The Home Market, Trade, and Industrial Structure

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Does national market size matter for industrial structure? This has been suggested by theoretical work on "home market" effects. In the present paper, I show that what previously was regarded as an assumption of convenience—transport costs only for the differentiated goods—matters a great deal. In a focal case in which differentiated and homogeneous goods have identical transport costs, the home market effect disappears. This paper discusses available evidence on the relative trade costs for differentiated and homogeneous goods. No compelling argument is found that market size will matter for industrial structure. (*JEL* F1, 01, R1)

I. The Role of Market Size

Small countries have long feared economic dominance by their larger neighbors. One element of this is concern that increased economic integration would lead important segments of national industry to abandon the smaller market for the larger market.[1] Insofar as these fears are based on *market size,* they find no foundation in traditional theories of trade due to comparative advantage. While such trade may restructure national industry, the *direction* of the change will depend not at all on relative market size.

However, this is not to dismiss these concerns. Such pure market-size effects have been shown to arise from perfectly well-specified—indeed highly influential—analyses in the area of economic geography. Paul R. Krugman (1980, 1995) has taken the lead in arguing that market size may indeed be a crucial element in determining the structure of national industry. This analysis has been extended in Elhanan Helpman and Krugman (1985), and applied to the case of European Union (EU) southern expansion in Krugman and Anthony J. Venables (1990). The key idea is what is termed the "home market" effect.[2] In brief, it notes that producers of differentiated goods under increasing returns to scale must choose a site for production. Location in the larger country is preferred, ceteris paribus, since this allows the majority of sales to be carried out without incurring transport costs. Hence the larger country will end up with a more-than-proportional share (though not necessarily all) of the differentiated goods industry. The smaller country is relatively specialized in the homogeneous good. Moreover, this home market effect has important welfare consequences. It reinforces the advantage of the large market in terms of a lower price index for differentiated manufactures, and conversely for the smaller country (Helpman and Krugman, 1985; Venables, 1987).

Helpman and Krugman were careful to note that problems with transport costs are

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[1] Ronald J. Wonnacott and Paul Wonnacott (1967 p. vii) noted that such concerns contributed to a traditional fear of Canadians that free trade with the United States would condemn them to be "hewers of wood and drawers of water."

[2] I will use this term throughout this paper to denote the phenomenon described in the works cited, and developed in Section III, subsection A. This follows, e.g., the usage of Krugman (1995). The reader should keep in mind that the term has also been used to encompass a broader concept in which a large home market matters in providing a base for a specific segment of exports, even, for example, when all industries are differentiated.

complex, and they were very explicit in acknowledging that they developed only a special example. Nonetheless, they argued (1985 p. 197): "... the example is useful for it illustrates what we believe to be an important principle, the effect of *market size;* that is, the tendency of increasing returns industries, other things equal, to concentrate production near their larger markets and export to smaller markets."

This paper shows that something close to the converse is true. Unless the *relative* costs of trading differentiated goods are unusually high, every country will produce them in exact proportion to its size. When transport costs are identical for both types of goods, the home market effect vanishes. This holds regardless of the magnitude of the market-size differences.

In deriving these results, I make one analytic departure from the framework of Krugman (1980, 1995). There he allowed for transport costs only in the production of differentiated goods. This was an assumption of convenience, as diversified production and costless trade in the homogeneous good led to nominal factor price equalization, greatly simplifying the analysis. Unfortunately this assumption is far from innocuous. The departure considered here is to allow for transport costs for the homogeneous good. This dramatically alters the analysis.[3]

A careful discussion of why the home market effect disappears must await development in Section III. But a rough logic can be spelled out here. Take as a base case a "proportional equilibrium," in which both countries produce their own requirements in the homogeneous good, with the consequence that manufacturing is likewise distributed according to country size. From this base, if production is shifted in the large market toward the differentiated good, and the reverse direction in the small market, then the total volume of trade falls in the differentiated good, and rises in the homogeneous good. The key insight is that differentiated-goods trade falls approximately in proportion to the *difference* in shares of world income, so less than one for one, while trade in the homogeneous good rises essentially one for one with the production shift. Unless trade costs are relatively high for the differentiated goods, total trade costs will have risen rather than fallen. Firms contemplating the shift of differentiated-goods production from this "proportional equilibrium" toward the larger market will, in fact, find it unprofitable to do so. Hence the home market effect will not arise.

The theoretical work focuses the discussion of whether large markets will have an advantage over small markets in industrial production to an empirical question—the relative costs of trading differentiated versus homogeneous goods. Accordingly, Section II will survey the available literature that might provide insights on these relative trade costs. It will also present some new results concerning the relation between measured trade costs and proxies for product differentiation and economies of scale. With this preface, Section III will proceed to develop the main theoretical results of the paper. Section IV will conclude.

