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The Home Market Effect and Bilateral Trade Patterns

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The Home Market Effect and Bilateral Trade Patterns

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Abstract. We test for home-market effects using a difference-in-difference gravity specification. The home-market effect is the tendency for large countries to be net exporters of goods with high transport costs and strong scale economies. It is predicted by models of trade based on increasing returns to scale but not by models of trade based on comparative advantage. In our estimation approach, we select pairs of exporting countries that belong to a common preferential trade area and examine their exports of goods with high transport costs and strong scale economies relative to their exports of goods with low transport costs and weak scale economies. We find that home-market effects exist and that the nature of these effects depends on industry transport costs. For industries with very high transport costs, it is national market size that determines national exports. For industries with moderately high transport costs, it is neighborhood market size that matters. In this case, national market size *plus* market size in nearby countries determine national exports.

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1. Introduction

Much recent theoretical work in international trade is based on increasing returns to scale of some kind. This includes models of intra-industry trade (Krugman, 1979, 1981; Helpman, 1981), multinational firms (Helpman, 1984; Markusen, 1984), and economic geography (Krugman, 1991; Venables, 1996). These efforts have produced compelling explanations for why similar countries may gain from trade, why most foreign direct investment tends to flow between rich countries, and why manufacturing activity tends to agglomerate spatially within countries.

For purposes of empirical work, however, trade theories based on increasing returns present a problem. Their predictions for trade flows are similar to those of models based on comparative advantage (Helpman and Krugman, 1985; Davis, 1995). This complicates testing trade theory (Helpman, 1999) and may account for why some attempts to estimate the importance of increasing returns for trade have yielded mixed results (Helpman, 1987; Hummels and Levinsohn, 1995; Debaere, 2001).[1]

Recently, empirical researchers have begun to estimate the impact of increasing returns on trade by exploiting home-market effects, as derived by Krugman (1980). The home-market effect is the tendency for large countries to be net exporters of goods with high transport costs and strong scale economies.[2] In the presence of fixed costs, and thus scale economies, firms prefer to concentrate global production of a good in a single

[1] The observational equivalence of scale economies and comparative advantage is a problem also for testing models of economic geography. See Ellison and Glaeser (1997) and Hanson (2001). See Evenett and Keller (2001) for other work on trade flows, increasing returns, and comparative advantage.

[2] There is debate about the robustness of the home market effect in Krugman (1980). Davis (1998) finds that with one differentiated-good sector (with positive fixed costs), one homogeneous good sector (with zero fixed costs), and identical sectoral transport costs the home-market effect disappears. Krugman and Venables (1999) counter Davis' result by showing that the home-market effect holds as long as some homogenous goods have low transport costs or some differentiated goods have zero fixed costs. Holmes and Stevens (2002) demonstrate further support for the generality of home-market effects.

location; in the presence of transport costs, it makes sense for this location to be a market with high product demand. Goods that are subject to weak scale economies and/or low transport costs are then produced by small economies. The home-market effect implies a link between market size and exports that does not exist in models in which trade is based solely on comparative advantage.

One approach to identify home-market effects uses the correlation between industry supply and industry demand across countries or regions. In Krugman (1980), the demand for individual goods varies across markets because of differences in consumer preferences (e.g., German consumers prefer beer, French consumers prefer wine), leading production of a good to concentrate in markets with high levels of demand. Davis and Weinstein (1999, 2002) find that, for manufacturing industries in either OECD countries or Japanese regions, industry production increases more than one-for-one with local demand for a good. Head and Ries (2001) find evidence of similar patterns of industry production and consumption in Canada and the United States. Both sets of results are interpreted as consistent with home-market effects.[3]

A second approach to estimate home-market effects is to examine how the income elasticity of exports varies across goods. In theory, the income elasticity of exports should be higher for goods subject to higher price-cost markups and higher trade costs, which are conditions associated with differentiated products (Rauch, 1999). Feenstra, Markusen, and Rose (1998) estimate gravity models of trade for an aggregate of differentiated products and for an aggregate of homogeneous products. They find that income elasticity of exports is higher in the former sample than in the latter, which they interpret as evidence of home-market effects.

[3] For related work, see Trionfetti (1998, 2001), Weder (1998), and Brulhart and Trionfetti (2001).

Empirical literature finds support for home-market effects, and so for the importance of increasing returns for trade. But existing approaches are subject to concerns about how these effects are identified. A problem with using the correlation between industry production and consumption to identify home-market effects is that it requires industry demand to be uncorrelated with shocks to industry supply. There are many instances in which this condition may fail, leading to concerns about consistency in estimation. There are also potential problems in using gravity equations to identify home-market effects. When estimated on aggregate data the gravity model may hide cross-industry variation in bilateral trade flows that we would expect to see were home-market effects present. Additionally, Anderson and van Wincoop (2001) show that many gravity applications fail to control for the 'remoteness' of importing countries and thereby introduce specification bias into the estimation.

