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The liberalization of trade and foreign direct investment: a political economy analysis

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This paper considers the implications of having trade and investment liberalization occur at different points in time. It is found that such a sequencing can be detrimental to the process of liberalization, but can never be beneficial. In particular, it is possible to find distributions of factor ownership where simultaneous trade and investment liberalization would be acceptable to the median voter, yet trade liberalization followed by investment liberalization would not. Finally, the paper derives some predictions about the effect of relative size and factor intensity differences on the likelihood of investment liberalization.

Keywords: trade agreements; foreign direct investment; tariffs; trade liberalization

JEL Classification: F12, F13, F15

1. Introduction

The success that trade liberalization has achieved under the GATT process has generated interest in applying similar principles to related issues. The ongoing effort to liberalize investment rules falls into this category. However, despite the apparent advantages to having a multinational agreement to liberalize foreign direct investment (FDI), the failure of the Multilateral Agreement on Investment (MAI) within the OECD illustrates that this process, much like that of trade liberalization, will not be straightforward. As consolation, it has been said that having trade and investment agreements maintained by different institutions was never a good idea, so the failure to reach agreement at the OECD provides an opportunity for negotiations to be transferred to the World Trade Organization (WTO). Indeed, the WTO currently has a number of disciplines relating to FDI (for a discussion see Hoekman and Saggi 2000). Pursuing a joint agenda of trade and investment liberalization seems to make good sense, especially given the close relationship between trade and factor mobility in the standard trade model (for evidence on the nature of the relationship between trade and FDI see Blonigen 2001). However, it is worth considering whether the difficulties encountered by the OECD may also be part of the reason for the slow progress in the WTO. Indeed, this paper argues that this is likely to be the case, with a potential barrier to achieving an agreement on investment being the success of the GATT in liberalizing trade.

If trade and investment liberalization are to occur at different stages in the process of liberalization, a formal approach to the process should consider how the likelihood of achieving both trade and investment liberalization is affected by the decision to pursue trade

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liberalization first. This paper uses a median voter setting to identify a mechanism by which trade liberalization may undermine political support for investment liberalization, but can never enhance political support for investment liberalization.

This conclusion stems from the different implications for the variety of products and associated prices at each stage of the liberalization process. In a setting where consumers value variety, an increase in variety raises the welfare of all consumers, including the median voter. In contrast, a change in product prices is associated with the familiar Stolper-Samuelson effects in which the payments to one factor increase and the payments to the other factor decrease. This implies that the distribution of factors among the population plays an important role in determining whether a country will find any given stage of liberalization acceptable.[1]

In order to capture these influences, we construct a model that focuses on trade and investment occurring in the same industry. Hence, the mechanism we isolate is driven by factors that relate to the possibility of intra-industry trade and FDI within a sector, and is not related to issue linkage. What we show in this setting is that trade liberalization is associated with a greater share of the variety benefits than FDI liberalization. Therefore, having trade and investment liberalization occur at different stages influences when the costs and benefits from liberalization will be incurred. In particular, allowing trade liberalization to precede FDI liberalization creates the potential for a situation where agreeing to liberalize FDI is impossible on political grounds since it would involve a large Stolper-Samuelson effect. The mix of costs and benefits is too unfavorable to reach an agreement. Hence, having trade liberalization occur before FDI liberalization can undermine the liberalization of investment and will never make it politically more attractive. Furthermore, there exist situations in which simultaneous trade and investment liberalization would be acceptable to the median voter, yet trade liberalization followed by investment liberalization would not.

While this mechanism operates regardless of whether FDI liberalization is proposed within the OECD or the WTO, the WTO does have at least one advantage over the OECD. The advantage arises since the mechanism described above is strongest when countries with similar capital-labor ratios are involved in negotiations. Since the WTO has a greater disparity in the capital-labor ratios of its members, this may reduce the influence of this mechanism and allow for a successful conclusion of negotiations within the WTO that would not be possible under the OECD.

In order to establish these results, the paper is organized in the following manner. Section 2 outlines the basic model and characterizes the outcome associated with the integrated world economy. Section 3 considers the political economy aspects of trade and investment liberalization and Section 4 considers the robustness of the results to a more general model, while Section 5 concludes.

2. The model

This section sets out the model, a simplified version of that set out in Brecher and Choudhri (1996), that will be used to analyze the implications of trade and investment liberalization occurring at different stages (or, alternatively, proceeding at a different pace). The model consists of two countries, $j \in \{1,2\}$, two primary factors (labor – L and capital – K), and one differentiated good produced in a monopolistically competitive industry. Assume that country 1 has an abundance of capital. Each consumer i within country j is assumed to be endowed with one unit of labor and possibly some of the country's endowment of capital $(K_j \geq k_j^i \geq 0)$. In addition, we assume that consumers in both countries have identical CES preferences:

$$U = \left[\sum_i x_i^{\rho}\right]^{\frac{1}{\rho}},$$
$$\rho = \left(1 - \frac{1}{\sigma}\right),$$
$$\sigma > 1$$

Each variety of the good requires its own single unit of specialized input (headquarter services – denoted by H). This specialized input (e.g., management, research) is produced at the firm's headquarters, while the production of the differentiated good occurs at a manufacturing plant (denoted by Q). The production functions for H and Q are assumed to take Cobb-Douglas form:

$$H = L_H^{\alpha} K_H^{1-\alpha}$$
$$Q = L_Q^{1-\alpha} K_Q^{\alpha}, \quad \alpha \in (0,1/2)$$

Since $\alpha < \alpha < \frac{1}{2}$, H services are capital intensive. Both countries are assumed to have identical technology, but the capital/labor endowment is higher in country 1. The location of the headquarters determines a firm's nationality.