II. Do Trade Costs Differ for Constant versus Increasing Returns Industries?

The discussion thus far suggests the value of pursuing two empirical questions: (1) Is there reason to believe that trade costs may be unusually high for differentiated goods?; and (2) How are the relative costs of transporting the distinct classes of goods evolving over time? My survey of these questions will serve to inform the theoretical work in the subsequent section.

In order to provide an answer to these questions, I would like to identify and measure the relevant costs. Some of these costs are *conventional,* so straightforward to characterize, such as insurance, freight, and tariffs. For some of the *nonconventional* costs of trade—such as nontariff barriers—there

[3] Recent independent work considers trade costs for the homogeneous good in a *closed* economy (Helpman, 1995; Masahisa Fujita et al., 1996; Yossi Hadar, 1996). These focus on the incentives for migration that may sustain regional agglomeration within a country. By contrast, migration is ruled out in my *open* economy model. Krugman and Venables (1990) briefly consider the problem of trade costs in the homogeneous good in an open economy. However their discussion *assumed* that this did not alter the pattern of trade, rather than examining this directly.

are measures, but these are far from ideal. And for others, the available information is very scanty, such as informational costs of trading across borders. The latter is particularly relevant to our problem, as some theoretical discussions (e.g., James E. Rauch, 1996) might suggest that these costs fall relatively heavily on differentiated goods.

Any such exercise should be treated with a healthy dollop of skepticism. The theoretical models are of necessity highly abstract, and surely not ready to take directly to data to explain world production and trade patterns. The available data both on trade costs and indicators of the presence of scale economies are very far from ideal. And often the data I consider is for trade of the United States, surely not a representative country. These reservations notwithstanding, it still seems valuable to inquire whether there is probable cause to suspect that trade costs are higher for increasing relative to constant returns goods.

The discussion will proceed in three parts. In the first part, I will focus strictly on conventional measures of trade costs to see if these are unusually high for differentiated goods. In the second part, I will discuss available evidence on whether nonconventional trade costs are important when compared to conventional costs. This will provide one criterion for how much weight should be placed on the results from the first exercise. Finally, I will discuss available evidence on whether conventional and nonconventional trade costs taken together are likely to be relatively high for differentiated goods.

A. *Conventional Trade Costs*

Rauch (1996) provides evidence concerning the relative costs of trading homogeneous versus differentiated goods. He divides goods *ex ante* into three groups: (1) those traded on an organized exchange; (2) those with a reference price in industry journals; and (3) those which fail to enter the first two categories. For our purposes, these can be translated respectively as homogeneous, near-homogeneous, and differentiated. For each, he calculated the transport factor (insurance and freight as percentage of customs value) for U.S. imports from Japan or similarly distant countries.

TABLE 1—TRANSPORT COSTS AS A SHARE OF CUSTOMS VALUE (PERCENT)

	1970	1980	1990
Homogeneous	15.59	12.45	13.51
Near-homogeneous	13.06	12.19	12.05
Differentiated	6.58	6.40	5.88

Rauch (1996) reports these results in his Table 3, reproduced here as Table 1.[4]

Rauch's figures reveal that transport costs (insurance plus freight) taken alone rather suggest that the relative costs of trade are unusually *low* for differentiated goods. This might be rationalized by the proposition that such goods are in a sense idea-intensive, so they might be expected to yield low weight to value ratios.

For our purposes, there are two directions in which I would like to strengthen these results. First, I would like to get a more comprehensive measure of the conventional costs, so I will provide data as well on tariff rates. Second, I would like to explore the robustness of this result by considering a variety of proxies for whether an industry produces differentiated goods. Hence I will examine correlations between conventional measures of trade costs and various indicators of the presence of scale economies.[5] Twenty-eight three-digit ISIC industries are included in the sample. Total trade costs are composed of transport costs and tariffs. The transport costs for each industry are calculated for the value of imports to the United States as [CIF/FAS − 1]. The average tariff rates by industry are calculated as [Import Duties/FAS Value of Imports]. Total measured trade costs are simply the sum of the two (calculated in percents). I also include a variety of indicators of

[4] This is for his "conservative" aggregation, but the results are similar for his "liberal" aggregation. Curiously, these measures are substantially lower than the typical transport factors reported by James E. Harrigan (1993) for 1983 trade of members of the Organization for Economic Cooperation and Development (OECD), although one might have suspected they would be higher given Rauch's focus on Japan-U.S. trade.

[5] See Data Appendix for sources.

