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GAINS FROM RESTRICTED OPENINGS OF TRADE

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Abstract

The magnitude of trade flows between a country and each of its trading partners varies a great deal, even if the latter are of similar size and possess similar production and consumption characteristics. The objective of this paper is to provide an explanation of what determines the identity of a country's major trading partners. The paper adopts a transactions cost approach which postulates that the setting-up of trading relations requires country-specific expenditures. It is quite obvious that these expenditures are lower when the importing country is geographically near and culturally similar, making it a primary candidate for being a major trading partner. This paper, however, focuses on a far less obvious explanation of the major trading partner phenomenon. One country may become the leading export market even if export set-up costs are the same in several potential foreign markets. It is shown to be in the interest of a country to establish stronger trading relations with a limited number among numerous equally suitable potential trading partners. A country is always better off by opening trade gradually, starting with just one or a few other countries, rather than opening trade to all countries at the same time. In this case, the trade volume with early traders tends to be permanently larger than with latecomers. It is even possible that a country gains by limiting its trade to a few partners permanently,and not just temporarily.

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1. Introduction

Most countries of the world have remarkably strong trade ties to a limited number of other countries, their so-called major trading partners. Their export and/or import flows are much larger than with minor trading partners, and these sizable differences in trade flows may occur even when major and minor trading partners possess quite similar production and consumption characteristics. For example, Germany is Turkey's major export market and the value of Turkish exports to Germany is about twice the value of Turkish exports to Japan, the United Kingdom, and France combined.[1] Scrutiny of the *Directions of Trade Statistics* immediately suggests that familiarity with each other's business and government institutions, based on past colonial ties,[2] extensive population migration,[3] and geographic vicinity is the most plausible explanation of why a certain country becomes a main trading partner. Although the exogenously given degree of familiarity with a country's business and government institutions explains a great deal about the relative magnitude of trade flows, it does not explain it fully. There exist numerous instances where the emergence of a main trading partner, among many potential partners, appears to be quite random.[4]

This paper develops a model which explains the concentration of trade flows to just one or a few countries even though there are many other countries out there with whom bilateral trade would be equally gainful. It is argued that trade flows become concentrated on one or a few partners because a country can gain by opening trade gradually with one country at a time and, possibly even, by permanently restricting trade to a few of many potential partners. The key assumption of this model is that any exchange of commodities, especially between the residents of different countries, results

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1 For these and other trade flow statistics, see the *Direction of Trade Statistics (1994)*.

2 This is most obvious in the case of former French colonies, such as Cameroon, Madagascar, New Caledonia, or Niger; but it also is quite noticeable for countries that had colonial ties to the United Kingdom, Portugal, Belgium, and the Netherlands.

3 This is quite clearly reflected in the trade flows between Argentina and Italy. Argentina has a large Italian immigrant component, and Italy has ranked consistently among Argentina's top five trading partners. A similar influence of migration on trade flows can be discerned with respect to Turkey and Germany.

4 Nepal is a good example. During the last five years, Germany has been Nepal's major export market, followed by the United States and New Zealand. Nepal's immediate neighbors, India and China, are relatively small export markets for the Himalayan country. On the other hand, India, Japan, and China are the main suppliers of imports to Nepal.

in significant *transactions costs* and that a sizable fraction of these transactions costs is sunk. Transactions costs are incurred in the process of exchange, rather than in the process of production, and consist primarily of "search and information costs, bargaining and decision costs, and policing and enforcement costs," (Dietrich, 1994, p.33). The magnitude of these transactions costs crucially depends on the prevailing institutions, as reflected in the laws, trading practices, social customs, law enforcement, and general business and government culture of a country. The fact that these institutions differ a great deal from country to country should be reflected in the specification of economic models (North, 1990, p.4). Firms of one country that want to sell their products in another country must first familiarize themselves with the institutions of the new market. The transactions costs caused by the entry into a foreign market are conveniently called *export set-up costs.* The initial familiarizing with a foreign country's institutions requires a one-time country-specific investment. The export set-up costs for a specific country are sunk.

The more familiar a country's firms are with the business and government institutions of another country, the lower the initial costs of entering the new market, and the more likely it is that it, rather than otherwise similar countries, becomes a major trading partner. Colonial ties of the past, a large number of immigrants from the trading partner, educational systems that teach the language spoken in the export market, common borders, etc. will keep the costs of market entry relatively low. The long-term persistence of trade flows between these countries, in turn, is a consequence of the sunk-cost nature of initially developing an export market.[5]

There are numerous instances in which the identity of a country's major trading partner appears to be quite unrelated to greater initial familiarity with the foreign markets' institutions. A country's firms might be equally familiar with the institutions of various foreign countries, and the latters' production and consumption characteristics might also be quite similar, but only one or a few of these potential trading partners becomes its major trading partner . This paper offers an explanation for this phenomenon. It is shown that a country, aware of the persistence of trade flows due to sunk costs, has an incentive to control the number of initial trading partners. A country

[5] The hysteresis literature has highlighted the role of sunk costs in explaining the persistence of real effects, as Baldwin (1988) and Dixit (1989) have done with respect to exchange rates and Cassing (1991) has done with respect to lobbying groups.

that faces two identical potential trading partners *will* definitely be better off opening trade with them *gradually*, first with one and later with the other, rather than *simultaneously*, with both at the same time. The gradual opening of trade enables a country to attain more favorable (factoral) terms of trade than would be the case under simultaneous opening with all countries. This suggests that relative newcomers to world trade, such as China, Vietnam, Lithuania, Latvia, and Estonia, might be reluctant to expand their initial trade ties to all countries of the world at the same time; they can become better off building their trade network first with a few, generally larger, countries. This finding also suggests that the existence of export set-up costs imparts a bias in favor of regional trade liberalization relative to global trade liberalization; a country may prefer to reduce its trade barriers to a few select countries rather than to all countries of the world.

This paper's model yields a second result of interest. A country that faces a number of identical potential trading partners *might* be better off *permanently* limiting its trade to a subset of potential partners than trading with all of them. Different from the situation discussed in the preceding paragraph, gradual expansion of trade does not pay either. It is best not to start trade with some countries at any time, now or later. The critical assumption behind this result is that the setting up of exports by industries that first enter a foreign market has a positive externality on industries whose firms enter later on. As the pioneers of market entry gain familiarity with the foreign country's institutions, this increased familiarity is assumed to spill over, at least in part, to other firms whose initial cost of market entry prevented them from being a pioneer. Limiting exports to a few countries, or what one may call *deepening of trade*, allows firms to become far more familiar with the institutions of these countries than they could ever hope to become if trading were spread over all potential trading partners. When trade is restricted to fewer countries, this advantage of lower market entry costs for future exporters has to be weighed against the disadvantage of trading with a smaller world as the latter results in less advantageous (factoral) terms of trade.