As a benchmark, consider the outcome if the world were just one integrated economy. The equilibrium values for the integrated world economy associated with this model are implicitly defined by the following conditions:

$$\phi = c_H(w,r) \tag{1}$$

$$m = c_Q(w,r) \tag{2}$$

The first condition defines the cost of a unit of headquarter services, while the second condition requires that a profit-maximizing firm set marginal revenue (m) equal to the marginal cost of production, where w is the wage rate, r is the rental rate and c_s is the derivative of the cost function with respect to argument $s \in \{H, Q\}$. Also note that free entry implies that firms make zero profits in equilibrium:

$$\phi = [p - c_Q(w,r)]x \tag{3}$$

Factor markets also clear in equilibrium:

$$a_{LH}(w,r)H + a_{LQ}(w,r)Q = \overline{L} \tag{4}$$

$$a_{KH}(w,r)H + a_{KQ}(w,r)Q = \overline{K} \tag{5}$$

where a_{ij} represents the unit input requirements of factor i in industry j. The product market is also assumed to clear:

$$pQ = E \tag{6}$$

where E represents total expenditure on the differentiated goods. Finally, the number of firms is given by the following conditions:

$$Q = xn \tag{7}$$

$$H = n \tag{8}$$

Note also that $p = m\left(\frac{\sigma}{1-\sigma}\right)$. These conditions implicitly define the equilibrium values of factors prices (w, r), product prices (m, ϕ), and the output of headquarter services and differentiated products (H, Q) as well as the number of varieties (n).

The focus of this paper will be on endowments for which free trade is not sufficient to equalize factor prices, however the integrated world equilibrium can be replicated if investment is also liberalized. In an Edgeworth box diagram, these would be initial endowments that lie above the main diagonal but within the parallelogram created by the cones of diversification (note that the only time that free trade replicates the integrated economy is when the endowment allocation is along the main diagonal). In this respect, the model is a simplified version of Helpman and Krugman (1985), which forms the basis of recent treatments of MNEs by Brainard (1993) and Markusen and Venables (1998). For an overview of the literature on FDI see Markusen (1995).

3. The process of liberalization

The model set out above is one that focuses on the incentives to undertake trade and investment in a differentiated goods framework. To capture the process of liberalization in a simple way, we assume that the economies start out in an autarkic equilibrium. From this initial state, they can proceed in either of two ways. First, they can present the citizens of each country with the option to liberalize trade and investment simultaneously. A second option would be to propose the liberalization of trade as an intermediate step to be followed by investment liberalization at a later date.[2] The second option most closely resembles the current approach of policymakers to liberalization: i.e., formal efforts to liberalize trade barriers under the GATT/WTO process with no efforts to simultaneously liberalize foreign direct investment. We abstract from issues relating to the enforcement of trade agreements, such as those in Bagwell and Staiger (1990).

In presenting these options to each country's citizens, the attitudes of the median voter are central to determining the likelihood of success for each proposal (the focus on the median voter follows that of Levy 1997 in his work on the political economy of trade liberalization). This attitude is based on the impact that the various proposals have on the welfare of the voter. The indirect utility function can be used to determine the impact of the various types of liberalization. The autarky level of utility for individual in country 1 is given by:

$$V^{Aut} = \left[n_1(\pi_1^{Aut})\right]^{\frac{1}{\sigma-1}}\left[\frac{r_1^{Aut}}{p_1^{Aut}}k^i + \frac{w_1^{Aut}}{p_1^{Aut}}\right] \tag{9}$$

where $\pi = \frac{\phi}{m}$, and the superscript *Aut* denotes autarky.

Under free trade (*FT*) the same individual achieves a level of utility given by:

$$V^{FT} = \left[n_1(\pi_1^{FT}) + n_2(\pi_2^{FT}) \left(\frac{p_2^{FT}}{p_1^{FT}} \right)^{\sigma-1} \right]^{\frac{1}{\sigma-1}} \left[\frac{r_1^{FT}}{p_1^{FT}} k^i + \frac{w_1^{FT}}{p_1^{FT}} \right] \tag{10}$$

When both trade and investment (*TL*) have been liberalized this individual receives:

$$V^{TL} = \left[n_1(\pi^{TL}) + n_2(\pi^{TL}) \right]^{\frac{1}{\sigma-1}} \left[\frac{r_1^{TL}}{p_1^{TL}} k^i + \frac{w_1^{TL}}{p_1^{TL}} \right] \tag{11}$$

Note that a comparison of these functions reveal three potential effects associated with efforts to liberalize. First, there is the likelihood of variety or economy of scale effects, represented by the n_i s. Second, there are terms-of-trade implications that amplify or dampen these variety effects. Finally, there is the possibility of Stolper-Samuelson effects on factor returns (distributional issues of FDI are also emphasized by Glass and Saggi 1999).

Lemma 1 helps to clarify the issues surrounding the sequencing of trade and investment liberalization by decomposing the variety and price implications for indirect utility of moving from autarky to free trade. All proofs are in the appendix.