TABLE 2—CORRELATIONS BETWEEN MEASURED TRADE COSTS AND PROXIES FOR SCALE ECONOMIES BY INDUSTRY FOR TOTAL U.S. IMPORTS

	Transport costs	Tariffs	Total measured costs
Research and development	−0.69	0.09	−0.53
Grubel-Lloyd index	−0.18	−0.45	−0.49
Concentration measures			
4-firm	−0.27	0.03	−0.09
8-firm	−0.26	0.03	−0.09
20-firm	−0.24	0.04	−0.06
50-firm	−0.16	0.10	0.02
Herfindahl index	−0.40	−0.07	−0.25

the presence of scale economies. The Grubel-Lloyd index is calculated as [1 − |Exports − Imports|/(Exports + Imports)]. While much criticized, on both empirical and theoretical grounds, the Grubel-Lloyd index has frequently been taken as an indicator of the presence of scale economies for products within the industry, so it is included here.[6] The research and development proxy is given as R&D spending as a share of sales, and was available for only 16 industries. If one thinks of the R&D as a fixed cost creating monopoly advantages, this may be the theoretically most sound measure. The remaining indicators are all measures of industry concentration, under the hypothesis that scale economies help to promote concentration. These include the Herfindahl index and 4-, 8-, 20-, and 50-firm concentration measures. These concentration measures are somewhat at odds with the theoretical model, since the monopolistic competition model explicitly rejects the idea of strong concentration, while the competitive constant returns models assume that firms act *as if* atomistic—not that they actually *are* atomistic. Finally, note that goods with sufficiently high trade costs are not traded, so would not enter my sample. This problem is familiar from critiques of the use of trade-weighted average tariffs to indicate protection. Unfortunately there is little we can do about this problem except to note it.

Our skepticism thus fortified, we can examine the correlations reported in Table 2. Industry-level transport costs ranged from 1.9 to 8.5 percent of the import values, with a mean of 4.8 percent. Industry-level tariffs ranged from 0.5 to 15.4 percent, with a mean of 4.1 percent. Total trade costs ranged from 3.2 to 20.7 percent, with a mean of 8.9 percent.

Table 2 provides no support for the notion that conventional trade costs may be unusually high for sectors characterized by economies of scale. All of the correlations between Total Measured Trade Costs and proxies for economies of scale are negative, save that for the 50-firm concentration ratio at 0.02. All Spearman rank correlations are negative. For the various concentration measures, one cannot reject a null of no relation between the conventional measures of trade costs and the proxies for scale economies. However, for the two measures with the strongest claim to a theoretical justification, the Grubel-Lloyd index and the R&D variable, the level of significance is 0.01 and 0.04, respectively. These results provide no support for the proposition that trade costs are unusually high for differentiated goods. In combination with the data from Rauch (1996) detailed in Table 1, these suggest the reverse is more likely true.

[6] More precisely, the Grubel-Lloyd index directly measures the degree of intra-industry trade. However such trade has frequently been adduced as evidence of scale economies at work. For contrasting perspectives, see Helpman and Krugman (1985) and Davis (1995).

B. *Nonconventional Trade Costs*

There is reason for concern that the conventional measures may substantially understate the costs of trade. Moreover there are plausible hypotheses under which nonconventional trade costs (NCTCs) may be higher for increasing relative to constant returns goods. If these costs are large and do exhibit such a bias, the home market effect may reemerge. Here I will discuss the recent literature on NCTCs and relate it to the problem of the home market effect.

The most striking evidence that nonconventional trade costs may matter for international exchange comes from John McCallum (1995). He employed a gravity equation approach to study the relative intensity of Canadian interprovincial trade relative to trade with similarly sized and distant U.S. states. Such controls should largely remove differentials in conventional transport costs as a reason for differences in trade intensity. Overt tariff barriers between the United States and Canada were already very low (under 5 percent) in his sample year of 1988 even though this was but the first year of the U.S.-Canada Free Trade Agreement. Precisely because of this apparent openness of the U.S.-Canadian border, it was very surprising to learn that Canadian provinces traded with each other *more than 20 times* the volume that they traded with similar counterparts among U.S. states. McCallum's results were confirmed by John Helliwell (1995) for 1988–1990.

Supporting evidence for the importance of NCTCs appears in the work of Charles Engel and John H. Rogers (1996). They examine price variability between matched U.S. and Canadian cities, seeking to explain it by distance and a border effect. In their central specification, they estimate that the border contributes as much or more to price variability as 1,780 miles of distance. Their final sample of prices includes a period after the U.S.-Canada Free Trade Agreement began to be implemented. The border effect actually rose from the pre-agreement level, suggesting to them that the border effect did not simply reflect conventional trade barriers. However, no direct measure of these costs was considered.

Nevertheless, evidence presented in the work of Harrigan (1993) and Shang-Jin Wei (1996) provides a caution on concluding that nonconventional trade costs are very high. Harrigan estimated the effects of barriers to trade on the level of OECD imports in 1983. He had direct measures for tariffs and constructed measures for transport costs, as well as coverage ratios for a variety of nontariff barriers. The surprising result from his work (p. 110) is that "elimination of [nontariff barriers] would have had a small or imperceptible effect on gross imports ... although NTB coverage is substantial ... [while] estimated transport costs and average tariffs had large negative effects on imports, although the level of tariffs was generally low." This at least raises doubts about whether NTBs should be considered a source for high nonconventional trade costs.