A modified Dornbusch-Fischer-Samuelson (1977) model is adopted, the modification consisting of the introduction of country-specific export set-up costs. Section II develops this model, determines conditions under which there will be no trade at all, distinguishes between exported, imported, and non-traded goods, and measures

the gains from trade. Section III compares the benefits from the gradual opening of trade with one potential partner with the benefits from the simultaneous opening of trade with two potential trading partners. The analysis is conducted under the assumption that a given country faces two potential trading partners whose production technologies, consumption preferences, and set-up costs for market entry are identical. In this analysis, export set-up costs are assumed to be constant over time. Section IV changes this assumption about export set-up costs and assumes that they are negatively related to the volume of exports of the past. Again, there is a country that faces two identical potential trading partners, and it is shown that familiarity with one of the country's institutions grows quicker through deepening of trade with one than through widening of trade with both of them. Weighing this benefit from deepening of trade against the terms of trade benefit from widening trade, it might be in the interest of a country to permanently restrict trade to a subset of potential partners.

2. The Model

A. Production and Export Technologies

This paper employs a modified Dornbusch-Fischer-Samuelson (1977) model, in which each of many commodities is produced from labor alone and the home country and rest of the world have different production technologies. The rest of the world may consist of more than one country, each country's labor endowment is constant, and labor is fully mobile among the industries within each country. The unit labor requirement to produce commodity i in country h is denoted by $a_h(i)$ and commodities are indexed on the interval [0,1] such that the comparative advantage in producing commodities of country h relative to country g declines with i; that is,

$$A(i) = a_g(i)/a_h(i), \tag{1}$$

where $A'(i) < 0$.

After a commodity is produced, it can be sold at home or in the foreign country. The activity of selling generates *transactions costs* whose magnitude critically depend on the seller's familiarity with the business and government institutions of the market where the sale takes place. For analytical purposes it is convenient to group all

transactions costs into *trade set-up costs* and *trade conduct costs*. Trade set-up costs involve a one-time expenditure that must be incurred before selling can begin in order to acquaint the firm with the specific market's business and government institutions. These set-up costs are assumed to be negligible for selling in the firm's home market, but non-negligible for selling in the firm's foreign markets. Trade conduct costs, on the other hand, arise with each actual transaction after trade has started. They play a role similar to transport costs and, since they are not the focus of our study, they are assumed to be negligible.

Concerning the trade set-up costs for entering another country, from now on called *export set-up costs*, it is assumed that each unit of commodity i to be sold per future period by firms of country h to buyers in country g requires a one-time, initial labor employment of $b_{hg}(i)$. Furthermore, it is assumed that this labor requirement for setting up future sales of commodity i is proportionate to commodity i's labor requirement for production, where ρ_{hg} is a factor of proportionality, common to all commodities. The value of this familiarity factor rises the less familiar firms of country h are with the institutions of country g. It follows that

$$b_{hg}(i) = \rho_{hg} a_h(i).^{6} \tag{2}$$

The value of ρ_{hg} is not the same for all countries. The more familiar firms of country h are with the institutions of country g, the lower this factor of proportionality will be. Accordingly, colonial ties, use of the same legal, banking, and educational institutions, proximity of firms to foreign centers of consumption, and the dissemination of cultures through television and movies all contribute to a lowering of this factor. In Sections II and III of the paper, it is assumed that ρ_{hg} is exogenously given; in particular, it is independent of the past volume of trade between two nations. In Section IV, on the other hand, ρ_{hg} is assumed to be negatively related to the past export volume of country h to country g; the more firms exported in the past, the more familiar they are with the foreign country's institutions in the present, and this knowledge is assumed to spill over to firms of other industries enabling them to enter the foreign market in later periods.

[6] This paper does not distinguish between exporting by the producing firm and exporting by a separate, specialized firm, sometimes called a General Trading Company. For a theoretical framework dealing with this issue and a discussion of exporting practices by Japanese and U.S. firms, see Kimura and Talmain (1994).

All industries are competitive, as firms take commodity prices and wages as given and face no barriers to entry. Accordingly, production equilibrium in a given country entails an allocation of labor among industries such that each firm's discounted profits are zero. When firms of country h sell goods in foreign country g, which requires positive export set-up costs, the zero-profit condition in industry i is:

(3) $$[p_g(i) - w_h a_h(i)]/r = w_h a_h(i)\rho_{hg} \qquad \text{or} \qquad p_g(i) = w_h a_h(i) R_{hg},$$

where $p_g(i)$ is the price of good i in country g, w_h is the wage rate in country h, r is the discount rate, and $R_{hg} = (1+r\rho_{hg}) > 1$. In writing (3), it is assumed that firms expect prices, wages, and familiarity with the foreign market to remain unchanged over time. The left-hand side of the first equation of (3) measures the discounted stream of profits from selling one unit of good i in the future; the right-hand side expresses the one-time expense of setting up trade of good i from country h to country g. The second equation of (3) is used to express the zero-profit condition for exporting in the remainder of the paper. Finally, when firms of country h sell goods in their own country, there are no set-up costs, and the zero-profit condition reduces to:

(4) $$p_h(i) = w_h a_h(i).$$

B. Consumption Preferences and Welfare Measures

The consuming population of country h is identical to its labor force, denoted by L_h. Consumer preferences are described by the Mill assumption, stating that each person's expenditure share, $\theta_h(i)$, is constant and equal, where

(5) $$\theta_h(i) = \frac{p_h(i)y_h(i)}{w_h L_h},$$

and where $y_h(i)$ denotes total demand for good i by all people of country h. In order to eliminate any demand influences on the pattern of trade, we assume that the expenditure share for good i is the same in every country, making $\theta_h(i) = \theta_g(i) = \theta(i)$.

The critical question raised by this paper is whether a country that faces a number of essentially identical potential trading partners can raise its welfare by limiting its trade to a subset of these partners, either temporarily or even permanently. In order to compare alternative trade regimes, we have to establish a way to measure the home country's welfare. To do so, we first note that the direct utility function that implies the Mill assumption of constant expenditure shares has the Cobb-Douglas form. Adjusting it for a continuum of goods on the interval [0,1], the indirect utility function is:

(6) $$V_h = \frac{w_h L_h}{\prod_0^1 [p_h(i)]^{\theta(i)}} = \frac{L_h}{\prod_0^1 [p_h(i)/w_h]^{\theta(i)}},$$

where V_h expresses maximum attainable welfare for country h as a whole and where $\int_0^1 \theta(i)di = 1$.

In autarky, all goods consumed are domestically produced, and the zero-profit condition of (4) holds for all $i \in [0, 1]$. Welfare of the representative person of country h in the state of autarky, denoted by $v_h(0)$, is then:

(7) $$v_h(0) = V(0)/L_h = 1/\prod_0^1 [a_h(i)]^{\theta(i)},$$

after substitution of (4) in (6). The average person's welfare crucially depends on how much labor is required for producing each of the consumed commodities. The less labor is required for production, the better off people will be, especially when the low labor requirement pertains to goods with high expenditure shares.