Lemma 1: *A proposal to move from autarky to free trade is only associated with variety gains and therefore will always be accepted by the median voter.*

Therefore, in this model with differentiated goods, trade liberalization is not associated with any potentially detrimental change in factor returns. Instead, it is associated exclusively with an increase in the number of varieties available in both countries.[3] This beneficial variety effect raises the welfare of all individuals (including the median voters) in both countries; consequently a proposal to liberalize trade will be accepted.

Now consider the implications of allowing trade to be liberalized before investment. Note first that free trade does not result in factor price equalization. Consequently, there is an incentive for the high-wage country (i.e., country 1, the capital abundant country) to undertake FDI by opening a production plant in the low-wage country, transferring production from the high-wage location to the low-wage location. The incentive for such FDI will persist until factor prices are equalized (empirical support for a factor proportions based explanation of FDI is contained in Yeaple 2003). From the perspective of Country 1, this has three effects. First, there is a negative terms-of-trade effect since the relative price of a differentiated good headquartered in Country 1 declines relative to the price of a differentiated good produced by a firm headquartered in Country 2. This is a natural consequence of factor price equalization for country 1 (i.e., compare equations (10) and (11)). Second, the change in relative prices is associated with a Stolper-Samuelson effect, where the nominal return to labor declines while the return to capital increases (since H is capital intensive and Q is labor intensive). Finally, this negative effect dilutes any beneficial increase in variety associated with the more efficient allocation of resources under investment liberalization. How favorably the median voter views investment liberalization depends on the relative strength of these three effects, along with the capital that the median voter holds.[4]

The relative strength of these three effects depends on the values of the main parameters of the model, α and σ. In particular, if the products are sufficiently differentiated (i.e., low

σ), then it is possible that the variety effects will dominate the negative Stolper-Samuelson effects. In this case, the order of trade and investment liberalization is irrelevant. However, this prediction conflicts with the outcome of efforts to liberalize FDI within the OECD. In order to focus on the set of parameter values that are potentially interesting, the following lemma provides conditions under which a voter holding only labor in country 1 would be opposed to investment liberalization after trade liberalization (this condition is similar to the one derived in the analysis of Helpman and Krugman 1985, Chapter 9).

Lemma 2: *If $\sigma > 2$ and $a \in (1/3, 1/2)$, then a voter holding only labor in country 1 would be opposed to investment liberalization after trade liberalization.*

This condition provides a set of sufficient conditions for the median voter to potentially care about the order in which trade and investment liberalization is pursued. Apart from isolating the potentially interesting cases, this restriction is also consistent with empirical evidence. Lai and Trefler (2002) estimate $\sigma = 5.30$, while computable general equilibrium models typically use a value of σ in the neighborhood of 15. From this point forward, σ and α will be assumed to satisfy the restrictions imposed by the above lemma. Under these conditions, we state Proposition 1.

Proposition 1. *If trade liberalization occurs before investment liberalization, then the political support for investment liberalization can be undermined but never enhanced by trade liberalization.*

To understand the mechanics of this proposition, consider a situation where a proposal to simultaneously liberalize trade and investment is just acceptable to the median voter (i.e., the median voter is indifferent between accepting complete liberalization or rejecting this option in favor of autarky). This indifference must be due to a fine balancing of the positive variety gains (variety/economies of scale gains) against the negative terms-of-trade effects. Since Lemma 1 tells us that trade liberalization is only associated with variety effects, it must be the case that investment liberalization contains a higher proportion of negative terms-of-trade effects relative to the positive variety effects. Consequently, the fine balance that existed before has been upset, and investment liberalization will no longer be acceptable to the median voter.

Both Lemma 1 and Proposition 1 can be understood with the aid of a diagram. Figure 1 graphs the indirect utility of the median voter under the scenarios of autarky (V^{Aut}), free trade (V^{FT}), and both trade and investment liberalization (V^{TL}). It is the relative position and slopes of these curves that determine the attitude of the median voter towards any attempts to liberalize trade and investment. All curves have been drawn using the normalization that p_1 is unity. These curves are linear in k^i with the intercept and slope of V^{Aut} given by $\Psi^{Aut}w_1$ and $\Psi^{Aut}r_1$ respectively. For V^{FT} the intercept is $\Psi^{FT}w_1$ and slope equal to $\Psi^{FT}r_1$, while the intercept for V^{TL} is $\Psi^{TL}w$ and the slope is $\Psi^{TL}r$ where:

$$\Psi^{Aut} = \left[n_1(\pi_1)\right]^{\frac{1}{\sigma-1}}$$

$$\Psi^{FT} = \left[n_1(\pi_1) + n_2(\pi_2)\left(\frac{p_2}{p_1}\right)^{\sigma-1}\right]^{\frac{1}{\sigma-1}}$$