The paper of Wei (1996) broadly aims to replicate McCallum's experiment for the broader sample of the OECD. Drawing on the theoretical framework of Alan V. Deardorff (1995), he estimates the degree of "home bias" in trade, and uses this to impute tariff-equivalent trade barriers. Where McCallum found that the border led internal trade to rise by a factor of 20, Wei found that for the OECD such trade rises by a factor of approximately 2.3.

Translating this into a tariff equivalent requires taking a stand on the substitutability between goods from different countries. For his central case ($\sigma = 10$), the estimated barrier was 9.5 percent. Given that actual tariff levels for these countries are approximately 4 percent, this would leave only 5.5 percent as the level of nonconventional trade costs—much smaller than would have been suggested by the work of McCallum. Wei notes that if he had followed Daniel Trefler (1995) in attributing part of this home bias to demand factors, the estimated effects of nonconventional costs of trade would have been correspondingly smaller. Unfortunately, Wei provides no account of why his results contrast so sharply with those of McCallum (1995).

Wei took his estimate of $\sigma = 10$ from Kimberly A. Clausing (1996). If instead I had followed Krugman and Venables (1995) in taking the central case as $\sigma = 5$, then the estimated barrier would have been 20.0 percent. Again subtracting an average tariff of 4 percent would have left the now more substantial nonconventional trade barrier of 16 percent.

In summary, whether nonconventional costs of trade are high is a question very much in contest. The striking results of Helliwell (1995) and McCallum (1995) are disputed in the work of Wei (1996). Unfortunately, the disparate state of the literature makes it impossible to draw strong conclusions at this point. For my purposes, this leaves a key empirical question unresolved.

C. *Are Total Trade Costs Unusually High for Differentiated Goods?*

The direct evidence on conventional trade costs suggests that, if anything, trade costs tend to be low for differentiated goods. The indirect evidence examined concerning nonconventional trade costs provided some stark—though contested—evidence that nonconventional trade costs may be very important. What we really want for our theory, though, is a measure of total trade costs, and this separately for homogeneous and differentiated goods. Unfortunately, the lack of congruence between the theoretical specification of iceberg transport costs and the empirical specifications of the gravity equation literature make it difficult to back out a single measure that addresses my question.

Rauch (1996) provides some insight for the problem. As noted above, he divides goods *ex ante* into three groups, which I term homogeneous, near-homogeneous, and differentiated. He then calculates gravity equations separately for each group. He interprets the coefficients on distance as reflecting a broad measure of trade costs. These differ insignificantly across the product categories.[7] His regressions also included adjacency dummies. One reason for such dummies is to control for so-called "border trade." However, if networks and search are crucial elements distinguishing differentiated from homogeneous goods, then one would expect to find that adjacency of two countries would be very important for the differentiated goods. Yet the reverse was the case in all versions and years of the gravity equations that he ran. But the important point to consider is that there is little suggestion that *total* trade costs are higher for the differentiated goods.[8]

D. *Will Economic Integration Deindustrialize Small Countries?*

The discussion above provides a few basic facts, some very suggestive results, and a good measure of residual uncertainty. Conventional trade costs are on the order of 10 percent, with somewhat more than half of that accounted for by transport costs and the remainder by tariffs. There is some indication that these trade costs may be relatively low for differentiated goods relative to homogeneous goods. There is little support for the idea that the reverse is true.

Several distinct strands in the recent literature point to the possibility that conventional measures of trade costs may miss the greater part of the story. As well, recent analytic contributions have provided a conceptual basis for believing that these nonconventional trade costs may be higher for differentiated goods than for homogeneous goods. However other contributions dispute this, and there remains a great deal of uncertainty regarding the magnitude and cross-industry structure of these trade costs.

The dynamic story one wants to tell depends on how one views the level, structure, and prospective evolution of these trade costs. Tariffs, at least within the OECD, are already very low. Transport costs, by Rauch's data, have declined at a slow pace. Nontariff barriers, by Harrigan's measures, have low tariff equivalents. If there would seem to be room for further declines in trade costs to matter in a significant way, it would come in either of two ways. First, for developing countries that still

[7] Rauch's concern was not so much with total trade costs, per se, but rather to identify unusual costs associated with search for the case of differentiated goods. Thus he interpreted the similar coefficients on distance as suggesting that search costs about exactly offset the greater "transportability" of differentiated goods suggested by Table 1. See Rauch (1996 pp. 17–18).