When country h trades with country g, some of the consumed goods are imported and others are produced at home. If, for example, goods $i \in [0, z_g]$ are produced domestically and goods $i \in [z_g, 1]$ are imported, then:

(8) $$v_h(1) = 1/\left\{\prod_0^z [a_h(i)]^{\theta(i)} \prod_z^1 [a_g(i) R_{gh} (w_g/w_h)]^{\theta(i)}\right\},$$

where we substituted (3) for imported goods and (4) for domestically produced goods in (6). Welfare of the representative individual of country h under free trade between countries h and g is denoted by $v_h(I)$ and depends not only on the domestic workers' own efficiency in producing its export goods, $a_h(i)$, but also on the foreign country's labor efficiency in producing its import goods, $a_g(i)$, the set-up costs for foreign (country g) firms to enter the market of country h, as reflected in the value of R_{gh}, and the factoral terms of trade between the two countries, (w_h/w_g). The home country's consumers benefit from greater efficiency of foreign workers, lower set-up costs for foreign exporters, and more favorable factoral terms of trade.

C. Trade Flows and Gains from Trade

This subsection determines the goods a country exports and imports, its factoral terms of trade, and the gains from trade provided there is an incentive to trade. Also, we will show how export set-up costs inhibit trade, possibly leading to a no-trade situation.

Firms of industry i in country h have an incentive to export commodity i if their unit cost of producing and exporting good i, measured by $w_h a_h(i) R_{hg}$, is no greater than the unit production cost in country g, given by $w_g a_g(i)$. The marginal export good of country h to country g is good z_h for which:

$$\mu = A(z_h)/R_{hg}, \tag{9}$$

where $\mu = (w_h/w_g)$ expresses the factoral terms of trade of country h and $A(i)$ was defined in (1). Since $A(i)$ decreases with i, country h exports all goods indexed by $i \in [0, z_h]$.

The consumers of country h have an incentive to import good i from country g if the domestic unit cost of producing it, $w_h a_h(i)$, exceeds the unit cost of producing it in country g and exporting it to country h, $w_g a_g(i) R_{gh}$. For the marginal import commodity of country h, denoted by z_g, the condition is that:

$$\mu = A(z_g)R_{gh}. \tag{10}$$

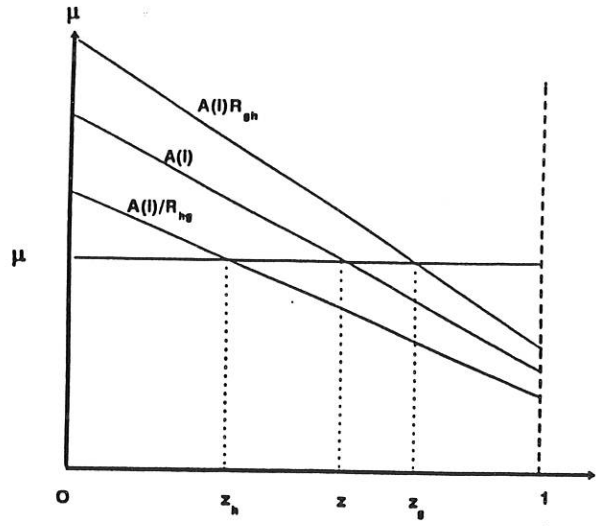
Since $A(i)$ is decreasing with i, all commodities indexed by $i \in [z_g, 1]$ are imported by country h from country g.

Trade between the two countries is balanced when the value of exports by country h equals the value of its imports; that is, when $\int_0^{z_h} p_g(i)y_g(i)di = \int_{z_g}^1 p_h(i)y_h(i)di$. Using (5) and the definition of μ, the condition for balanced trade becomes:

$$\mu = \frac{L_g \int_0^{z_h} \theta(i)di}{L_h \int_{z_g}^1 \theta(i)di}. \tag{11}$$

Equations (9)-(11) determine for country h which commodities are exported and which are imported, as well as the value of the factoral terms of trade. This trading equilibrium is portrayed by Figure 1. The $A(i)$ schedule shows that commodities are indexed according to labor's efficiency in producing them in country h relative to country g; the greater the value of $A(i)$, the greater the comparative advantage of country h in producing good i. In the absence of any export set-up costs, $R_{hg} = R_{gh} = 0$, commodities $i \in [0, z]$ would be exported by h, commodities $i \in [z, 1]$ would be imported, and the factoral terms of trade would be μ, just as in the standard Dornbusch-Fischer-Samuelson presentation. With export set-up costs, however, export goods, $i \in [0, z_h]$, are determined by the intersection of the $A(i)/R_{hg}$ and μ schedules, import goods, $i \in [z_g, 1]$, are determined by the intersection of the $A(i)R_{gh}$ and μ schedules, and goods $i \in [z_h, z_g]$ are nontraded. The diagram itself does not reveal explicitly how the position of the μ–line is determined; in the Appendix it is shown that the factoral terms of trade of h, given by $\mu = w_h/w_g$, will improve if the population of g rises relative to h, the export set-up costs of h fall, or the export set-up costs of g go up. Also, the index number of the marginal export good, z_h, increases with population growth of h relative to g and with a lowering of either country's export set-up costs; and the index number of the marginal import good, z_g, declines with a fall in the population of h relative to g and with a lowering of either country's export set-up costs.

Figure 1: *Trading Equilibrium in the Presence of Export Set-up Costs*



When export set-up costs are extremely high, there may be no incentive to trade as all commodities remain non-traded, even though the two countries' production technologies are quite different. Specifically, there will be no trade if:

$$A(0)/R_{hg} < A(1)R_{gh}, \tag{12}$$

since there exists no value for the factoral terms of trade, μ, at which country h will export at least some commodities and import some other commodities. When (12) holds, the trade equilibrium conditions of (9)-(11) cannot be satisfied.

When the inequality of (12) is reversed, there will be trade between h and g. The gains from trade for the average person of country h can then be measured by:

$$\frac{v_h(1)-v_h(0)}{v_h(0)} = \prod_{z_g}^{1}\left(\frac{\mu}{A(i)R_{gh}}\right)^{\theta(i)} - 1 = \prod_{z_g}^{1}\left(\frac{A(z_g)}{A(i)}\right)^{\theta(i)} - 1, \tag{13}$$

where we employed (1), (7), (8), and (10).

One can see from Figure 1 that $A(z_g) > A(i)$ for all $i \in (z_g, 1]$. Consequently, the expression of (13) is positive and the people of country h benefit from the opening of trade. Furthermore, any force that – given the countries' production technologies – raises the number of import commodities of h has a positive impact on the country's welfare. It follows from the derivations in the Appendix that such welfare improvements will come about when there is a relative increase in the foreign population or a decline in either country's export set-up costs.

D. Persistence of Trade Flows

A firm's export set-up costs are incurred before any commodities are sold in the foreign country and these costs cannot be recovered. Consequently, the decision to leave a foreign market is not the mirror image of the decision to enter that market; and unexpected external price shocks may have no effect on export flows.