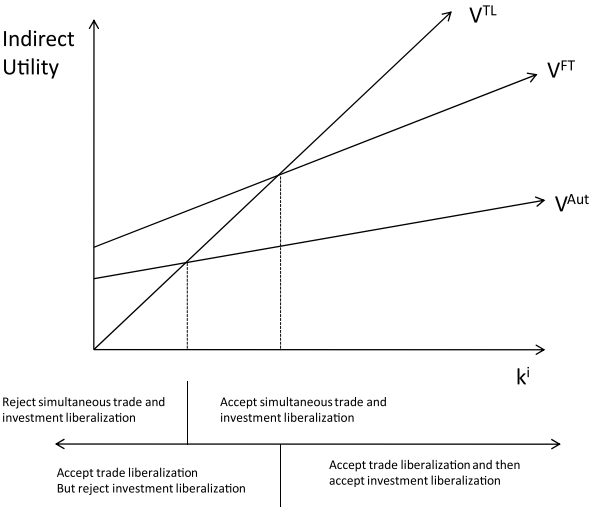

Figure 1. The indirect utility of the median voter (CES preferences).

$$\Psi^{TL} = \left[n_1(\pi^{TL}) + n_2(\pi^{TL}) \right]^{\frac{1}{\sigma - 1}}.$$

When using Figure 1 to evaluate the likely success of liberalization, it is helpful to note that as long as the world endowments of capital and labor remain constant, then the curve denoting the indirect utility associated with total liberalization is invariant to the distribution of the endowments between the two countries. Consequently, all the propositions can be understood by focusing on what happens to V^{FT} in any given situation.

From Lemma 1 we know that the V^{FT} lies uniformly above V^{Aut}, demonstrating that no matter what the distribution of capital is within country 1, free trade is always agreeable to its residents in this differentiated goods setting. In contrast, the option to liberalize both trade and investment is associated with Stolper-Samuelson effects, making the slope of V^{TL} steeper than V^{FT} (since $r_1 < r$). The relative positions of the intercepts are given by Lemma 1, which ensures that $\Psi^{FT} w_1 > \Psi^{TL} w$. As a consequence, V^{Aut} intersects V^{FT} to the left of the intersection of V^{TL} and V^{FT}. It is this gap that underlies Proposition 1. If the median voter has a capital–labor ratio that lies in this area, he or she will vote for free trade but against the subsequent proposal to liberalize investment. Note in addition that if both trade and investment liberalization were to be offered simultaneously, this would be accepted by the median voter with a capital–labor ratio in this region. Hence, pursuing trade liberalization first can be detrimental to the prospects of investment liberalization and never aids the prospect of investment liberalization in country 1.

The size of this region of conflict is a function of the parameters of the model. In particular, there are three factors that can influence where these lines intersect: the magnitude of σ, the relative sizes of the two countries, and the relative endowments of the two countries. The impact of σ is straightforward, with higher values of σ associated with both a greater difference between the intercepts and slopes of the two curves (V^{FT} and V^{TL}). Intuitively, the more homogeneous are the products, the more valuable is the terms-of-trade benefit conferred upon the capital-abundant country in the move from autarky to free trade.

Turning to the impact of a size differential, the following proposition describes the impact of relative size differences on the likelihood of investment liberalization being successful, given that it has been preceded by trade liberalization.

Proposition 2. *Given the distribution of capital ownership in the capital-abundant country and assuming that trade has been liberalized, the smaller is the capital-abundant country, the less likely investment liberalization is to be accepted after trade liberalization has occurred.*

The impact of the difference in relative size is intuitive, with the smaller the capital-abundant country, the more likely investment liberalization is to be voted down. Once again, the main factor underlying this result is the value of the terms-of-trade effect. The smaller the capital-intensive country, the greater the terms-of-trade benefit that it receives (i.e., when a small capital-abundant country moves to free trade, it gets a large increase in variety and these varieties are cheaper than the home varieties). As the capital-abundant country gets larger this benefit diminishes, and in the limit there is no difference between the capital-abundant country and the world economy and consequently no terms-of-trade benefit.

Proposition 2 can also be illustrated using the indirect utility diagram (see Figure 1). Since size is the only dimension in which country 1 changes, V^{FT} shifts upwards since this curve depends on the location of production. Therefore, the intersection between V^{FT} and V^{TL} occurs at a higher capital–labor ratio, reducing the likelihood of the acceptance of investment liberalization.

The final dimension in which countries can differ is relative factor abundance. The following proposition clarifies the implications of increasing the capital abundance of country 1:

Proposition 3. *Given the distribution of capital ownership in the capital-abundant country and assuming that trade has been liberalized, the more dissimilar countries are in capital abundance, the more likely investment liberalization is to be accepted after trade liberalization has occurred.*

The intuition for this result follows the mechanics that are familiar from factor proportion models. Consider a reallocation of factors between countries that results in a proportional increase in the endowment of labor and capital in country 1, making country 1 relatively more capital-abundant.[5] This proportional increase in endowments generates a proportional increase in the number of varieties produced in country 1. In contrast, country 2 experiences a decline in its capital–labor ratio which, due to standard Rybczynski effects, results in a more than proportional decline in the number of varieties produced in country 2. On balance, the number of varieties available overall declines as the relative difference in factor endowments increases, which lowers the positive benefits from trade liberalization for all voters, including the median voter.

These effects can also be represented in the indirect utility diagram (see Figure 1). The increase in the relative capital–labor ratio of country 1 is achieved by a proportional increase in the labor and capital endowments of country 1, which lowers the capital–labor endowment of country 2. Consequently, V^{FT} shifts downward (since $n_1 + n_2\left(\frac{p_2^{FT}}{p_1^{FT}}\right)^{\sigma-1}$ decreases).