[8] Rauch (1996) is one of the most interesting recent empirical trade papers. One of the interesting conclusions from the paper is how difficult it is to find strong support within the industry trade data for a hypothesis with a great deal of *ex ante* appeal.

maintain high barriers, trade liberalization, or regional integration schemes may raise the issues addressed in this paper. Whether this is likely to deindustrialize smaller economies will then depend on whether the liberalization is particularly strong for differentiated goods. The second possibility would be through further declines in the cost of information—hence in the relative cost of trading differentiated goods. As will be seen in the following section, this should not be expected to deindustrialize small countries.

III. The Home Market: Revisiting the Theory

I begin with a model based on Krugman (1980) and Helpman and Krugman (1985). Consider a world with two countries. One is endowed with a larger quantity of the single factor labor, so that $L > L^*$. There are two types of goods. Industry X produces a large variety $\{x_i\}$ of differentiated goods I will term manufactures. Industry Y produces a single homogeneous good I will term agriculture.

The preferences of a representative consumer are given by:

$$(1) \qquad U = C_X^{\alpha} C_Y^{1-\alpha}$$

where $\alpha \in (0, 1)$. Taking N and N^* as the number of varieties available from the large and small countries respectively, the manufacturing aggregate is in turn described by:

$$(2) \qquad C_X = \left(\sum_{i=1}^{N} x_i^{\rho} + \sum_{i=1}^{N^*} x_i^{*\rho} \right)^{1/\rho}.$$

International shipment of manufactures incurs transport costs of the Samuelson "iceberg" variety. If τ units of a manufacture are shipped, only a single unit arrives in the other country. Thus $\tau = 1$ is the case of zero transport costs, and $\tau > 1$ implies positive transport costs. If the fob prices of manufactures in the local markets are $\{p, p^*\}$, then the landed prices in the large country will be $\{p, \tau p^*\}$, and in the small country they will be $\{\tau p, p^*\}$.

Producers of the differentiated manufactures compete in Dixit-Stiglitz monopolistic competition. An individual producer of one of the manufactures in the large country faces demand both from at home and abroad (provided the transport costs are not too high). With a large country wage of w, and spending share α on the manufacturing aggregate, the demand from local consumers is given by:

$$(3) \qquad c_i = \frac{p_i^{-\sigma}}{Np^{1-\sigma} + N^*(\tau p^*)^{1-\sigma}} \alpha w L.$$

The derived demand (transport cost inclusive) for a single large country manufacture from consumers in the small country is:

$$(4) \qquad c_i^* = \frac{(\tau p_i)^{-\sigma}}{N(\tau p)^{1-\sigma} + N^* p^{*1-\sigma}} \tau \alpha w^* L^*.$$

With the total number of varieties available to consumers ($N + N^*$) being very large, producers treat the denominator in each of these expressions as a constant. Thus in the case of iceberg transport costs, the elasticity of demand facing a producer is the constant $\sigma = 1/(1 - \rho) > 1$ in each market. Similar demand equations can be written down for producers of manufactures in the small country.

Producers of manufactures share a production function that is common across varieties and countries. Production of a good in amount x_i requires labor:

$$(5) \qquad l_i = \phi + \beta x_i$$

where ϕ is a fixed labor cost and β is the marginal labor cost of output. The producer's first-order conditions for profit maximization insure here that the price-wage markup is a constant:

$$(6) \qquad \frac{p_i}{w} = \frac{\sigma}{\sigma - 1} \beta.$$

In combination with the free-entry zero profit condition, this insures that the equilibrium output per variety of manufactures, x^e, is constant, common across countries, and independent of the level of transport costs at:

$$(7) \qquad x^e = \frac{\phi(\sigma - 1)}{\beta}.$$

Production of the agricultural good Y is competitive with output given simply as:

$$(8) \qquad Y = L_Y.$$

I allow for the possibility that there are costs of transporting Y.[9] Let these also be of the iceberg variety indexed by $\gamma > 1$. If the numeraire is taken to be a unit of Y available in the small country, then demand for Y in the small country is simply given by $(1 - \alpha)wL$. In the large country, the demand is given generically as $(1 - \alpha)wL/P_Y$. If the large country imports Y then $P_Y = \gamma$; if it exports Y then $P_Y = 1/\gamma$. When Y is not traded in equilibrium, demand insures that $(1 - \alpha)$ share of the labor force in each country is devoted to production of the agricultural good, and the residual to manufactures. I now turn to consider a variety of assumptions concerning transport costs.[10]

A. *The Krugman Case: Trade Costs in the IRS Sector Only*

The case in which $\tau > 1$ and $\gamma = 1$, i.e., in which only manufactures feature transport costs, is discussed in Krugman (1980) and explored in detail in Helpman and Krugman (1985). So long as the agricultural sector remains active in both countries, a common technology and costless trade in Y insure that the wage faced by producers is common between the large and small countries. Thus the plant-based cost of producing a manufactured variety at the equilibrium scale is the same in both countries. All else equal this would lead producers to prefer producing in the large country, since they would face transport costs on a smaller share of their output. This is the "home market" effect.

