalization is simply the converse of the usual large country advantage in a trade war. Assumption A5 suggests that the country making the smallest cuts tends to have a relative advantage when foreign investment is liberalized while Assumption A6 suggests that the country retaining the larger

8. Since the liberalization of trade in capital services may reduce but cannot eliminate the North-South per-capita income gap, there remains a sense in which it is better to be capital rich than capital poor.

restrictions also tends to have an advantage. Of course, individually or in combination these other effects could swamp the host-country advantage.[9] Nevertheless, host-country status remains as one type of advantage in the broader picture.

The effect of low labour productivity in South is particularly interesting since it could offset the effects of a larger physical endowment of labour.

Proposition 3: Given that Assumptions A1, A2, and A5 hold but Assumption A4 is violated because South's physical endowment of labour exceeds that of North(i.e., $b<1$), the elimination of foreign investment restrictions (i.e., $t_1=t_1^*=0$) will reduce the North-South per-capita income gap provided that Southern labour productivity is sufficiently low (i.e., $a \leq b^2$).

The world rental rate must fall and the first term in equation (12) must be negative because North must have a larger endowment of efficiency units of labour than South (i.e., $a \leq b^2 < b < 1$). The second term in equation (12) disappears because taxes are completely eliminated. Finally, Lemma 1 together with the low labour productivity condition (i.e., $a \leq b^2$) imply that the third term is negative.

The critical role of Assumption A2 in the preceding analysis should, however, be noted. If the technology were unusual in the sense that the marginal product of capital did not always decline at a decreasing rate over the relevant domain, neither Lemma 1 nor Propositions 1-3 would hold. Moreover, if the technology were very unusual in the sense that the marginal product of capital declined at an always increasing rate over the relevant domain (i.e., if $f'(c)$ were concave of $f'''(c) < 0 \; \forall \; c \in [k^*/a, k]$), then Lemma 1 would be reversed. Furthermore, after changing the direction of the inequalities in Assumptions A3-A6, Propositions 1 and 2 would also be reversed.

9. For example, in the extreme case where North initially levies no taxes on foreign investment, South would lose from relinquishing market power with a unilateral tax cut provided that its tax was not excessive in the first place.

V. Liberalization from an Initial Nash Equilibrium

The analysis of the liberalization of trade in capital services can be adapted to allow for an initial Nash equilibrium where the per-unit taxes are endogenously determined.[10] Suppose that each country has chosen its initial per-unit tax in order to maximize its per-capita income while taking the tax of the other country as given. The first-order conditions that stem from such income maximization imply the following optimum tax formulae.[11]

$$t = -h(t^*)\frac{b}{a}f''\left(\frac{k^* + bh(t+t^*)}{a}\right) > 0 \tag{13}$$

$$t^* = -h(t+t^*)f''(k - h(t+t^*)) > 0 \tag{14}$$

Equations (13) and (14) can be interpreted as tax reaction functions in implicit form. Consequently, the initial Nash equilibrium taxes, $\tilde{t}_0$ and $\tilde{t}_0^*$, can be determined by simultaneously solving these two reaction functions.[12] In the Nash equilibrium, each country assesses an optimum

10. Dixit (1987) discusses a Nash equilibrium in tariffs for a two-country, two-good model of commodity trade. Although an initial Nash equilibrium is a very useful reference point for the theory of the liberalization of foreign investment, it also has some drawbacks. Most important, there is considerable evidence that countries do not always act as national welfare maximizers when they set their trade policies. Furthermore, as in the case of oligopoly, the Nash equilibrium will be dependent on the instrument chosen. For example, Rodriguez (1974) shows the non-equivalence of tariffs and quotas under retaliation. Nevertheless, it could easily be shown that the qualitative conclusions obtained below concerning relatively greater host country gains would continue to hold for initial Nash equilibria in ad valorem taxes or quantity restrictions.

11. North's objective is to choose its tax so as to maximizes its income (i.e., in equation(4)) given South's per-capita demand for capital (i.e., equation(2)) and the condition that determines equilibrium per-capita foreign investment (i.e., equation(3)). Similarly, South maximizes its income in equation (5) subject to equations (1) and (3). The optimal per-unit taxes on foreign investment could be converted to the well-known relationships between an ad valorem tax rates and inverse elasticities (see Ruffin, 1984, 253) by dividing by the world rental rate.

12. If it is always the case that $f''(c*) < -(b/a) \; zf'''(c*)$ then North's reaction function has $dt*/dt < -1$, and if it is always the case that $f''(c) < zf'''(c)$ then South's reaction function has $0 > dt*/dt > -1$. The situation where both of these inequalities hold is sufficient, but not necessary, for the taxes of the two countries to be strategic substitutes (see Bulow et al.).

trade tax which is positive and, thus, foreign investment is restricted in comparison with free trade.