The downward shift in V^{FT} lowers the capital–labor ratio required for the median voter to find investment liberalization acceptable after trade liberalization has occurred.

Proposition 3 helps to make sense of a puzzling aspect of the MAI negotiations within the OECD. One motivation for having the MAI negotiated within the OECD was to mitigate some of the potential stumbling blocks to an agreement by restricting negotiations to a relatively homogenous set of countries. However, as Proposition 3 indicates, restricting negotiations to similar countries may exacerbate difficulties in crafting an acceptable agreement, especially given the advanced stage of trade liberalization on industrial goods in the OECD. This also suggests that the WTO might be a more promising forum for negotiations. While the mechanism described in Proposition 1 may still affect negotiations within the WTO, Proposition 3 suggests that there is a greater chance of success when capital–output ratios are more different; this clearly describes the WTO more than the OECD.

4. Extensions

The results of this paper have been derived using a simplified framework (in particular, the assumption of CES preferences). This specification drives Lemma 1, and hence trade liberalization is not associated with any negative Stolper-Samuelson type effects. However, generalizing the model does not change the result that a sequencing of reforms that enable trade liberalization to precede investment liberalization may undermine support for investment liberalization, but can never enhance political support for investment liberalization.

This can be seen most clearly by examining a more general formulation of the indirect utility function. Assuming that the utility function is homothetic, the indirect utility function may be expressed as:

$$V(n, p)(rk_i + w).$$

Hence the linearity of the indirect utility function with respect to k is a property that is solely related to the homotheticity of the utility function. To focus attention on the relevant case, assume that the welfare ranking of the alternatives for a citizen holding an above-average endowment of capital is: $V_{TL} > V_{FT} > V_{Aut}$. Therefore, the country finds that liberalization is beneficial in aggregate. Now suppose that trade liberalization is associated with Stolper-Samuelson effects that are sufficiently strong so that a citizen holding only labor has the following welfare ranking over the three options: $V_{Aut} > V_{FT} > V_{TL}$. Allowing trade liberalization to have Stolper-Samuelson effects of this magnitude generates two cases to analyze.

The first is depicted in Figure 2. Comparing Figures 1 and 2 reveals that the same qualitative conclusions emerge. That is, a region exists where if trade liberalization precedes investment, then investment liberalization is rejected even though a proposal of simultaneous trade and investment liberalization would have been accepted by the median voter. Hence, it is possible that trade liberalization can undermine political support for investment liberalization.

The second situation is depicted in Figure 3. The relevant region to consider is the one in which reforms have some potential of being accepted. In this region $V_{TL} > V_{FT}$, so the mechanism emphasized previously does not operate. However, now it is possible that trade liberalization may be rejected, halting the whole process of liberalization, even though a more ambitious program of reform that liberalized both trade and investment would be acceptable. Hence, the general conclusion that allowing trade liberalization to precede investment liberalization can undermine support for investment liberalization continues to hold.

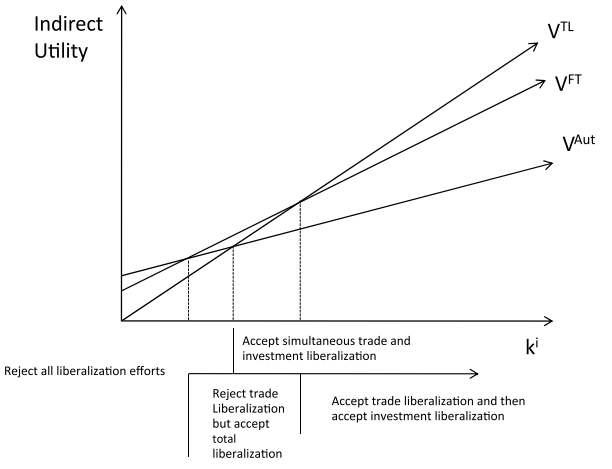

Figure 2. The indirect utility of the median voter: Case 1.

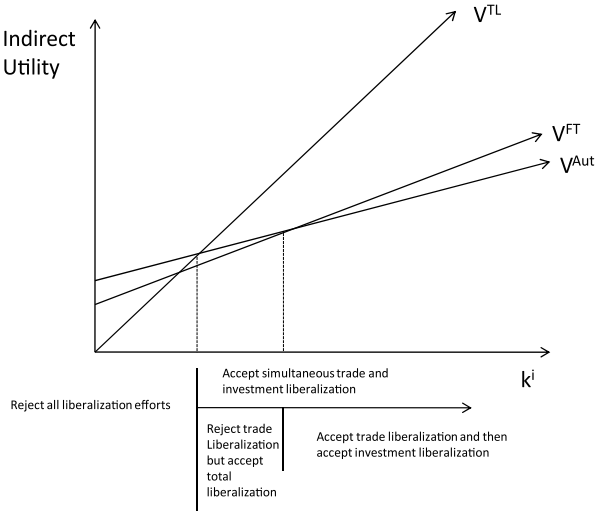

Figure 3. The indirect utility of the median voter: Case 2.

5. Conclusion

In this paper, we have considered the implications of having trade and investment liberalization occur at different points in time. We show that such a sequencing can be detrimental to the process of liberalization but can never be beneficial. In particular, it is possible to find distributions of factor ownership where simultaneous trade and investment liberalization would be acceptable to the median voter, yet trade liberalization followed by investment liberalization would not. This suggests that moving negotiations from the OECD to the WTO may not overcome some of the problems associated with liberalizing investment – problems that stem from the advanced nature of the process of trade liberalization. However, Proposition 3 suggests that the WTO may have an advantage over the OECD,

since an agreement on investment liberalization is more likely when countries differ more in their relative factor endowments.