When country h opens trade with country g, the former's marginal export good is determined by (9). Should, thereafter, some exogenous event result in declining factoral terms of trade, then μ will be below the value of $A(z_h)/R_{hg}$ and some producers of nontraded goods will have an incentive to export to g as well. If, on the other hand, an external shock pushes μ above the value of $A(z_h)/R_{hg}$, then the number of different commodities exported by h might remain unaffected. More precisely, country h, which initially exported goods i$\in [0, z_h]$, will not change its exports as long as:

$$A(z_h)/R_{hg} \leq \mu \leq A(z_h). \tag{14}$$

The left-hand inequality expresses the absence of an incentive to expand exports to goods with an index number beyond z_h since the cost of providing these good to country g consumers is less for firms of country g than for firms of country h; that is, $a_g(i)w_g < a_h(i)w_hR_{hg}$. The right-hand inequality, on the other hand, states that exporting firms of country h, having sunk their export set-up costs already, have no incentive to leave the export market of country g as long as their pure production costs do not exceed those of their foreign competitors; that is, as long as $a_h(i)w_h < a_g(i)w_g$.

Imports of country h, provided by firms of country g, show a corresponding persistence to small external shocks. The initially established imports, indexed by i $\in [z_g, 1]$, will not change as long as:

(15) $$A(z_g) \leq \mu \leq A(z_g)R_{gh}.$$

Given the criteria of (14) and (15) for unchanging trade flows, let us examine the effects of a sequence of disturbances after the initial opening of trade between *h* and *g*. The initial trading equilibrium was described by (9)-(11). Whatever the nature of the first external shock, we assume that it is unexpected and that it lowers the factoral terms of trade of *h*. Since $\mu = A(z_h)/R_{hg}$ at the initial equilibrium, some firms of country *h* that so far produced nontraded goods find it profitable to export, thereby raising the index number of the marginal export good above z_h, say to $z_{h'}$. On the other hand, it follows from (15) that the decline in μ will not alter the index number of the marginal import good, z_g, since initially $\mu = A(z_g)R_{gh}$. Hence, the first in a sequence of unexpected disturbances, which is assumed to result in lower factoral terms of trade of *h*, expands exports of country *h* without altering exports of country *g*. Had the disturbance raised the factoral terms of trade of *h*, her exports would have remained unchanged and those of *g* would have grown.

Next, there occurs a *second* disturbance. The trading equilibrium, newly established in response to the first disturbance, is to be evaluated, whereby we assume that the second disturbance consists of a small shock in the opposite direction of the first disturbance. The outcome is that the already established trade flows will remain unchanged as neither country's firms have incentives to either expand or contract their production for foreign markets. To show this, we define the pre-disturbances factoral terms of trade by μ^o and the factoral terms of trade after the first disturbance by μ', where $\mu^o > \mu'$. The first disturbance changes the index number of the marginal export good of *h* from z_h to $z_{h'}$, while z_g remains the marginal export good of *g*. It follows from (14) and (15) that neither country's marginal export good will change in response to the second shock provided the factoral terms of trade after the second disturbance are such that:

(16) $$A(z_{h'})/R_{hg} = \mu' \leq \mu \leq A(z_{h'}) \quad \text{and} \quad A(z_g) \leq \mu \leq \mu^o = A(z_g)R_{gh}.$$

The second disturbance has no influence on trade flows as long as the resulting factoral terms of trade are such that $\mu' \leq \mu \leq \mu^o$ where $A(z_{h'})/R_{hg} = \mu' < \mu^o = A(z_g)R_{gh}$. One, therefore, can conclude that it is quite possible that established trade flows will not adjust when there are changes in peoples' consumption preferences, population sizes, or other exogenous factors pertaining to one of the two trading countries and, in a sequence of disturbances the later one partially reverses the impact of the earlier one.

3. Opening Trade Gradually

When a country considers joining the international trading community, it faces a large number of potential trading partners. According to standard economic theory, social welfare is maximized by opening trade with all these countries at the same time. What we frequently observe in the real world, however, is that countries that open their economies to global competition do so by exporting to just a few selected markets first, followed by a gradual expansion of trade to other countries. The goal of this section is to show that such gradual opening of trade is optimal for countries of a world in which export set-up costs play a significant role. We are going to show that a country that faces two identical potential trading partners is always better off opening trade gradually, first with one and later with the other country, than starting trade with both of them simultaneously.

A. Adding Another Trading Partner

A model that examines the gradual opening of trade has to allow for at least three trading countries. Accordingly, we add a third country, called *s*, to the already trading countries *h* and *g*. Country *s* is assumed to have the same production technologies, set-up costs for exporting to and importing from country *h*, and consumption preferences as country *g*; countries *g* and *s* may, however, differ with respect to population size.

Initially, country *h* finds itself in a state of autarky and, when the opening of trade is considered, country *h* is able to control with which country it wants to exchange goods. If *h* were to start trade with one of the two countries only, it would choose the larger one as its trading partner; as shown in the Appendix, the larger the trading partner the greater are the gains from trade. So let us assume that country *h* establishes trade with country *g* first, such that conditions (9)-(11) hold in equilibrium, with goods i

$\in [0, z_{hg}]$ being exported from h to g, and goods i$\in [z_{gh}, 1]$ being imported by h from g. The factoral terms of trade between the two countries are given by μ.

After trade between h and g has been established, country h considers opening trade with country s as well, where the labor requirements for production, as well as for exporting and importing are the same in s as they are in g; that is, $a_s(i)/a_h(i) = a_g(i)/a_h(i) = A(i)$, $R_{hg} = R_{hs} = R_h$, and $R_{gh} = R_{sh} = R_g$. Country h will export commodity i to the latecomer in trade, country s, if the cost of producing it and incurring export set-up costs, $w_h a_h(i) R_h$, is no greater than the cost of producing it in s, measured by $w_s a_s(i)$. Denoting the factoral terms of trade of h with respect to s by $\mu_s = w_h / w_s$, the marginal export good of h to s, z_{hs}, is determined by:

(17) $$A(z_{hs})/R_h = \mu_s .$$

When country s exports to country h, it competes with two types of goods: goods produced by h and so far not traded, and goods produced by g and imported by h. Concerning the former, country s will export good i to h if $w_s a_s(i) R_{sh}$ is no larger than $w_h a_h(i)$; concerning the latter, s will export good i to h if $w_s a_s(i) R_{sh}$ is no larger than $w_g a_g(i)$.[7] An immediate implication of these trading conditions is that the latecomer s will not be able to engage in any trade with h unless its wage rate, w_s, is below the prevailing wage rate of the early trader g, denoted by w_g. If w_s were equal to w_g, country s could not compete with country g in providing goods $i \in [z_g, 1]$ since the latter has incurred its sunk costs already, and it could not export any goods $i \in [z_h, z_g)$, that so far were nontraded, since for them $A(i) R_{sh} > \mu_s$. Accordingly, the factoral terms of trade of country h relative to the latecomer in trade, μ_s, must be more favorable than the prevailing factoral terms of trade relative to the early trader, μ.

The latecomer's market entry results in one of two kinds of market equilibria. For the first kind of equilibrium, $\mu_g < \mu_s < \mu_g R_{sh}$ and country s will not displace any exports of country g as it will export only those goods that so far had been produced by h at home. The marginal export good of s to h is then determined by

(18) $$A(z_{sh}) R_{sh} = \mu_s ,$$

[7] For firms of country g the export set-up costs are already sunk. Accordingly, they will retain the market as long as the price charged by the competition exceeds their own pure production costs.

which implies that the opening of trade with s enlarges the number of import commodities of country h, the latter receiving goods i$\in [z_{gh}, 1]$ from the early trader g, just as before, and goods i$\in [z_{sh}, z_{gh}]$ from the latecomer s. For the second kind of equilibrium, $\mu_g < \mu_s = \mu_g R_{sh}$ and the latecomer will export the entire range of goods i $\in [z_{sh}, 1]$ so far produced by either country h or country g, and the marginal export good is again determined by (18).