In this paper, we develop an alternative test for home-market effects. Similar to some previous work, we use the gravity model as a starting point. But distinct from previous work, we develop a "difference-in-difference" gravity specification that is consistent with theory and estimable with readily available data. First, we select pairs of countries that are likely to face common trade barriers in markets to which they export; second, we restrict attention to two groups of industries, one with high transport costs and strong scale economies and one with low transport costs and weak scale economies; and third, we examine whether, across exporter pairs, larger countries tend to export more of high-transport cost, strong-scale economy goods relative to their exports of low-transport cost, weak-scale economy goods, as implied by the home-market effect. Our test for

home-market effects, then, is to see whether German exports of steel relative to pencils are higher than Belgian exports of steel relative to pencils.

This approach has several important advantages. By using a gravity framework, with national income, distance, and similar controls as regressors, we reduce concerns about simultaneity in the estimation. By examining exports for country pairs to a common set of markets, we difference out the impacts of remoteness and trade barriers on trade flows. And by separating industries by scale economies and transport costs, we focus the analysis on cases where home-market effects are most likely to appear.

To preview the results, we find that home-market effects exist and that the nature of these effects depends on industry transport costs. Measuring exporter size using national GDP, support for home-market effects is strong for industries with very high transport costs and weak for industries with moderately high transport costs. Alternatively, measuring exporter size using market potential, which accounts for demand links between proximate countries, the pattern reverses. Support for home-market effects is weak for industries with very high transport costs and strong for industries with moderately high transport costs. These results suggest that for industries with very high transport costs, it is national market size that determines national exports. But for industries with moderately high transport costs, it is not the national market that matters as much as the neighborhood market. In this case, national market size *plus* market size in nearby countries determine national exports.

Our findings that home-market effects vary systematically across industries are important for understanding how falling trade barriers may affect industry location. In Europe, for instance, there is concern that economic integration will deindustrialize small

countries (Krugman and Venables, 1990). The fear is that lower trade barriers would allow large countries to attract industry away from small, peripheral countries. Our results suggest that only in very high transport cost industries would this sort of industry relocation occur. Following a reduction in trade barriers, moderately high transport cost industries might actually move into well-located small countries.

The remainder of the paper is organized as follows. In section 2, we use theory to develop an empirical framework. In section 3, we describe the data and estimation issues. In section 4, we present empirical results. And in section 5, we conclude.

2. Theory and Empirical Specification

In this section, we use a standard model of trade with increasing returns to scale and monopolistic competition (Helpman and Krugman, 1985) to develop an estimation strategy for identifying home-market effects.

2.1 A Model

Let there be J countries and M sectors, where each sector has a large number of product varieties. All consumers have identical Cobb-Douglas preferences over sectoral composites of manufacturing products,

$$U = \prod_{m=1}^{M} Q_m^{\mu_m}, \qquad (1)$$

where we temporarily ignore country subscripts, μ_m is the share of expenditure on sector m ($\sum_m \mu_m = 1$), and Q_m is a composite of symmetric product varieties in sector m given by

$$Q_m = [\sum_{i=1}^{n_m} C_{mi}^{\frac{\sigma_m - 1}{\sigma_m}}]^{\frac{\sigma_m}{\sigma_m - 1}} \quad . \qquad (2)$$

In (2), $\sigma_m > 1$ is the elasticity of substitution between any pair of varieties in m, and n_m is the number of varieties of m produced. There are increasing returns to scale in the production of each variety such that the minimum cost for producing x_{im} units of variety i in sector m is

$$f_m(w_m, x_{im}) = w_m(a_m + b_m x_{im}), \qquad (3)$$

where a_m and b_m are constants and w_m is unit factor cost (e.g., the wage, for a single factor of production, or a factor-price index, for multiple factors), which are assumed to be constant across varieties of m. In equilibrium each variety is produced by a single monopolistically-competitive firm and n_m is large, so that the price for each variety is a constant markup over marginal cost. Free entry drives profits to zero, equating price with average cost.