Notes

1. The mix of variety and Stopler-Samuelson effects has been analyzed in a pure trade setting by Helpman and Krugman (1985, Chapter 9) and Levy (1997).
2. Of course a third option also exists where investment liberalization occurs before trade liberalization. If this option is undertaken, then the capacity to open a plant in the foreign country will completely substitute for trade and result in factor price equalization.
3. This result is standard in trade models of differentiated goods involving a single factor. The result also exists for models that include mutliple factors, see Helpman and Krugman (1985, Chapter 9)
4. If we assume that the median voter in country 2 (the labor-abundant country) has a capital–labor ratio less than the country average, then the median voter for country 2 is indifferent about the sequence in which trade and investment liberalization are offered (i.e., any proposal to liberalize will be accepted). This occurs under the above distributional assumption because the variety and Stolper-Samuelson effects work in the same direction. Therefore, the analysis from this point forward will focus on the behavior of the median voter in country 1 (the capital abundant country). This focus is complementary to the analysis of Markusen (1997).
5. Although K/L stays the same in country 1, K/L must be reduced in the other country.

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Appendix

Proof of Lemma 1

Consider Country 1. Using equations (7) and (8), the factor market clearing conditions for Country 1 can be written as:

$$a_{LH}(w_1, r_1)n_1 + a_{LQ}(w_1, r_1)x_1 n_1 = \overline{L}_1 \tag{12}$$

$$a_{KH}(w_1, r_1)n_1 + a_{KQ}(w_1, r_1)x_1 n_1 = \overline{K}_1 \tag{13}$$

In addition equations (1), (2), and (3) can be combined to give:

$$x_1 = \frac{\phi_1}{m_1}(\sigma - 1) = z(w_1, r_1) \tag{14}$$

Combining these three equations gives:

$$\frac{\overline{K}^1}{\overline{L}^1} = \frac{a_{KH}(w_1, r_1) + a_{KQ}(w_1, r_1)z(w_1, r_1)}{a_{LH}(w_1, r_1) + a_{LQ}(w_1, r_1)z(w_1, r_1)} \tag{15}$$

This implicitly defines the equilibrium value of w_1/r_1 as solely a function of the endowments of Country 1. Since these do not change under free trade, this implies that n_1, ϕ / m_1, and $x_1$take on the same values under both autarky and free trade. A similar argument shows that free trade does not alter the equilibrium values of n_2, ϕ / m_2, and x_2.

The model is closed by deriving the relationship between $\frac{p_1}{p_2}$ and $\frac{\phi_2 / m_2}{\phi_1 / m_1}$. Market clearing for the output of differentiated goods produced in country 1 implies:

$$x_1 = \frac{(E_1 + E_2)p_1^{-\sigma}}{n_1 p_1^{1-\sigma} + n_2 p_2^{1-\sigma}}$$

Combining this with the similar condition for Country 2 yields $\frac{x_2}{x_1} = \left(\frac{p_1}{p_2}\right)^{\sigma}$. Note that equation (14) and its counterpart in Country 2 imply $\frac{x_2}{x_1} = \frac{\phi_2 / m_2}{\phi_1 / m_1}$. Thus $\frac{p_1}{p_2} = \left(\frac{\phi_2 / m_2}{\phi_1 / m_1}\right)^{\sigma}$. By setting the price of a Country 1 differentiated good to be the numeraire, can be determined from the above relation. Since the specification of the numeraire is arbitrary, the implied value of p_2 can be used as the numeraire for the autarky in Country 2. Therefore, free trade does not induce any change in relative prices but it does allow each country to gain through the access to a greater variety of differentiated goods.

This completes the proof.

Proof of Lemma 2

In order to establish this lemma, we need to find conditions under which:

$$\left[n_1^{FT} + n_2^{FT}\left(\frac{p_2^{FT}}{p_1^{FT}}\right)^{\sigma-1}\right]^{\frac{1}{\sigma-1}} w_1 > \left[n^{IWE}\right]^{\frac{1}{\sigma-1}} w^{IWE}$$

Solving the model for n and w yields:

$$n = \Delta L^{\alpha} K^{1-\alpha}$$
$$w = \Theta\left[\frac{K}{L}\right]^{\alpha}$$

where both Δ and Θ are functions of constants. Substitution and simplifications give:

$$\left[K_1 + K_2\left(\frac{k_1}{k_2}\right)^{3\alpha-1+\frac{1-2\alpha}{\sigma}}\right] k_1^{\alpha(\sigma-2)} > \overline{Kk}^{\alpha(\sigma-2)}$$

where k_i is the capital labor ratio in country i and overbars represent global/integrated world economy variables. A sufficient condition for this inequality to hold is $\sigma > 2$ and $\alpha \in (\frac{1}{3}, \frac{1}{2})$

This completes the proof.