In the following analysis we are going to examine the first kind of equilibrium only, keeping in mind that the essence of the conclusions reached, namely that the gradual opening of trade with one country at a time is better than the simultaneous opening with both countries, holds for the second equilibrium as well. In the first kind of equilibrium under discussion – which comes about after market entry of the latecomer s –country h continues to import the same commodities from the early trader g as it did before the arrival of the latecomer, namely goods i$\in [z_{gh}, 1]$. The factoral terms of trade of h with respect to g, denoted by μ_g, as well as the types of goods exported by h to g will adjust, however. The reason for these changes is that arrival of the latecomer affects how much buyers in h are willing to pay for goods imported from g. Although the new competition cannot push the early traders' export industries out of the market as long as $w_g a_g(i) < w_s a_s(i) R_{sh}$, the export industries of country g have to lower their prices charged to buyers in country h from $p_h(i) = w_g a_g(i) R_{gh}$, before entry of the latecomer, to $p_h(i) = w_s a_s(i) R_{sh}$, after entry of the latecomer, in order to keep the new competition at bay. It follows that all goods imported by country h, no matter whether they come from country g or country s, sell in country h at the unit cost of the latecomer's firms, inclusive of export set-up costs, such that

(19) $$p_h(i) = w_s a_s(i) R_{sh} \qquad \text{for all } i \in [z_{sh}, 1].$$

In the new trading equilibrium, the marginal export good of h to s and the marginal import good of h from s are determined by (17) and (18), respectively, given the factoral terms of trade of h relative to s, μ_s. The latter, in turn, are determined by the condition that the value of exports of h to s equals the value of imports from s to h, such that $\int_0^{z_{hs}} p_s(i) y_s(i) di = w_s L_s \int_0^{z_{hs}} \theta(i) di$ equals $\int_{z_{sh}}^{z_{gh}} p_h(i) y_h(i) di = w_h L_h \int_{z_{sh}}^{z_{gh}} \theta(i) di$. This implies that:

$$\mu_s = \frac{L_s \int_0^{z_{hs}} \theta(i)di}{L_h \int_{z_{sh}}^{z_{gh}} \theta(i)di}, \tag{20}$$

where z_{gh} is given as the marginal import good of h before the latecomer entered, and z_{hs} and z_{sh} are the solutions to (17) and (18).

Concerning trade between country h and the early trader g, the marginal import good of h continues to be determined by equations (9)-(11), the trade equilibrium conditions before arrival of the latecomer. As mentioned before, the factoral terms of trade will be changing, however. We now distinguish the factoral terms of trade before arrival of the latecomer, μ, from the factoral terms of trade after the latecomer has entered trading relations with h, μ_g. Given μ_g, the marginal export good of h to g, denoted by z_{hg}, is determined by (9), but will be different from the previously established marginal export good z_h since the latter prevailed when the factoral terms of trade were still μ. The reason for the change in factoral terms of trade is that entry of the latecomer reduces export prices of the early trader, as discussed before, which, in turn, reduces the early trader's income and value of its expenditures on goods produced in country h. The lower expenditures on goods produced in h curtail derived demand for labor in h, and the factoral terms of trade of h relative to g must decline. More precisely, the income of country g after entry by s, denoted by Y_g, becomes:

$$Y_g = w_g L_g - \int_{z_{gh}}^{1} [w_g a_g(i) R_{gh} - w_s a_s(i) R_{sh}] y_h(i) di,$$

where the term inside the bracket represents the loss per unit of good i sold to country h as firms receive only a price of $w_s a_s(i) R_{sh}$ rather than $w_g a_g(i) R_{gh}$, the amount which would have been received per unit if the latecomer had not entered. Multiplying $y_h(i)$ by $p_h(i)$, dividing it by the same-value of $w_s a_s(i) R_{sh}$, and substituting (5) yields:

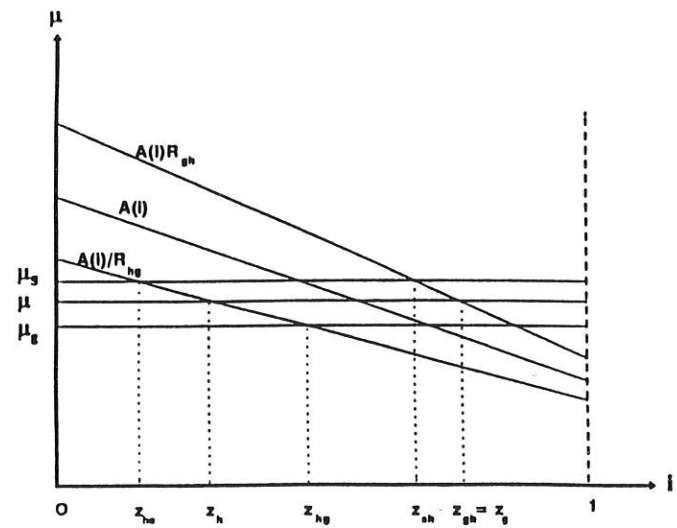
$$Y_g = w_g [L_g - L_h(\mu_s - \mu_g) \int_{z_{gh}}^{1} \theta(i)di]. \tag{21}$$

The factoral terms of trade of h relative to g are determined by equating the value of imports by h from g, $w_h L_h \int_{z_{gh}}^{1} \theta(i)di$, with the value of exports from h to g, $Y_g \int_0^{z_{hg}} \theta(i)di$, such that:

$$\mu_g = \frac{L_g \int_0^{z_{hg}} \theta(i)di}{L_h \int_{z_{gh}}^{1} \theta(i)di} - (\mu_s - \mu_g) \int_0^{z_{hg}} \theta(i)di. \tag{22}$$

The factoral terms of trade of h relative to g, which come about after h has expanded its trade to the latecomer and which are expressed by (22), must be lower than they were before the latecomer arrived, as was stated in (11). This follows from the condition that $\mu_s > \mu_g$ if the latecomer s is going to export at all, as well as the facts that z_{gh} does not change and that z_{hg} is inversely related to μ_g. Figure 2 portrays the newly established equilibrium, its important features being the following: The factoral terms of trade of h relative to the latecomer s are better than they used to be with the early trader, $\mu_s > \mu$; the factoral terms of trade of h relative to the early trader g deteriorate, $\mu_g < \mu$; goods $i \in [0, z_{hs}]$ and goods $i \in [0, z_{hg}]$ are exported by h to s and g, respectively; and goods $i \in [z_{sh}, z_{gh}]$ and goods $i \in [z_{gh}, 1]$ are imported from s and g, respectively.