It is now possible to consider the effects of the liberalization of foreign investment when the initial state is a Nash equilibrium in per-unit taxes. To begin with, Proposition 1 concerning the world rental rate can be extended.

Corollary 1.1: Given assumptions A1-A3 and A6, and beginning from a Nash equilibrium in per-unit taxes, the world rental rate must fall when foreign investment is liberalized.

The Nash equilibrium taxes are $\tilde{t}_0 = -\frac{b\tilde{z}_0}{a} f''(\frac{k^* + b\,\tilde{z}_o}{a})$ and $\tilde{t}_0^* = -\tilde{z}_0 f''(k - \bar{z}_0)$ where $\bar{z}_0$ is North's per-capita foreign investment in the initial Nash equilibrium. Given Lemma 1, it follows that North's initial Nash-equilibrium tax exceeds that of South (i.e., $\tilde{t}_0 > \tilde{t}^*$). Since North's final, post-liberalization tax can be no higher than that of South by Assumption 6 (i.e., $t_1 \leq t_1^*$), North's tax cut must exceed that of South (i.e., $\tilde{t}_0 - t_1 > \tilde{t}_{0^*} - t_1^*$). In conjunction with Assumption A3 and Lemma 1, this implies that the integral in equation (10) must be negative.

Propositions 2 and 3 concerning the per-capita income gap can also be extended.

Corollary 2.1: Given assumptions A1-A4 and A6, and beginning from a Nash equilibrium in per-unit taxes, the North-South per-capita income gap must be reduced when foreign investment is liberalized.

Corollary 1.1 implies that the first term in equation (10) is negative and the proof that the second and third terms are negative is the same as for Proposition 2.

Corollary 3.1: Given that Assumptions A1 and A2 hold but Assumption A4 is violated because South's physical endowment of labour exceeds that of North (i.e., b < 1), the elimination of foreign investment restrictions (i.e., $t_1 = t_1^* = 0$) beginning from an initial Nash equilibrium in per-unit taxes *will reduce the North-South per-capita income gap provided that Southern labour productivity is sufficiently low (i.e., $a \leq b^2$).*

Since North's tax cut exceeds that of South (i.e., $\tilde{t}_0 > \tilde{t}_0^*$) and since North must have a larger endowment of efficiency units of labour than South (i.e., $a \leq b^2 < b < 1$), the world rental rate must fall and the first term in equation (12) must be negative. The proof that the second term in equation (12) is equal to zero and the third term is negative is the same as for Proposition 3.

VI. Conclusion

The world efficiency gains associated with the liberalization of capital services seem likely to generate significant absolute benefits for source and host countries alike.

Nevertheless, even the simple MacDougall-Kemp model suggests that there will likely be resistance to such liberalization on political-economy grounds. In this model, the reduction of barriers to foreign investment would push the real wage down and the real rental rate up in the North and do the reverse in South. Consequently, in both source and host countries there may be a great deal of potential for domestic conflicts over whether to pursue a conciliatory or aggressive foreign investment policy regardless of the national interest.[13]

The analysis of this paper suggests that host countries should actively pursue the multilateral liberalization of foreign investment in conjunction with trade liberalization. It has been shown that balanced reductions in barriers to foreign investment tends to confer relative as well as absolute gains upon the host country if other things are equal. While a country's other relative advantages and disadvantages certainly do matter, host-country status tends to be a relative advantage in the liberalization process. Moreover, even if the host country has a larger physical endowment of labour than the source, balanced liberalization will still

13. In spite of the political tension that is likely to arise, many would deem the upward pressure on wages at the expense of the domestic rental rate on capital in host countries to be a "good" distributional effect.

reduce the source-host per-capita income gap if the host country's labour productivity is sufficiently low. Consequently, the results of this paper, building on those of Ruffin (1984), indicate that the multilateral liberalization of trade in capital services could act as a stimulus to development that helps reduce per-capita income gap between source and host countries. This case is made still stronger because the rents that arise when host countries apply non-tax restrictions on foreign investment may actually accrue to Northern firms and investors in many instances. There is, however, a need for host countries to be vigilant in their pursuit of liberalized foreign investment because source-country barriers tend to be more subtle and work through the unequal treatment of earnings on foreign as opposed to domestically invested capital in personal and corporate income tax systems.

This paper also indicates that host countries are particularly vulnerable in the event of increased protectionism pertaining to foreign investment. Of course, regardless of a country's foreign investment status, absolute losses in national welfare would typically arise from multilateral moves in the direction of foreign-investment restriction. Nevertheless, if other things were equal, a host country's per-capita income loss from such protectionism would tend to be larger than that of a source country. Whatever other strengths and weaknesses a country may possess if trade hostilities were to erupt over foreign investment, host-country status would tend to be a relative disadvantage.