Consider the variation in product prices across countries. We allow for iceberg transport costs in shipping goods between countries and for import tariffs, such that the c.i.f. price of variety i in sector m produced by country j and sold in country k is

$$P_{imjk} = P_{imj} t_{mjk} (d_{jk})^{\gamma_m} = \left(\frac{\sigma_m}{\sigma_m - 1} \right) b_m w_{mj} t_{mjk} (d_{jk})^{\gamma_m} \qquad (4)$$

where P_{imj} is the f.o.b. price of product i in sector m manufactured in country j; t_{mjk} is one plus the ad valorem tariff in k on imports of m from j; d_{jk} is distance between j and k; $\gamma_m > 0$ is the elasticity of transportation costs with respect to distance; and the second equality replaces P_{imj} with a markup over marginal cost (which is constant across varieties of m).[4]

Next, consider the demand by country k for varieties of m produced in country j. Let C_{imjk} be the quantity of variety i from sector m that k purchases from j, which equals,

[4] For analytical ease, we assume that the markup of price over marginal cost is a multiplicative function of production costs, tariffs, and transport costs.

$$C_{imjk} = \mu_m Y_k \frac{(P_{imjk})^{-\sigma_m}}{\sum_{h=1}^{J} \sum_{i=1}^{n_{mh}} (P_{imhk})^{1-\sigma_m}} \tag{5}$$

where Y_k is national income in k. Define $S_{mjk} \equiv \sum_i P_{imjk} C_{imjk}$, which is total sales of varieties of sector m by country j to country k. Utilizing the symmetry of product varieties in preferences and technology (and dropping variety subscripts), these sales equal,

$$S_{mjk} = \mu_m Y_k n_{mj} \left(\frac{P_{mjk}}{P_{mk}} \right)^{1-\sigma_m} \tag{6}$$

where P_{mk} is the price index for sector m products in country k (equal to the denominator on the right of (5) raised to the power, $1/(1-\sigma_m)$).

To develop the logic of the home-market effect, compare country j's exports of good m to country k with some other country h's exports of good m to country k. Combining equations (4) and (6), these relative export sales are given by,

$$\frac{S_{mjk}}{S_{mhk}} = \frac{n_{mj}}{n_{mh}} \left(\frac{w_{mj}}{w_{mh}} \right)^{1-\sigma_m} \left(\frac{d_{jk}}{d_{hk}} \right)^{(1-\sigma_m)\gamma_m} \tag{7}$$

where we assume countries h and j have common production technology and face common tariffs in country k. Expressing sales in relative terms removes the price index in country k from the expression and comparing exporters that face common trade policy barriers in k removes tariffs from the expression. Since $\sigma_m > 1$, equation (7) shows that for some sector m, country j's exports to country k are more likely to exceed country h's exports to country k the lower are production costs in j relative to h, the closer to k is j relative to h, and the larger is the number of product varieties produced in j relative to h. Country j may produce more product varieties than country h for many reasons, including a home-market effect.

To isolate this effect, compare two sectors: sector m, which has a low value of σ_m (and so extensive product differentiation and high markups of price over marginal cost) and a high value of γ (and so high transport costs), and sector o, which has a high value of σ (low price-cost markups) and a low value of γ (low transport costs). In what follows, we will refer to sector m (high markups, high transport costs) as the "treatment" industry and sector o (low markups, low transport costs) as the "control" industry. From equation (7), the ratio of relative sales of m versus o goods by countries j and h to country k is,

$$\frac{S_{mjk}/S_{mhk}}{S_{ojk}/S_{ohk}} = \frac{n_{mj}/n_{mh}}{n_{oj}/n_{oh}} \frac{(w_{mj}/w_{mh})^{1-\sigma_m}}{(w_{oj}/w_{oh})^{1-\sigma_o}} (d_{jk}/d_{hk})^{(1-\sigma_m)\gamma_m-(1-\sigma_o)\gamma_o} \qquad (8)$$

A home-market effect exists where the ratio $(n_{mj}/n_{mh})/(n_{oj}/n_{oh})$ is higher the larger is country j relative to country h. In words, for two countries, j and h, the ratio of their relative exports of high-markup, high-transport cost good m to their relative exports of low-markup, low-transport cost good o will be higher the larger is j relative to h.[5]

Formal statements of the home-market effect abound in the literature (Krugman, 1980; Helpman and Krugman, 1985; Davis, 1995; Feenstra, Markusen, and Rose, 1998; Krugman and Venables, 1999). A general intuition for the result is that, with fixed costs in producing varieties of sector m and transport costs in delivering sector m products to market, it is cost minimizing for firms to concentrate production of m in larger markets. This logic depends on there being a sector o, in which transport costs are small and σ is

[5] The simplest proof of the home-market effect (see Krugman, 1980, and Helpman and Krugman, 1985) uses a model with a single factor of production, two countries, and two sectors, one with a finite substitution elasticity and positive fixed costs and another with a homogeneous good (i.e., an infinite substitution elasticity) and zero fixed costs. In this case, the number of goods in the o sector (the homogeneous-good sector) is one in both countries and the number of differentiated goods country 1 produces relative to country 2 is increasing in the relative size of country 1 to country 2. This result holds over the range of relative country sizes where both countries produce the differentiated good. If country sizes are too asymmetric, only the large country produces the differentiated good. As a practical matter, in our data all exporting countries have positive exports in all industrial sectors we examine.

large. Such products can be made anywhere, because they are cheap to transport and highly substitutable in consumption. In equilibrium, they are produced in small economies.