Proof of Proposition 2

To isolate changes in the size of the capital-abundant country from changes in the relative abundance of capital, consider initial situations where $K/L = k$ is the same for both countries (i.e., endowments along the diagonal of the Edgeworth box). From this initial situation, consider how the relative size of country 1 affects the variety gains that it receives from a given increase in its capital–labor ratio. To begin, note that with fixed world endowments, the capital–labor ratio in country 2 can be expressed as a function of the capital–labor ratio in country 1 as follows:

$$k_2 = \frac{k_w - \lambda k_1}{1-\lambda} \tag{16}$$

Now note that the variety effect is given by:

$$v = n_1(\pi_1) + n_2(\pi_2)\left(\frac{\pi_2}{\pi_1}\right)^{\frac{\sigma-1}{\sigma}} \tag{17}$$

Differentiating equation (17) with respect to k_1 gives:

$$\frac{\partial v}{\partial k_1} = n_1' \frac{\partial \pi_1}{\partial k_1} + n_1' \frac{\partial \pi_2}{\partial k_1}\left(\frac{\pi_2}{\pi_1}\right)^{\frac{\sigma-1}{\sigma}} + \frac{\sigma-1}{\sigma} n_2 \left(\frac{\pi_1}{\pi_2}\right)^{\frac{1}{\sigma}} \left(\frac{\partial \pi_2}{\partial k_1} - \frac{\partial \pi_1}{\partial k_1}\pi_1\right)$$

To evaluate this expression, note that $\pi_1 = g(k_1)$ and $\pi_2 = g(\frac{k_w - \lambda k_1}{1-\lambda})$, with $g' < 0$ and that $\pi_1 = \pi_2$ along the diagonal. Furthermore, note that $n_i' = \frac{\pi_i Q_i' - Q_i}{\pi_i^2(\sigma-1)}$ and $\mu = \frac{\lambda}{1-\lambda}$. Substitution and simplification gives:

$$\frac{\partial v}{\partial k_1} = \frac{\partial \pi_1 / \partial k_1}{\pi_i^2(\sigma-1)}\left[(Q_1' - Q_2'\mu)\pi + (Q_2\mu - Q_1)\right] + \frac{\sigma-1}{\sigma} n_2\left(-\mu - \pi_1\right)\frac{\partial \pi_1}{\partial k_1}$$

Noting that $(Q_2\mu - Q_1) = 0$ and $Q_1' = Q_2'$ yields:

$$\frac{\partial v}{\partial k_1} = \frac{\partial \pi_1 / \partial k_1}{\pi(\sigma-1)}\left[Q'(1-\mu)\right] + \frac{\sigma-1}{\sigma} n_2\left(-\mu - \pi_1\right)\frac{\partial \pi_1}{\partial k_1}$$

Note that this expression is linear in μ and that when $\mu = 0$ this derivative is positive. In addition, it must be the case that as the size of country 1 approaches that of the integrated world economy, any variety effect must go to zero. Therefore, this derivative must be non-negative and declining in the size of country 1. Consequently, the relative variety effect from free trade is larger, the smaller is the capital-abundant country.

This completes the proof.

Proof of Proposition 3

The unit input requirements are given by:

$$a_{LH} = \left[\frac{\alpha}{1-\alpha}\frac{r}{w}\right]^{1-\alpha}, a_{LQ} = \left[\frac{1-\alpha}{\alpha}\frac{r}{w}\right]^{\alpha}, a_{KH} = \left[\frac{1-\alpha}{\alpha}\frac{w}{r}\right]^{\alpha}, a_{KQ} = \left[\frac{\alpha}{1-\alpha}\frac{w}{r}\right]^{1-\alpha}$$

Also note that since $\phi = \frac{w^{\alpha} r^{1-\alpha}}{(1-\alpha)^{1-\alpha}\alpha^{\alpha}}$ and $m = \frac{w^{1-\alpha} r^{\alpha}}{(1-\alpha)^{1-\alpha}\alpha^{\alpha}}$, the zero profit condition (see equation (3)) implies that $x = \frac{\phi}{m} = \left(\frac{w}{r}\right)^{2\alpha-1}$

Using equations (4), (5), (7), and (8), the factor market clearing conditions can be written as:

$$a_{LH} n + a_{LQ} x n = L \tag{18}$$

$$a_{KH} n + a_{KQ} x n = K \tag{19}$$

Dividing equation (18) by (19) gives

$$\frac{a_{LH} + a_{LQ} x}{a_{KH} + a_{KQ} x} = \frac{L}{K}$$

Substituting in for the unit input requirements and x gives:

$$\frac{\left[\frac{\alpha}{1-\alpha}\frac{r}{w}\right]^{1-\alpha} + \left[\frac{1-\alpha}{\alpha}\frac{r}{w}\right]^{\alpha}\left(\frac{w}{r}\right)^{2\alpha-1}}{\left[\frac{1-\alpha}{\alpha}\frac{w}{r}\right]^{\alpha} + \left[\frac{\alpha}{1-\alpha}\frac{w}{r}\right]^{1-\alpha}\left(\frac{w}{r}\right)^{2\alpha-1}} = \frac{L}{K}$$

Simplifying gives:

$$\frac{w}{r} = \frac{K}{L} \tag{20}$$

Using equation (18) the number of varieties is given by:

$$n = \frac{L}{a_{LH} + a_{LQ}x}$$

Substituting for the unit input requirements and using equation (20) gives:

$$n = \frac{L^{\alpha}K^{1-\alpha}}{\left[\frac{\alpha}{1-\alpha}\right]^{1-\alpha} + \left[\frac{1-\alpha}{\alpha}\right]^{\alpha}}$$

One final detail to note is that $\frac{p_2}{p_1} = \left(\frac{K_1/L_1}{K_2/L_2}\right)^{\frac{2\alpha-1}{\sigma}}$.