Appendix

The Derivation of Equation 12: Based on equation (11), the discrete change in the per-capita real income gap can be written as follows.

$$\triangle\gamma=(1+b)z_0\int_0^1 P'(\theta)d\theta+(t_1-bt_1^*)\int_0^1 \zeta'(\theta)d\theta$$
$$+\tau\int_0^1(1-\theta)\zeta'(\theta)d\theta+(1+b)\int_0^1(\zeta(\theta)-z_0)P'(\theta)d\theta \qquad \text{(A1)}$$

Here, $\tau\equiv(t_0-t_1)-(t_0^*-t_1^*)b$. Equation (10) can now be utilized.

$$\triangle\gamma=(1+b)z_0\triangle\rho+(t_1-bt_1^*)\int_0^1 \zeta'(\theta)d\theta+\tau\int_0^1(1-\theta)\zeta'(\theta)d\theta$$
$$+(1+b)\int_0^1(\zeta(\theta)-z_0)\Big\{(\frac{t_0-t_1}{T})(\frac{b}{a})f''(\frac{k^*+b\zeta(\theta)}{a})$$
$$-(\frac{t_0^*-t_1^*}{T})f''(k-\zeta(\theta)\Big\}\zeta'(\theta)d\theta \qquad \text{(A2)}$$

Since $-\frac{\zeta'(\theta)}{T}\Big\{f''(k-\zeta(\theta))+\frac{b}{a}f''(\frac{k^*+b\zeta(\theta)}{a})\Big\}=1$
$\forall\theta\in[0,1]$ from equation (3′), it follows that:

$$-\tau\int_0^1(\zeta(\theta)-z_0)d\theta-\frac{\tau}{T}\int_0^1(\zeta(\theta)-z_0)$$
$$\Big\{f''(k-\zeta(\theta))+\frac{b}{a}f''(\frac{k^*+b\zeta(\theta)}{a})\Big\}\zeta'(\theta)d\theta=0. \qquad \text{(A3)}$$

Adding this equation to equation (A2) yields:

$$\triangle\gamma=(a+b)z_0\triangle\rho+(t_1-bt_1^*)\int_0^1 \zeta'(\theta)d\theta+\tau\int_0^1(1-\theta)\zeta'(\theta)d\theta$$
$$-\tau\int_0^1(\zeta(\theta)-z_0)d\theta+(1+b)\int_0^1(\zeta(\theta)-z_0)\{f''(k-\zeta(\theta))$$
$$-(\frac{b^2}{a})f''(\frac{k^*+b\zeta(\theta)}{a})\Big\}\zeta'(\theta)d\theta. \qquad \text{(A4)}$$

Note that $(1+b)\ (\frac{t_0-t_1}{T})-\frac{\tau}{T}=b$ and $-(1+b)(\frac{t_0^*-t_1^*}{T})-\frac{\tau}{T}=-1$. In order to obtain equation (12) in the text, it must also be shown that:

$$\int_0^1 (1-\theta)\,\zeta'(\theta)d\theta=\int_0^1 (\zeta(\theta)-z_0)d\theta \tag{A5}$$

This equality follows from the fact that the area below the continuous, monotonic function $\zeta(\theta)$ between θ = 0 and θ = 1 must be the same no matter how it is calculated. Note that:

$$\int_0^1 (1-\theta)\,\zeta'(\theta)d\theta=\int_{z_0}^{z_1}(1-\theta)d\,\zeta(\theta), \tag{A6}$$

since $z_0=\zeta(0)$ and $z_1=\zeta(1)$. Integrating $1-\theta$, over changes in $\zeta(\theta)$ from z_0 to z_1 (i.e., the integral on the right side of equation (A6)) is equivalent to integrating $\zeta(\theta)-z_0$ over changes in θ from zero to one (i.e., the integral on the right side of equation (A5)).

Background on Assumption 2: Consider the example of a per-capita, constant-returns-to-scale, CES production function which has the form: $f(c)=\beta[\ \delta c^{-\alpha}+1-\delta]^{-1/\alpha}$ where $\beta<0$, $0<\delta<1$ and $\alpha>-1$. Appropriate differentiation reveals that $f'''(c)$ is positive if, and only if, $\frac{1-\delta}{\delta}>(\frac{\alpha-1}{2\alpha})c^{\alpha}$. The higher is the elasticity of substitution, $\sigma=\frac{1}{1+\alpha'}$ and the smaller is the distributive parameter, δ, the less likely it is that this condition will be violated. Notice that $\sigma\geq 1/2$ (i.e., $\alpha\leq 1$) is sufficient, but certainly not necessary, to establish that $f'''(c)$ is positive. In the Cobb-Douglas case where α goes to zero, this sufficiency condition must be met.