To clarify the logic of the home-market effect, we simulate the model based on explicit assumptions about how transport costs and substitution elasticities vary across sectors. We assume a single factor of production, labor, and two countries of unequal sizes. There is a continuum of sectors indexed by $z \in [0,1]$, each of which has a large number of product varieties. Cobb-Douglas expenditure shares are uniform across sectors. σ is monotonically decreasing in z according to the formula $\sigma(z)=(2-z)*4$, such that σ declines from 8 to 4 as z rises from 0 to 1 (implying, over the range of z, an increase in the price-cost markup from 1.13 to 1.25). Transport costs are given by $\exp(-\tau(z))$, where τ is increasing monotonically in z (according to the formula $\log([15z+3]/[(2-z)*4)-1])$ such that τ rises from 0.06 to 0.40 as z rises from 0 to 1. High z sectors, then, have high transport costs and low σ's and are good candidates for treatment industries in our framework; low z sectors have low transport costs and high σ's and are good candidates for control industries.[6] Theory predicts that high z sectors will be relatively concentrated in the large country and that low z sectors to be relatively concentrated in the small country.

Figure 1 plots the excess concentration of production in the large country – the large country's share of world output of a sector minus it's share of world GDP – against z. This is done for two scenarios, one in which the large country is 1.2 times the size of the small country and one in which the size differential is 1.6. Consistent with theory, high z (high transportation costs, low σ) sectors are relatively concentrated in the large country and low z (low transportation cost, high σ) sectors are relatively concentrated in the small country.

[6] This setup loosely follows the framework in Krugman and Venables (1999).

The extent of excess concentration in the large country is greater the larger is the size difference between the two countries.[7]

2.2 Empirical Specification

To search for evidence of home-market effects empirically, we specify equation (8) in log terms using the following regression:

$$\ln\left(\frac{S_{mjk}/S_{mhk}}{S_{ojk}/S_{ohk}}\right)=\alpha+\beta\ln\left(\frac{Y_j}{Y_h}\right)+\phi(X_j-X_h)+\theta\ln\left(\frac{d_{jk}}{d_{hk}}\right)+\varepsilon_{mojkh} \qquad (9)$$

where Y_j/Y_h is relative exporter market size; X_l is a vector of control variables that determine relative production costs for sectors m and o in country l; and ε_{mojkh} is an error term. Our test for home-market effects is whether $\beta>0$, or whether larger countries export relatively more of high-markup, high-transport cost goods.

Equation (9) is a 'difference-in-difference' specification of trade flows between countries. The dependent variable is for two countries the log difference in their exports of high-markup, high-transport cost good m minus the log difference in their exports of a low-markup, low-transport cost good o. The home-market effect implies that for two countries, j and h, the ratio of their relative exports of good m to their relative exports of good o will be higher the larger is Y_j relative to Y_h. The countries' relative exports of good o act as a control, sweeping out of the dependent variable any general tendency for one country to export relatively more than the other.

Consider, instead, using the log difference in two countries' exports of good m as the dependent variable (i.e., the log of the variable on the left of equation (7)). Then the

[7] In this particular model, the desire of firms to concentrate production in the large country bids up wages relative to the small country. High wages in the large country drive out footloose industries, which are those with low transport costs and/or high substitution elasticities.

coefficient β could not be interpreted as capturing a home-market effect since large countries may export relatively more of all goods. The advantage of the difference-in-difference specification is that it (a) controls for the tendency of large countries to export more of all goods, (b) removes from the estimation tariffs, sectoral price indices, and home bias effects, all of which are hard to measure, and (c) for exporter pairs with similar production costs, differences out of the estimation all determinants of relative exports, except relative distance and relative country size. For completeness, we report estimation results using both the single log difference of exports (for a pair of exporters, log relative exports of a single good) and the double log difference of exports (for a pair of exporters, log relative exports of a treatment industry minus log relative exports of a control industry) as the dependent variable.