Figure 2: *Trading Equilibrium with Early Trader and Newcomer*



B. The Gains from Trade: Gradual versus Simultaneous Opening

Having described the final trading equilibrium when country h opens its trade gradually, first with country g and later on with country s, we now determine the welfare gains from this process and compare it with the welfare gains that would be attainable if trade were opened with both g and s at the same time. Welfare of people in country h is again measured with the help of the indirect utility function of (6). Starting with the case of gradual opening, the welfare measure is evaluated for the period when trade with both latecomer and early trader is taking place at the equilibrium level discussed before. After substitution of (4) for the $i \in [0, z_{sh}]$ goods that are produced by h and (19) for the $i \in [z_{sh}, 1]$ goods that are imported from either g or s, the representative consumer's utility after the gradual opening, $v_h(G)$, becomes:

$$(23) \qquad v_h(G) = 1/\left\{\prod_0^{z_{sh}} [a_h(i)]^{\theta(i)} \prod_{z_{sh}}^1 [a_s(i) R_{sh}(w_s/w_h)]^{\theta(i)}\right\}.$$

The welfare change, compared to what it was before the latecomer's entry, is:

$$(24) \qquad \frac{v_h(G)-v_h(1)}{v_h(1)} = \prod_{z_{sh}}^{z_{gh}} \left[\frac{A(z_{sh})}{A(i)}\right]^{\theta(i)} \prod_{z_{gh}}^1 \left[\frac{\mu_s}{\mu}\right]^{\theta(i)} - 1 > 0.$$

The finding that adding country s as a trading partner raises welfare can be ascertained from Figure 2, where one can see that $A(z_{sh}) > A(i)$ for all $i \in [z_{sh}, z_{gh}]$ and that $\mu_s > \mu$. There are gains for h from an increase in the number of import goods as the latecomer adds to the imports coming from the early trader and the relevant factoral terms of trade, namely those of h relative to the latecomer s, improve.

The comparison of welfare gains from gradual and simultaneous opening of trade is based on an assessment of welfare after the full opening of trade compared to what it was in autarky. Under *gradual opening of trade*, the welfare gains are given by:

$$(25) \qquad \frac{v_h(G)-v_h(0)}{v_h(0)} = \prod_{z_{sh}}^1 \left[\frac{\mu_s}{A(i)R_{sh}}\right]^{\theta(i)} - 1 = \prod_{z_{sh}}^1 \left[\frac{A(z_{sh})}{A(i)}\right]^{\theta(i)} - 1,$$

where we employed (7) and (23). Given the three countries' production structures, as reflected in the values of $A(i)$, and of the consumers' preferences, as expressed by the values of $\theta(i)$, the gains from trade are inversely related to the value of the index number

of country h's marginal import good; the lower the index number of z_{sh}, the more different commodities are imported, and the higher is the level of welfare to the representative consumer of country h.

Under *simultaneous opening of trade*, the nature of the trading equilibrium is the same as it was when country h traded with country g only, except that now the trading partner of h is enlarged by the addition of s. Accordingly, we employ again (9)-(11), with the modification that the marginal import good of h is now z_{g+s}, instead of z_g, that the marginal export good of h becomes $z_{h'}$ instead of z_h, and that the factoral terms of trade are now determined by:

$$(11') \qquad \mu_{g+s} = \frac{[L_g+L_s]}{L_h} \frac{\int_0^{z_{h'}} \theta(i)di}{\int_{z_{g+s}}^1 \theta(i)di}.$$

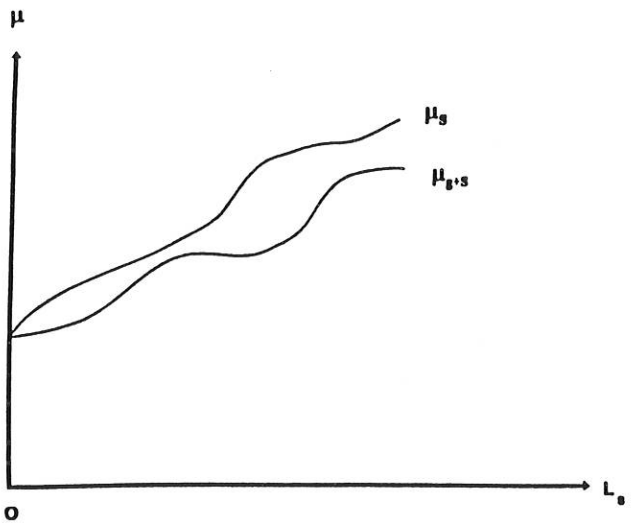
Since the factoral terms of trade of h, as well as the number of different import commodities rises with the size (population) of the trading partner, it must be that, for any $L_h > 0$: $\mu_{g+s} > \mu$, $z_{h'} < z_h$, and $z_{g+s} < z_g$.

The gains to the representative consumer of h, derived from the simultaneous opening of trade with both g and s, are again measured by (13), after z_g is replaced by z_{g+s}. It is clear that the gains from trade are larger the more goods are imported by h, as expressed by a smaller index number of the marginal import good z_{g+h}. Hence, opening trade with both g and s at the same time makes country h better off than limiting trade to exchanges with g alone.

Will the representative consumer of country h be better off under gradual or simultaneous opening of trade? The answer to this question depends on a comparison of the gains from trade expressions of the two situations, measured by (25) for the former and (13) for the latter after replacing z_g by z_{g+s}. It can be seen immediately that gradual opening is superior to simultaneous opening if and only if $z_{sh} < z_{g+s}$, or, stated alternatively, if and only if $\mu_s > \mu_{g+s}$; that is, if and only if country h imports more different commodities or, what means the same, enjoys higher factoral terms of trade relative to the country from which the marginal import good originates.

Figure 3 portrays the relationship between μ_s and μ_{g+s} for different sizes of country s, given the size of country g. The diagram shows that, no matter what the size of country s, it always must be that $\mu_s > \mu_{g+s}$. The Appendix provides the proof. Starting with the observation that $\mu_s = \mu_{g+s} = \mu$ when $L_s = 0$, it is shown that the μ_s curve must rise faster than the μ_{g+s} curve if country s is quite small, and that the μ_s curve does not lie below the μ_{g+s} curve for any larger size of country s since the latter cannot intersect the former from below.

Figure 3: *Comparison of Terms of Trade under Alternative Trade Regimes*



It follows that the gradual opening of trade benefits the people of country h more than the simultaneous opening, no matter what the size of the second potential trading partner, country s. Getting the early trader locked into a country-specific trading relationship with h enables the latter to improve her terms of trade through the delayed entry of another country. This model, thereby, provides one explanation for the frequently observed gradual, country-by-country expansion of trading relationships.

4. Dynamic Externalities from Exporting

Export set-up costs are incurred to overcome the exporter's lack of familiarity with foreign business and government institutions. So far, it was assumed that these export set-up costs were significant and constant; in particular, they did not change as trade with a foreign country grew. The assumption that export set-up costs of firms in one industry are not influenced by the past volume of exports by other industries of the same country is, however, quite unrealistic. Trading with foreign businesses breeds familiarity with foreign institutions and this increased familiarity by existing exporters is likely to have a positive spillover effect on firms of industries not yet operating in the export market. An appropriate assumption, therefore, is that the exporting of goods from country h to country g lowers the value of R_{hg} over time, with the implication that some industries eventually have an incentive to enter the foreign market even though this incentive was absent at the two countries' initial opening of trade.