Helpman and Krugman (1985) demonstrate that the home market effect leads the large country to be a net exporter of manufactures and an importer of the agricultural good. Equivalently, the large country acquires a share in world production of manufactures that exceeds its share in world income. And correspondingly, the small country has a smaller share in world production of manufactures than its share in world income. Production of manufactures in the smaller country need not entirely disappear, since the transport costs provide natural protection for local producers of manufactures vis-à-vis imports from the larger market. They also show that a decline in transport costs that falls short of costless trade, hence a reduction in this natural protection, will lead more—perhaps all—of manufactures production to shift to the large country. Thus if one interprets growing economic integration here as a secular decline in (strictly positive) trade costs, this may provide cause to believe that deindustrialization of the small countries will proceed apace, with manufacturing ever more concentrated in the large countries.

B. *A "Proportional Equilibrium" Case: Identical Trade Costs in Both Sectors*

The assumption that transport costs exist for manufactures only was made for the convenience it yields by insuring factor price equalization. The question investigated here is whether this matters for the qualitative results of the model. Accordingly, I begin with the simplest case of equal transport costs, i.e., in which $\tau = \gamma > 1$. I will begin by stating a proposition, and then offer a proof.

PROPOSITION: *In the model developed above, with equal transport costs $\tau = \gamma > 1$ for goods in both industries, manufacturing is distributed in proportion to country size: $N/N^* = L/L^*$. Equivalently, the homogeneous agricultural good is not traded in equilibrium, and so trade in manufactures is balanced.*

[9] This has also been considered in interesting recent work by Helpman (1995) and Hadar (1996). They examine closed economies and focus on the incentives for migration that may give rise to regional agglomeration.

[10] The simplest case is when $\tau = \gamma = 1$, i.e., when both goods are traded costlessly. This is a variant of the model of Krugman (1979). In this case, there is no geography to speak of, and the world functions as if it were fully integrated. It devotes $(1 - \alpha)(L + L^*)$ of its labor force to agriculture, and the remaining $\alpha(L + L^*)$ to manufactures. The number of varieties available in the world is thus $(N + N^*) = \alpha(L + L^*)/l^e$, where $l^e \equiv \phi + \beta x^e$ as above. However neither the division of resources between industries for the two countries, nor the pattern of trade in individual manufactures, is determinate. Neither, though, does it matter. Wages, prices, and so welfare for individuals are the same in both the large and small country.

One path of proof for this proposition would involve solving for the full equilibrium of the model with transport costs on both goods. However, an alternative proves much simpler. This will be to assume that we are in an equilibrium in which the agricultural good is traded, and to demonstrate that this cannot in fact be an equilibrium since it will feature unexploited profit opportunities. The remaining elements of the proposition follow from this demonstration.

Suppose then that an equilibrium exists in which the small country is an exporter of the agricultural good, so a net importer of the manufactured good. If this is an equilibrium, then firms in both sectors earn zero profits, due to constant returns technology and marginal cost pricing in the competitive agriculture sector, and due to free entry in the monopolistically competitive manufactures sector.

If the small country exports the competitive good, this allows us to restrict the set of feasible relative wages. If both countries produce this good (with common Ricardian input coefficients), then the wage can differ only by the transport cost wedge: $w/w^* = \tau$. If wages in the large country have risen sufficiently that the competitive industry cannot be active there, then $w/w^* > \tau$. Summarizing, if the small country exports Y, it must be the case that:

$$(9) \qquad \frac{w}{w^*} \geq \tau.$$

There are, of course, limits to how large this wage gap may grow. The large country must pay for imports of Y with exports of varieties of the differentiated goods x. If the large country wage grows excessively, production of these varieties in the large country will not be feasible. To explore this constraint, I need to define a few new variables. I noted above that the typical variety has an equilibrium scale of production, x^e, which is not affected by the level of transport costs. By choice of units, set $x^e \equiv 1$. Let μ of this be the *optimal* deliveries of a large country producer directly to the large market, with $(1 - \mu)/\tau$ units delivered to the small market. Now consider a hypothetical output and employment level, $\tilde{x}$ and $\tilde{l}$, defined as the minimum output and employment levels required to make deliveries of μ to the large market and $(1 - \mu)/\tau$ to the small market *when production of the variety occurs in the small market.* This yields:

$$(10) \qquad \tilde{x} \equiv \tau\mu + \frac{(1 - \mu)}{\tau} \qquad \tilde{l} \equiv \phi + \beta\tilde{x}.$$