Estimation of equation (9) requires that we place restrictions on the set of industries and countries included in the sample and define the set of regressors. First, we must choose pairs of exporting countries that face common trade policy barriers in the countries that import their goods. It is an added advantage if these country pairs have similar production costs, such that comparative advantage plays a small role in determining their relative exports (i.e., in (9), $(X_j - X_h) \cong 0$). We choose exporting country pairs that belong to a common preferential trade area and that have relatively similar average incomes. Second, we must identify a set of high-markup, high-transport cost industries and a set of low-markup, low-transport cost industries. This is complicated somewhat by the simplicity of trade models. The standard framework is the Dixit-Stiglitz (1977) model of monopolistic competition, in which prices, and so average costs, are a constant markup over marginal cost, where this markup is fixed by σ. σ, then, determines both the equilibrium extent of

product differentiation (the number of product varieties) and the equilibrium strength of scale economies (the ratio of average to marginal costs). In reality, product differentiation and scale economies may not be so tightly related. The apparel industry, for instance, has a high degree of product differentiation but flat average cost curves. We would not expect this industry to be subject to a home-market effect. We select high-markup and low-markup industries on the basis of average plant size, a common metric of scale economies.

A final consideration is how to measure relative country size. In equation (9), we use relative GDP to capture relative market size for a pair of exporters. This is certainly appropriate for a world with two countries. But with many countries neighborhood effects may be important for industry location. Belgium's national market, for instance, is small relative to Spain's. But Belgium has three large neighbors, France, Germany, and the Netherlands, whereas Spain has one large neighbor, France and one small neighbor, Portugal. Belgium's neighbors may be an important source of demand for its output and may result in the country having stronger home-market effects than its own GDP would imply. To capture relative market size for Belgium and Spain, we may want to account for the relative size of both their national markets and their neighboring markets.

The potential for neighborhood effects to influence the location of production is implied by recent theories of economic geography (Fujita, Krugman, and Venables, 1999). These theories extend trade models based on monopolistic competition to regional settings. In this body of work, neighborhood effects are captured by a market-potential function, in which demand for a country's goods is a function of income in other countries weighted by transport costs to those economies. Applying this logic, we measure relative exporter size in two ways. The first is the simple ratio of national GDPs, as in equation (9). The second is

the ratio of the market-potential functions for two countries.[8] Following Fujita, Krugman, and Venables (1999) and Hanson (2001), we define the market potential for country i as the distance-weighted sum of GDP in other countries, or

$$MP_i = \sum_{l=1}^{J} Y_l d_{li}^{-\lambda} \qquad (10)$$

When using market potential to define country size, we replace $\ln(Y_j/Y_h)$ in (9) with $\ln(MP_j/MP_h)$.[9] This approach is similar in spirit to Davis and Weinstein (2002), who use a gravity-based measure of industry demand to test for home-market effects. Using coefficient estimates on the distance variable from the gravity model in Hummels (1999), we set λ equal to 0.92, but we also report results for other values.[10]

3. Data and Estimation Issues

The data for the estimation come from several sources. For country exports by product, we use the World Trade Database for 1990 (Feenstra, Lipsey, and Bowen, 1997). This source gives bilateral trade flows between countries for three- or four-digit SITC revision 2 product classes. At this level of industry classification (chemical fertilizers, woven cotton fabrics, gas turbines) product classes are better seen as sectoral aggregates than as individual product varieties, which is consistent with our empirical specification. We choose 1990 to have a recent year, for which there are more non-zero observations on bilateral trade at the product level, but not so recent that data on other country characteristics are unavailable.

[8] For other applications of market potential see Hanson (2001) and Redding and Venables (2002).

[9] One issue is how to measure a country's distance to itself. Following Davis and Weinstein (2002) and previous literature, we set this distance equal to $(\text{land area}/\pi)^{0.5}$. Distance to the domestic market is then larger for countries with greater land mass. We also discuss results for other measures.

[10] Hummels' (1999) estimates of the gravity distance coefficient are similar to results in many other studies. We choose to use his estimates simply because we also rely on other results in his paper.

For data on GDP, we use the Penn World Tables. For data on country characteristics related to production costs, we use nonresidential capital per worker from the Penn World Tables; available land supply relative to the population and average education of the adult population from Barro and Lee (2000); and the average wage in low-skill industries (apparel and textiles) from the UNIDO Industrial data base. For distance and other gravity variables (whether countries share a common border, whether countries share a common language), we use data from Haveman (www.eiit.org). Table 1 gives summary statistics on the regression variables.

There are several estimation issues to be addressed. First, we need to select pairs of exporting countries under the constraint that both members of a pair face common trade policy barriers in importing countries. To ensure that exporters have diversified manufacturing industries (and are not specialized in primary commodities or low-skill goods), we limit the sample of exporters to OECD countries. Within this group, we form country pairs from sets of countries that belong to a preferential trading arrangement of some kind. These include the members of the European Economic Community (now European Union);[11] Canada and the United States (U.S.-Canada Free Trade Area); and New Zealand and Australia (British Commonwealth). This yields a potential number of 107 exporter pairs per importer and industry.