The objective of this section is to explore the implication of this export set-up externality for the choice of trading partners. When the exporting by a country's most efficient industries today enhances the export opportunities for less efficient industries in the future, definite advantages arise from the *deepening of trade* with one other country; the larger the initial trade volume with another country, the larger the number of goods that will be traded with the same country in the future. This potential benefit from the deepening of trade raises the issue of gains from limiting a country's number of actual trading partners *permanently*. Can a country gain permanently by establishing trading relationships with just one or a few countries when there are many other potential trading partners as well?

Developing a model of market entry for firms in the presence of dynamic export externalities is an exceedingly complex task that goes beyond the ambitions of this paper.[8] For purposes of this section it suffices to make two simplifying assumptions. First, it is assumed that export set-up costs for all periods after the initial opening of trade decline with the initial *actual* volume of trade. Second, it is assumed that this initial actual volume of trade in the presence of expected declining export set-up costs is positively related to what the volume of trade would have been if firms expected

[8] The main problem is that one no longer can assume that firms expect export set-up costs, wages, and prices to remain constant over the relevant planning horizon. One has to make specific assumptions about the firms' formation of expectations concerning these parameters.

revenues and costs to remain constant over time. The first of these assumptions addresses the labor requirement to initiate one unit of exports of good *i* from country *h* to country *g*, measured by $b_{hg}(i) = \rho_{hg}a(i)$. The proportionality factor ρ_{hg}, which now varies over time, is assumed to be negatively related to the amount of labor employed in exporting from country *h* to country *g* at the time trade is first opened. More precisely,

$$(26) \qquad \rho_{hg} = \rho_{hg}[t, X(0)] \qquad \text{and} \qquad \partial\rho_{hg}[t, X(0)]/\partial X(0) < 0,$$

where $X(0)$ denotes the amount of labor that must be employed to produce the opening volume of exports from *h* to *g*. The second assumption is introduced to avoid the specification of a separate, highly complex, model of export market entry with dynamic expectations and, instead, to use the apparatus of Section II with constant expectations for determining the relationship between future export set-up costs and the initial volume of exports. Defining the *actual* labor employment required to produce the opening volume of exports from *h* to *g* by X(0) and the corresponding *hypothetical* labor employment required if export set-up costs were expected to remain unchanged by $x(0)$, we assume that::

$$(27) \qquad X(0) = g[x(0)] \qquad \text{and} \qquad g'[x(0)] \geq 0, \quad \text{where}$$

$$(28) \qquad x(0) = \int_0^{z_h} a_h(i)y_g(i)di = \frac{L_g}{A(z_h)} \int_0^{z_h} \theta(i)di,$$

using (5), (3'), and (9) to express total labor employed to produce exports of good *i* from *h* to *g*, $a_h(i)y_h(i)$, under the assumptions of section II.

When country *h* has trading opportunities with two identical trading partners, countries *g* and *s*, is it possible that the gains from trade are larger from *deepening trade* with one of the two identical countries only than from *widening trade* to both countries? A necessary condition for deepening of trade to be preferred is that export set-up costs under deepening are less than under widening for at least some periods of time; that is, that the values of either ρ_{hg} or ρ_{gh} are lower for, at least, some periods of the future under deepening of trade. The lower the set-up costs for exports and imports, the more

different goods will be exported and imported, and the greater will be the benefits from trade.

It is, indeed, the case that, under the above-made assumptions, deepening of trade lowers the set-up costs for exports and imports more than widening of trade. Considering (26)-(28), one can see that the value of $x(0)$ is larger, and the resulting value of $\rho_{hg}[t,X(0)]$ is smaller when country *h* trades with *g* only instead of trading with both *g* and *s*. We look at (28) and note that labor employment required by *h* to produce its opening volume of exports to *g* clearly depends on the size of the population in the export market, L_g. In particular, for an unchanging marginal export good z_h, $x(0)$ rises at the same rate as L_g. We know from the Appendix, however, that the identity of the marginal export good is not constant, as it varies with the size of the foreign population; the larger the value of L_g, the smaller the value of z_h. Accordingly, the amount of labor employed by *h* to produce export goods, $x(0)$, will rise less than proportionately with an increase in the foreign market's population. The immediate implication is that the *aggregate* amount of labor employed to produce export goods is larger when there is trade with both *g* and *s* than when trade is limited to *g* only, but that the amount of *labor employed to produce goods for the market in g alone* is smaller when there is trade with both *g* and *s* than when trade is limited to *g* only.[9]

Deepening trade with one country cuts the magnitude of export set-up costs to this particular market below what they would be if trade had widened to both countries. As can be seen from Figure 1, this leads to larger imports and exports, as the $A(i)/R_{hg}$ curve shifts up and the $A(i)R_{gh}$ curve shifts down. A larger number of different import goods implies higher welfare to people of country *h*, as revealed by (13), resulting in definite welfare benefits from deepening of trade. These benefits come at a cost, however. By deepening trade with one market only, country *h* sacrifices the benefits from trading with a larger market, consisting of both countries *g* and *s*. Recalling the derivations in the Appendix, doubling the size of the foreign country improves the factoral terms of trade for *h*, lowers the value of z_g, and raises the gains from trade, as measured by (13). If the values of R_{hg} and R_{gh} remained constant, as it was assumed in the discussion on the gradual opening of trade, it always would be better to trade with

[9] A corresponding result can be shown to hold for imports; the amount of labor employed by country *g* to produce its exports going to *h* rises with the size of its own population, but less than proportionately.

both g and s than to trade with g only. If, on the other hand, these values of R_{hg} and R_{gh} decline in value the larger the initial volume of exports to a country, then it is possible that a country gains by restricting trade to a subset of potential trading partners. In the latter case, the net benefits from widening trade might be outweighed by the benefits from deepening trade.

5. Concluding Remarks

Traditionally, two features are said to distinguish international from domestic trade: factors of production are more mobile domestically than internationally, and domestic trade takes place under the laws and regulations of one country, while international exchanges are subject to the laws and regulations of more than one country. This paper suggests another important feature that distinguishes international trade from domestic trade: the transactions costs are much higher and the firms' cost of entering a new market are more likely to be sunk in international than domestic markets.

The fact that export set-up costs are country-specific implies that, once firms have completed the set-up, they are vulnerable to the newly-gained monopoly power of the importing country. In the current paper, the importing country makes use of this monopoly power by controlling the rate at which it opens trade with other countries. The gradual opening of trade to a limited number of countries allows the opening country to end up with better factoral terms of trade and higher welfare than would be the case if trade were opened to all countries at the same time. There will be early traders and latecomers in trade and, other things equal, early traders will capture most of the market and become the major trading partners of the country in question. The appearance of major trading partners is even more likely when exporting entails positive externalities with respect to setting up exports to a given market and it pays for a country to permanently restrict its trade to a subset of more or less equally suitable potential trading partners.