Now consider the more general constant-returns-to-scale production function, F(C,L) = Lf(c) where C is the quantity of capital utilized in domestic production. Clearly, $f'''(c)\geq 0$ if and only if $F_{CCC}(C,L)\geq 0$.

Given that the production function, F(C,L), exhibits homogeneity of degree one, $F_C(C,L)$ and $F_L(C,L)$ are homogeneous of degree zero, and $F_{CC}(C,L)$, $F_{CL}(C,L)$ and $F_{LL}(C,L)$ are homogeneous of degree negative one. When applied to partials of the second derivatives of the production function, Euler's theorem implies that :

$$CF_{CCC}(C,L) + LF_{CCL}(C,L) = -F_{CC}(C,L)/\lambda^2 > 0$$
$$CF_{CCL}(C,L) + LF_{CLL}(C,L) = -F_{CL}(C,L)/\lambda^2 > 0$$
$$CF_{CLL}(C,L) + LF_{LLL}(C,L) = -F_{LL}(C,L)/\lambda^2 > 0$$

where : $\lambda > 0$.

The convexity of isoquants implies that $F_{CL}(C,L)$ is positive given that $F_{CC}(C,L)$ and $F_{LL}(C,L)$ are negative. Of the five possible sign patterns of third partial derivatives of the production function which are consistent with these Euler conditions, only the fifth has $F_{CCC}(C,L)$ negative.

Third Partials of F(C,L)	Possible Sign Patterns				
	I	II	III	IV	V
$F_{CCC}(C,L)$	(+)	(+)	(+)	(+)	(-)
$F_{CCC}(C,L)$	(-)	(+)	(-)	(-)	(+)
$F_{CLL}(C,L)$	(+)	(-)	(-)	(+)	(-)
$F_{LLL}(C,L)$	(-)	(+)	(+)	(+)	(+)

Proof of Lemma 1: At all stages in which the implementation of liberalization remains incomplete: (i) the taxes of both countries must remain positive, (ii) the domestic rental rate on capital must be lower in North than South, and (iii) effective capital intensity of North must exceed that of South (i.e., $k - \zeta(\theta) > \frac{k^*+b\zeta(\theta)}{a}$ $\forall\theta \in (0,1]$). Thus, North will operate at a strictly flatter point than South on the common inverse demand function for capital per efficiency unit of labour provided that the inverse demand function is convex over the relevant domain (i.e., $0 > f''(k-\zeta(\theta)) > f''(\frac{k^*+b\zeta(\theta)}{a})\forall\theta\in[0,1]$ if $f'''(c) > 0$

$\forall\ c \in [\ k^*/a, k])$. Now consider the most extreme final situation where there is completely unrestricted trade in capital services in the final equilibrium (i.e., $t_1 = t_1^* = 0$). In this situation, both the domestic rental rates and the effective capital intensities of the two countries will be equalized (i.e., $k - \zeta(\theta) = \frac{k^* + b\zeta(\theta)}{a}$ when $\theta = 1$ and $t_1 = t_1^* = 0$). Thus, under pure free trade, the two countries operate at the same point, with the same slope, on the common $f'(\cdot)$ function (i.e., $f''(\ k - \zeta(\theta)) = f''(\frac{k^* + b\zeta(\theta)}{a})$ when $\theta = 1$ and $t_1 = t_1^* = 0$). This establishes Lemma 1.

References

Bulow, J., J. Geanakoplos and P. Klemperer, "Multimarket Oligopoly: Strategic Substitutes and Complements," *Journal of Political Economy*, 93, 1985, 488-511.

Dixit, A.K., "Strategic aspects of trade policy," in T. Bewley ed., *Advances in Economic Theory, Proceedings of the 5th World Congress of the Econometrics Society*, Cambridge University Press, Cambridge UK, 1987.

Economist, The, 329, 18-24, December, 1993, 59-60.

External Affairs and International Trade Canada, *NAFTA: What's it All About?*, Ottawa, Government of Canada, 1993.

External Affairs and International Trade Canada, North American *Free Trade Agreement*, Ottawa, Government of Canada, 1992.

Kemp, M.C., "Foreign Investment and the National Advantage," *Economic Record*, 38, 1962, 56-62.

MacDougall, G.D.A., "The Costs and Benefits of Private Investment From Abroad: A Theoretical Approach," *Economic Record*, Special Issue, 1960, 189-211.

Rodriguez, C., "The Non-Equivalence of Tariffs and Quotas Under Retaliation," *Journal of International Economics*, 4, August 1974, 295-298.

Ruffin, R.J., "International Factor Mavements," in R.W. Jones and P.B.Kenen eds., *Handbook of International Economics*, Vol. 1, Amsterdam, North Holland, 1984.