The second condition I impose is that the large country wage advantage cannot grow so large that—holding *fixed* the deliveries to each market for the typical large country variety—it is strictly cheaper to locate production of these varieties in the small country. Let $l^e \equiv \phi + \beta x^e$. Then the condition for large country production of varieties of x to be feasible in equilibrium requires that $wl^e \leq w^*\tilde{l}$. Solving for the relative wage and substituting for the employment levels yields the condition:

$$(11) \qquad \frac{w}{w^*} \leq \tau\left[\frac{\frac{\phi}{\tau} + \beta\left(\mu + \frac{(1 - \mu)}{\tau^2}\right)}{\phi + \beta}\right].$$

However (keeping in mind that $\tau > 1$) direct inspection reveals that the right-hand side of equation (11) is strictly smaller than τ. Thus production of varieties of x in the large country requires the condition that:

$$(12) \qquad \frac{w}{w^*} < \tau.$$

This requirement conflicts directly with that in equation (9), which is necessary for exports of Y from the small to large country. Thus export of Y by the small country is inconsistent with equilibrium for the case of equal trade costs in both goods.[11]

[11] An alternative heuristic for this proposition comes from thinking about this as the problem of a small multinational corporation allocating its workforce across various activities. Suppose that our MNC initially produces some Y in the small country for export, and initially produces some varieties of x in the large country (but few enough to remain a Dixit-Stiglitz monopolistic competitor). By cutting back deliveries to the large market of one unit of Y to the large market, τ units of labor are saved in the small country. Of course, to produce that unit of Y now in the large market requires one unit of its labor, which in turn requires the elimination of n^* varieties initially

Note that while prior expectations about the pattern of trade led me to couch this in terms of exports of Y from the small country to the large country, exactly the same argument would have insured that Y will not be traded the other direction. Thus the assumption that we are in equilibrium with positive exports in the Y sector leads to a contradiction.

Of course, there are still the conventional reasons for the countries to trade differentiated manufactures, and this trade will now be balanced. The Cobb-Douglas preferences thus insure that each country will devote $(1 - \alpha)$ share of its labor force to production of Y. The remainder will be devoted to manufactures production. As before, a common technology and preferences insure that equilibrium scale will be common at x^e. This then implies directly that $N/N^* = L/L^*$, completing the proof of the proposition.

C. *A Generalized Case: When IRS Trade Costs Unusually High*

I now return to the more general case in which the iceberg transport costs on the homogeneous good (γ) need not equal that on differentiated manufactures (τ). I would like to place restrictions on the difference in transport costs that are consistent with the small country maintaining its proportional share of manufacturing production. It was seen above that the case in which transport costs are equal between sectors is an over-sufficient condition. From above, the restriction on relative wages in equation (11) would be unchanged, but that on equation (9) would depend on γ (not τ). Putting these together, and noting that conditions are now stated for *maintaining* the proportional equilibrium (hence reversing the inequality), the relevant restriction is seen as:

$$(13)\quad \gamma > 1 + \frac{\beta}{\phi + \beta}\left[\tau\mu + \frac{(1-\mu)}{\tau} - 1\right].$$

This has a simple interpretation. The γ on the left-hand side reflects the relative *labor* cost of producing a unit of Y in the small country (instead of the large) given that it will be consumed in the large. The right-hand side expresses a similar condition for a variety of x, holding fixed the pattern of deliveries. The first addend expresses the relative labor cost (unity) of producing at the same level as the equilibrium output per variety in the large country. However, there is a price to be paid for moving production of these varieties to the small market. This is that the production runs necessary to make the original deliveries to each of the markets may exceed the output level $(x^e = 1)$ required when production was in the large market. The term in brackets reflects these longer production runs. Since no additional fixed cost need be incurred, these longer production runs lead labor requirements to rise only in proportion to the share of variable labor requirements, as reflected by the coefficient $\beta/(\phi + \beta)$.[12]

So long as the condition specified in equation (13) is met, the small country will maintain its proportional share of manufacturing. How stringent is this condition? It will prove useful to consider a couple of numerical examples to get a feel for this. First, define the relative transport costs for the differentiated relative to the homogeneous good as $R = (\tau - 1)/(\gamma - 1)$. Note also that for fixed τ and γ, the condition is more likely to be violated when relative country size [indexed by μ] and the share of variable in total labor costs $[\beta/(\phi + \beta)]$ are high. Consider an example in which $\mu = 2/3$, so that the large country is (roughly) twice the size of the small. Assume that fixed costs are relatively unimportant compared to variable labor cost, so take $\beta/(\phi + \beta) = 0.9$. Finally, assume that $\tau = 1.1$, so that transport costs in the differentiated good are approximately 10 percent. How high would the relative transport costs

produced in the large market (where $n^*l^e \equiv 1$). As suggested by equation (11), making all the same deliveries of x as before requires strictly less than τ times as much output, given that the deliveries must now be made from the small market. Yet the small market has *exactly* τ times as much labor (now released from producing Y) with which to carry out this production. Given that production is subject to decreasing average costs in units of labor, this implies that all deliveries of all goods can be carried out as before with strictly less labor. Iteration of this argument requires elimination of Y exports from the small country.