Given this structure, the proposition considers the case where the distribution of capital within country 1 is given, which implies that $K_1/L_1 \equiv k_1$ is a constant. Therefore, to prove the proposition requires considering the case where $dk_1 = 0$ and $dk_2 < 0$. From Lemma 1, this implies that both the wage and the rental rate in country 1 will be constant.

The indirect utility function under free trade is given by equation (10). Substitution for n_i, $\frac{p_2}{p_1}$ and P_1 using as the numeraire gives:

$$V^{FT} = \left[\frac{L_1^{\alpha}K_1^{1-\alpha}}{\left[\frac{\alpha}{1-\alpha}\right]^{1-\alpha} + \left[\frac{1-\alpha}{\alpha}\right]^{\alpha}} + \frac{L_2^{\alpha}K_2^{1-\alpha}}{\left[\frac{\alpha}{1-\alpha}\right]^{1-\alpha} + \left[\frac{1-\alpha}{\alpha}\right]^{\alpha}}\left(\frac{K_1/L_1}{K_2/L_2}\right)^{\frac{(2\alpha-1)(\sigma-1)}{\sigma}}\right]^{\frac{1}{\sigma-1}}\left[r_1^{FT}k^i + w_1^{FT}\right]$$

$$= \left(\frac{1}{\left[\frac{\alpha}{1-\alpha}\right]^{1-\alpha} + \left[\frac{1-\alpha}{\alpha}\right]^{\alpha}}\right)^{\frac{1}{\sigma-1}}\left[L_1^{\alpha}K_1^{1-\alpha} + L_2^{\alpha}K_2^{1-\alpha}\left(\frac{K_1/L_1}{K_2/L_2}\right)^{\frac{(2\alpha-1)(\sigma-1)}{\sigma}}\right]^{\frac{1}{\sigma-1}}\left[r_1^{FT}k^i + w_1^{FT}\right]$$

$$= \left(\frac{1}{\left[\frac{\alpha}{1-\alpha}\right]^{1-\alpha} + \left[\frac{1-\alpha}{\alpha}\right]^{\alpha}}\right)^{\frac{1}{\sigma-1}}\left[L_1^{\alpha}K_1^{1-\alpha} + L_2^{1-\alpha+\frac{(2\alpha-1)}{\sigma}}K_2^{\alpha-\frac{(2\alpha-1)}{\sigma}}\left(\frac{K_1}{L_1}\right)^{\frac{(2\alpha-1)(\sigma-1)}{\sigma}}\right]^{\frac{1}{\sigma-1}}$$

$$\left[r_1^{FT}k^i + w_1^{FT}\right]$$

The proof of the proposition boils down to showing that the middle bracketed term decreases when $dk_1 = 0$ and $dk_2 < 0$. To see this, totally differentiate the middle bracketed term to get:

$$dL_1\frac{(\alpha L_1^{\alpha}K_1^{1-\alpha})}{L_1}+dK_1\frac{((1-\alpha)L_1^{\alpha}K_1^{1-\alpha})}{K_1}+dL_2\left(\frac{(1-\alpha+\frac{(2\alpha-1)}{\sigma})L_2^{1-\alpha+\frac{(2\alpha-1)}{\sigma}}K_2^{\alpha-\frac{(2\alpha-1)}{\sigma}}\left(\frac{K_1}{L_1}\right)^{\frac{(2\alpha-1)(\alpha-1)}{\sigma}}}{L_2}\right)+dK_2\left(\frac{(\alpha-\frac{(2\alpha-1)}{\sigma})L_2^{1-\alpha+\frac{(2\alpha-1)}{\sigma}}K_2^{\alpha-\frac{(2\alpha-1)}{\sigma}}\left(\frac{K_1}{L_1}\right)^{\frac{(2\alpha-1)(\sigma-1)}{\sigma}}}{K_2}\right)$$

We can simplify this by noting that $dL_2 = -dL_1$, $dK_2 = -dK_1$, and $\frac{dL_1}{L_1}=\frac{dK_1}{K_1}=\frac{dE}{E}$ (which is one way of expressing $dK_1 = 0$ and $dK_2 < 0$), which results in

$$\frac{dE}{E}L_1^{\alpha}K_1^{1-\alpha}\left[1-(1-\alpha+\frac{(2\alpha-1)}{\sigma})\frac{k_2}{k_1}^{\alpha-\frac{(2\alpha-1)}{\sigma}}-(\alpha-\frac{(2\alpha-1)}{\sigma})\frac{k_1}{k_2}^{1-\alpha+\frac{(2\alpha-1)}{\sigma}}\right]$$

So the task now is to sign the term in brackets. To do this, consider the following parameter restriction implied by the model: $\frac{k_1}{k_2}>1$, $\sigma > 1$, and $\alpha \in (0, 1/2)$. It can be shown that under these parameter restrictions that the term in brackets is always negative. Therefore, holding the distribution of capital constant in country 1 while increasing its relative capital abundance lowers the indirect utility of free trade, thus making investment liberalization more attractive to the median voter.

This completes the proof.