This paper does not explore whether the gradual opening of trade, although beneficial, is also a first-best approach to reaping extra gains from trade in the presence of sunk export set-up costs. Tariff policy provides an alternative instrument to exploit the newly established monopoly power. This, as well as the possibility of counter-strategies by the exporting country will be the subject of future research.

Appendix

Comparative Statics Results:

Differentiating the equilibrium conditions (9)-(11) with respect to the exogenous variables L_g, L_h, R_{hg}, and R_{gh} yields the following expressions:

$$1 > \left(\frac{\partial\mu}{\partial L_g}/\frac{\mu}{L_g}\right) = -\left(\frac{\partial\mu}{\partial L_h}/\frac{\mu}{L_h}\right) = \frac{\alpha(z_h)\alpha(z_g)}{\Delta} > 0,$$

(A.1)

$$\frac{\partial\mu}{\partial R_{hg}} = \frac{-\alpha(z_g)\beta(z_h)}{R_{hg}\Delta} < 0, \quad \text{and} \quad \frac{\partial\mu}{\partial R_{gh}} = \frac{\alpha(z_h)\beta(z_g)}{R_{gh}\Delta} > 0.$$

$$\frac{\partial z_h}{\partial L_g} = -\frac{\alpha(z_g)}{L_g\Delta} < 0, \qquad \frac{\partial z_h}{\partial L_h} = \frac{\alpha(z_g)}{L_h\Delta} > 0,$$

(A.2)

$$\frac{\partial z_h}{\partial R_{hg}} = -\frac{\alpha(z_g)+\beta(z_g)}{R_{hg}\Delta} < 0, \qquad \frac{\partial z_h}{\partial R_{gh}} = -\frac{\beta(z_g)}{R_{gh}\Delta} < 0.$$

$$\frac{\partial z_g}{\partial L_g} = -\frac{\alpha(z_h)}{L_g\Delta} < 0, \qquad \frac{\partial z_g}{\partial L_h} = \frac{\alpha(z_h)}{L_h\Delta} > 0,$$

(A.3)

$$\frac{\partial z_g}{\partial R_{hg}} = \frac{\beta(z_h)}{R_{hg}\Delta} > 0, \qquad \frac{\partial z_g}{\partial R_{gh}} = \frac{\alpha(z_h)+\beta(z_h)}{R_{gh}\Delta} > 0,$$

where $\alpha(z) = -A'(z)/A(z) > 0$, $\beta(z_h) = \theta(z_h)/\int_0^{z_h}\theta(i)di > 0$, $\beta(z_g) = \theta(z_g)/\int_{z_g}^{1}\theta(i)di > 0$, and $\Delta = \alpha(z_h)\alpha(z_g) + \alpha(z_h)\beta(z_g) + \alpha(z_g)\beta(z_h) > 0$.

Considering the result established in (A.2), namely that a rise in the population of country g lowers the value of z_g and thereby expands imports, one can see from (13) that the gains from trade are larger the larger the foreign trading partner.

Comparing the values of μ_s and μ_{g+s}

In describing Figure 3, we first note that $\lim_{L_s\to 0}\mu_{g+s} = \mu$ and $\lim_{L_s\to 0}\mu_s = \mu$; that is, if the additional potential trading partner were very small, the already established factoral terms of trade would not change, no matter whether country h started to trade with country s at the same time it opens trade with country g or only after trade with g has

already been set up. This also means that $\lim_{L_s \to 0} z_{h'} = z$ and $\lim_{L_s \to 0} z_{g+s} = z$ in (11'), and $\lim_{L_s \to 0} z_{hs} = z_h$ and $\lim_{L_s \to 0} z_{sh} = z$ in (20).

Differentiation of (11') and (20) with respect to L_s yields:

$$\text{(A.4)} \quad \frac{\partial \mu_{g+s}}{\partial L_s} = \mu_{g+s} / \left\{ [L_g + L_s][1 - \mu_{g+s}\beta(z_{h'}) \frac{dz_{h'}}{d\mu_{g+s}} - \mu_{g+s}\beta(z_{g+s}) \frac{dz_{g+s}}{d\mu_{g+s}}] \right\} > 0$$

$$\text{(A.5)} \quad \frac{\partial \mu_s}{\partial L_s} = \mu_s / \left\{ L_s \left[1 - \mu_s \beta(z_{hs}) \frac{dz_{hs}}{d\mu_s} - \mu_s \beta(z_{sh}) \frac{dz_{sh}}{d\mu_s} \right] \right\} > 0.$$

For a very small country s, the slope expressions become:

$$\text{(A.6)} \quad \lim_{L_s \to 0} \frac{\partial \mu_{g+s}}{\partial L_s} = 1 / \left\{ L_g \left[1/\mu - \beta(z_h) \frac{dz_h}{d\mu} - \beta(z_g) \frac{dz_g}{d\mu} \right] \right\}$$

$$\text{(A.7)} \quad \lim_{L_s \to 0} \frac{\partial \mu_s}{\partial L_s} = -1 / [L_g \beta(z_g) \frac{dz_g}{d\mu}],$$

after using $L_s / \int_{z_{sh}}^{z_g} \theta(i)di = (\mu_s L_h) / \int_0^{z_{hs}} \theta(i)di$ from (20) and $(\mu L_h) / \int_0^{z_h} \theta(i)di = L_g / \int_{z_g}^{1} \theta(i)di$ from (11). Since $\frac{dz_h}{d\mu} < 0$, it must be that $0 < \lim_{L_s \to 0} \frac{d\mu_{g+s}}{dL_s} < \lim_{L_s \to 0} \frac{d\mu_S}{dL_s}$.

Finally, we show that it is not possible that the μ_{g+s} function intersects the μ_s function from below. In order for such an intersection to occur, there must be a value of $L_s > 0$ at which $\mu_{g+s} = \mu_s$ and $\frac{\partial \mu_{g+s}}{\partial L_s} > \frac{\partial \mu_s}{\partial L_s}$. It follows from (9)-(10) and (17)-(18) that $z_{hs} = z_{h'}$ and $z_{sh} = z_{g+s}$ at such a point. Making the appropriate substitutions in the slope expression for the μ_s function, we obtain:

$$\text{(A.8)} \quad \frac{\partial \mu_s}{\partial L_s} = \mu_{g+s} / \left\{ L_s \left[1 - \mu_{g+s}\beta(z_{h'}) \frac{dz_{h'}}{d\mu_{g+s}} \right] - [L_g + L_s] \left[\mu_{g+s}\beta(z_{gs}) \frac{dz_{g+s}}{d\mu_{g+s}} \right] \right\},$$

where we set $L_s / \int_{z_{sh}}^{z_{gh}} \theta(i)di = (L_h \mu_s) / \int_0^{z_{hs}} \theta(i)di = (L_h \mu_{g+s}) / \int_0^{z_{h'}} \theta(i)di = (L_g + L_s) / \int_{z_{g+s}}^{1} \theta(i)di$ from (11') and (20), when $\mu_{g+s} = \mu_s$. Comparing (A.8) with (A.4), it is clear that the value of the latter exceeds the value of the former, which implies that the μ_{g+s} function cannot intersect the μ_s function from below.

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