[12] It should be clear that the condition in equation (13) is also overly sufficient, since I have constrained the firm to make all deliveries to all markets just as before, which will not in general be optimal.

of differentiated goods R have to be in order for our proportional equilibrium to break down? Plugging these numbers into equation (13) and our formula for relative transport costs yields $R = (\tau - 1)/(\gamma - 1) = (0.1)/(0.032) = 3.08$ for equality in equation (13). That is, trade costs for the differentiated good would need to be *more than three times as large* as for the homogeneous good for the proportional equilibrium to break down.

Consider a second example. Again set $\mu = 2/3$ and $\beta/(\alpha + \beta) = 0.9$. But now suppose that there are two types of trade costs—conventional and nonconventional. Assume that conventional trade costs (t_C) are the same for the two types of goods, but that nonconventional trade costs may differ (t_X and t_Y). Thus let $\tau = (1 + t_C + t_X)$ and $\gamma = (1 + t_C + t_Y)$. Further, suppose that conventional trade costs are $t_C = 0.1$. By what factor could the nonconventional trade costs in manufactures exceed those in the homogeneous good before the proportional equilibrium would be disrupted? The answer comes from these definitions and equation (13) once the relative importance of nonconventional to conventional trade costs for the differentiated good, t_X/t_C, has been specified. Thus, consider the cases of $t_X/t_C = 2$, 3, and 4—hence in which the nonconventional (unmeasured) trade costs far exceed conventional (measured) trade costs. Rounding off for the various cases, maintaining the proportional equilibrium will be possible even if the relative nonconventional trade costs in manufactures are higher by a factor of $t_X/t_Y = 28$, 6, and 4 for the respective cases. Thus, unless the nonconventional trade costs are very high relative to conventional costs, and many times higher for differentiated goods than for homogeneous goods, the home market effect will not appear. We will remain in the proportional equilibrium.

IV. Conclusion

Does market size matter for national industrial structure? An influential strand in the theoretical literature has responded in the affirmative. The main positive contribution of this paper has been to show how this result depends on the relative size of trade costs in differentiated and homogenous industries. In a focal case in which the industries have identical trade costs, the home market effect disappears. Industrial structure then does not depend on market size.

A preliminary look at available empirical evidence fails to support the hypothesis that trade costs are unusually high for differentiated-goods industries. However, the importance of the home market hypothesis for production and trade structure is such that more extensive inquiry is in order.

The model developed here is simple. It assumes away other forces that could link trade integration and industrial structure. For example, simple comparative advantage can lead to a rise or decline in the differentiated-goods industry. Likewise, Krugman and Venables (1995) have shown that quasi-Ricardian technical differences based on market size may arise if there are increasing returns in the production of intermediates. If these exhibit a sufficiently strong bias (perfect in their model) toward production of differentiated final goods, then trade integration may yet lead small countries to deindustrialize. These considerations invite further empirical investigation.

Data Appendix

Data Sources.—Firm concentration data is from the *U.S. Census of Manufactures* (U.S. Bureau of the Census, 1992a), and is reported by four-digit SIC classification.
Trade data is from Robert C. Feenstra (1996) and from the U.S. Census Bureau's (1992b) *U.S. Merchandise Trade: Exports, General Imports, and Imports for Consumption,* SITC Commodity by Country (FT 925). It is collected at the two-digit SITC level.
Conversion of the two-digit SITC data into three-digit ISIC data was done according to Maskus (1991).
The four-digit SIC data was aggregated to the three-digit, then converted into three-digit ISIC.
The R&D data is from National Science Foundation/Division of Science Resources Studies (1992), *Research and Development in Industry.*

Variable Definitions.—Transport Costs are defined as [CIF/FAS − 1].
The Grubel-Lloyd index is [1 − {|Exports − Imports|/(Exports + Imports)}].
Tariffs are computed as [Import Duties/FAS value of imports].
Total Measured Trade Costs are just transport costs + tariffs.

SUMMARY STATISTICS

Variables	Observations	Mean	Standard deviation	Minimum	Maximum
Grubel-Lloyd	28	0.66	0.25	0.15	0.99
R&D	16	2.81	2.98	0.5	8.9
Herfindahl	28	662	357	195	1979
4-firm	28	0.396	0.149	0.214	0.904
8-firm	28	0.528	0.152	0.298	0.992
20-firm	28	0.685	0.142	0.423	0.998
50-firm	28	0.811	0.128	0.547	1
Transport Cost	28	0.048	0.018	0.019	0.085
Tariff	28	0.041	0.036	0.005	0.154
Total Measured Cost	28	0.089	0.040	0.032	0.207

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