Figure 2 shows the cumulative distribution of log relative exporter GDPs (in which the larger country of a pair occupies the numerator) for all exporter country pairs in the sample. There is considerable variation in country size. For 65% of the observations one country is at least 75 log points larger than the other and for 40% of the

[11] The European exporter countries are Austria, Belgium-Luxembourg, Denmark, Finland, France, Germany, Great Britain, Greece, Italy, Ireland, the Netherlands, Norway, Portugal, Spain, and Sweden.

observations one country is at least 150 log points larger than the other. The variation in relative market potential within our sample, shown in Figure 3, is also considerable, but is less than that for relative GDP. This is not surprising, since the market potential measure places less weight on own-country GDP and more weight on other-countries' GDP, reducing the cross-country variation in market size.

Second, we need to choose the set of countries that import goods from these exporters. One might presume that we should include all importer countries in the sample. A problem with this approach is that many small countries have zero imports from many of their bilateral trading partners, as one would expect given their size. In many contexts, having the dependent variable take zero values can be addressed with standard techniques, such as the Tobit. In our case, however, the dependent variable is constructed from four separate export values (since it is a double log difference). Determining the joint probability that two or more of these values are zero, as would be necessary to employ a Tobit-style estimator, is a complicated problem and beyond the scope of this paper. Instead, we limit our sample to the 15 largest importing countries,[12] which in 1990 accounted for 69% of world imports of manufacturing goods. Restricting the sample in this way greatly reduces the number of observations with zero export values.[13] Since the theory applies to importers on a case-by-case basis, there is in principle no loss in focusing on large importers. To check the sensitivity of the results to this restriction, we report results using samples of either the 58 largest importers (97% of

[12] These are Australia, Austria, Belgium-Luxembourg, Denmark, France, Germany, Italy, Japan, the Netherlands, Spain, Sweden, Switzerland, the United Kingdom, and the United States. Among other large importers, we exclude Hong Kong and Singapore, which are entrepot economies, and China, which has much lower per capita income than other large importers.

[13] For this sample, 81% of the observations have non-zero values for all four components of the dependent variable. To preserve information on zero trade values, we follow Eaton and Tamura (1994) and assume countries with zero reported bilateral imports of a good actually import minute quantities, which we set to one. The results are unaffected by dropping observations that contain zero trade values from the sample.

1990 world imports) or the 7 largest importers (52% of 1990 world imports).[14]

Third, we need to identify industries with strong scale economies and low transport costs and industries with weak scale economies and high transport costs. To do so, we use data on average industry plant size from the 1992 U.S. Census of Manufacturers and data on average industry transport costs in 1990 based on Feenstra's (1996) import series for U.S. industries. We use the SIC code to define these industries, as it is the only classification for which we can obtain data on both industry plant size and industry transport costs. We then match the selected SIC industries to SITC industries. The measure of transport costs we use is freight costs as a share of total import value by industry across all countries that export to the United States.[15]

Table 2 lists the industries in the sample. To obtain this group, we rank industries by average employment per establishment and by average freight costs. We first select industries with freight costs in either the bottom third of the industry distribution of freight costs, which constitute the low-transport cost group, or in the top third of the distribution of freight costs, which constitute the high-transport cost group. Table 3 shows quantiles for freight costs and plant size. We then define the control group of industries to be those with transport costs in the top third and above median average plant size and the treatment group of industries to be those with transport costs in the bottom third and below median average plant size.[16] From these two groups, we exclude (a) industries for which natural resources are likely to influence heavily industry location

[14] For the samples of 7 large importers and 58 large importers, respectively, 85% and 47% of the observations have non-zero values for all four components of the dependent variable.
[15] Freight costs for an industry equal (c.i.f. imports/customs value of imports)-1.
[16] This excludes from the sample low-transport cost industries with above median average plant size (most transportation equipment (SIC 37) and chemicals (SIC 28)) and high-transport cost industries with below median average plant size (textiles (SIC 22), apparel (SIC 23), leather and footwear (SIC 31)).

(food processing (SIC 20), tobacco (SIC 21), lumber and wood products (SIC 24), petroleum refining (SIC 29)); (b) industries that could not be concorded easily to an SITC industry at the three digit-level (fabricated metal products (SIC 34), industries with a "not elsewhere classified" designation); and (c) SIC industries that can only be matched to SITC industries at the three-digit level and whose four-digit industries show high variance in either plant size or freight cost (electric and electronic equipment (SIC 36), some nonmetallic minerals (SIC 32), jewelry (SIC 391)).[17]

One might be concerned that average plant size is a noisy measure of industries with high markups of price over marginal cost. For independent verification that our large-plant size industries appear to have relatively high markups and that our small-plant size industries appear to have relatively low markups, we draw on Hummels' (1999) estimates of the elasticity of substitution (σ) by industry. Hummels estimates a specification similar to (6), using data on bilateral trade flows, import tariffs, transport costs, etc. In theory, σ pins down both the markup of price over marginal cost and the ratio of average to marginal cost (under free entry) for an industry. Hummels estimates substitution elasticities by two-digit SITC industry. In Table 2, we report his estimates that correspond to the three or four digit SITC industries in our data.[18] It is reassuring to find that our large-plant size industries have low values of σ (indicating high price-cost markups and high average to marginal cost ratios), with a median value of 3.5, and that our small-plant size industries have high values of σ (indicating low price-cost markups

[17] We also exclude printing trades machinery (SIC 3555, SITC 726), due to the fact that measured trade of this good was zero for nearly all bilateral country pairings, and cement (SIC 3241, SITC 6612), as this industry had zero bilateral trade values for nearly two-thirds of bilateral country pairings.

[18] These are OLS estimates. Hummels (1999) also reports IV estimates of σ, which tend to produce lower values of σ for our large-plant size industries and higher values of σ for our small-plant size industries.

and low average to marginal cost ratios), with a median value of 7.1.[19]

We estimate equation (9) by matching industries from the first group in Table 2 with industries from the second group in Table 2. The high-transport cost, large-plant size industries are the treatment group that theory suggests will be subject to home market effects; the low-transport cost, small-plant size industries are the control group.

4. Estimation Results

4.1 Preliminary Results

Before we present the main estimation results, it is useful to consider a simple specification in which the dependent variable is for a pair of exporters log relative exports of a good (which is equivalent to the numerator of the regressand in (9)) and the independent variables are as in equation (9). We are interested in seeing whether the results of this initial 'single-difference' specification are consistent with results for standard gravity models, which show an elasticity of bilateral exporters with respect to exporter GDP of about one. The results will also reveal whether the correlation between relative exports and relative exporter size is larger for treatment (high-transport cost, large plant size) industries than for control (low-transport cost, small plant size) industries, as would be consistent with home-market effects.

Table 4 shows single-difference gravity estimation results for the 8 treatment and 13 control industries in our sample. The regressors are for a pair of exporters log relative exporter size, dummy variables for whether an exporter and importer share a common

[19] Other industries with low values of σ (less than four) tend to be intensive in natural resources (sugar, animal oils), and other industries with high values of σ (greater than seven) tend to be intensive in natural resources (meat and dairy products), to have large average plant sizes (organic chemicals, pharmaceuticals, telecommunications equipment), or to have high transport costs (leather).

border or a common language (in level differences for an exporter pair), log relative capital per worker, log relative land area per capita, log relative average schooling, and log relative wages in low-skill industries.[20] The variable of interest is log relative exporter size, which we measure as either log relative exporter GDP or log relative exporter market potential. We show coefficient estimates for these variables only. In the appendix, we show complete estimation results for a subset of industries.

Coefficient estimates on relative exporter GDP are uniformly positive and in most cases precisely estimated. Large countries export more of all kinds of goods, both those with high transport costs and those with low transport costs. This is consistent with estimation of standard gravity models, which show that bilateral exports are increasing in exporter income. We obtain qualitatively similar results when we replace relative exporter GDP with relative exporter market potential, though these estimates are somewhat less precise and contain some negative values.

More illuminating is to compare results for relative exporter size for treatment and control industries. The average coefficient on exporter GDP is 1.5 for the treatment industries and 1.1 for the control industries and on exporter market potential is 1.5 for the treatment industries and 0.9 for the control industries. This is suggestive of home-market effects. Exporters with larger home markets have higher exports of high-transport cost, large-plant-size goods and lower exports of low-transport cost, small-plant-size goods. It is also apparent in Table 4 that the impact of relative size on relative exports is larger for some control industries than for some treatment industries. This is an initial indication that support for home-market effects may not be uniform across industries.

[20] Since the data include observations on relative income, distance, and other variables for given exporter pairs across multiple importing countries, we correct the standard errors to allow for correlation in the errors across observations that share the same exporter pair.

4.2 Main Results

Tables 5a and 5b show estimation results for equation (9). The dependent variable is for two countries log relative exports of a treatment (high-transport cost, large-plant size) industry minus log relative exports of a control (low-transport cost, small-plant size) industry. The independent variables are as in Table 4. We estimate regressions separately for each of the 104 (8x13) treatment and control industry matches in the data.[21] In Table 5a, the measure of relative exporter size is relative GDP and for brevity we report coefficient estimates for this variable only. The sample is exports by 107 country pairs to 15 large importing countries. Treatment industries, in order of ascending freight costs, are arrayed across the columns; control industries, also in order of ascending freight costs, are arrayed down the rows.

Table 5a shows some evidence of home-market effects and of variation in these effects across industries (as suggested by Table 4). Of the 104 regressions, the coefficient on relative exporter GDPs is positive in 76 (73%) of the cases and positive and statistically significant at the 10% level in 54 (52%) of the cases. Overall, this is hardly overwhelming support for home-market effects.

Table 5b summarizes the coefficient estimates in Table 5a for subgroups of treatment and control industry pairings. For each group we report the fraction of regressions with a positive coefficient estimate on log relative exporter GDP and the fraction of regressions in which this coefficient is positive and statistically significant at the 10% level. Treatment industries with very high transport costs show strong evidence

[21] Since the regressors do not vary across industries, there is no gain to estimating equation (9) jointly across pairs of treatment and control industries (OLS is just as efficient as GLS).

of home-market effects. Of the 39 regressions for the three treatment industries in the top 15% of transport costs (clay products, steel mills, steel pipes and tubes), the coefficient on relative exporter GDPs is positive in 87% of the cases and positive and statistically significant at the 10% level in 74% of the cases. For the five treatment industries in the next 20% of transport costs, the coefficient on relative exporter GDP is positive in only 58% of the cases and positive and statistically significant in only 37% of the cases. Thus, we find the strongest support for home-market effects where we would expect, among the treatment industries with highest transport costs. No clear patterns appear when we break out low-transport cost industries in terms of either freight costs or average plant size.

Table 6a shows coefficient estimates for relative exporter size measured using relative exporter market potential. There is again variation in the strength of home-market effects across industries, but the patterns are quite different from Table 5a. This is perhaps easier to see in Table 6b, which summarizes the results in Table 6a. With exporter size measured in terms of market potential, home-market effects are strongest among treatment industries with lower transport costs (with transport costs between the 65^{th} and 85^{th} percentiles). For treatment industries in the top 15% of transport costs, the coefficient on relative exporter market potential is positive and statistically significant in only 8% of the cases. For treatment industries in the next 20% of transport costs, the coefficient on relative exporter market potential is positive in 89% of the cases and positive and statistically significant in 75% of the cases. For all treatment industries, evidence of home-market effects is stronger when compared against the control industries with either the lowest transport costs or the smallest average plant sizes.

To summarize the results, support for home-market effects depends on the

measure of relative exporter size that is used. For relative exporter size measured using GDP, support for home-market effects is strong for treatment industries with very high transport costs and weak for treatment industries with moderately high transport costs. For relative exporter size measured using market potential, this pattern is reversed. Support for home-market effects is weak for very high transport cost treatment industries and strong for moderately high transport cost treatment industries.

One explanation for these results is that the relevant definition of exporter size for the home-market effect depends on the transport costs of the industry in question. For industries with strong scale economies and very high transport costs, the relevant market for exporter size may be the national market. Very high transport costs may mean that the demand kick from an exporter's neighboring markets is small. To return to the Belgium and Spain example, in strong scale economy and very high transport cost industries, national market size may matter more for industry location than how big an exporting country's neighbors are. In these industries, Belgium may get only a small demand boost from France, Germany, and the Netherlands, such that their proximity does not compensate for Belgium having a smaller national market than Spain. For industries with strong scale economies and moderately high transport costs, however, the relevant market for exporter size appears to include neighboring countries. Transport costs may be low enough that industries in a given country get a demand boost from nearby nations. In these cases, Belgium's neighbors may generate enough demand for Belgium's goods that the country offers industries a larger base of demand than does Spain.

4.3 Further Results and Sensitivity Analysis

To gauge the sensitivity of our findings to sample selection and model specification, we examine the impact on the results of imposing alternative sample restrictions and of using alternative sets of regression variables.

We begin by expanding the list of importers to include the 58 countries with the highest value of imports in 1990 (which together accounted for 97% of world imports) and then re-estimating equation (9). Table 7a summarizes results using GDP to measure relative exporter size and Table 7b summarizes results using market potential to measure relative exporter size. These findings are quite similar to those in Tables 5a and 6a. This is reassuring, given that a higher fraction of bilateral industry trade values are zero for this expanded sample of importers. Zero industry trade values in the data thus do not appear to be overly influencing the results (see notes 13 and 14).

In Table 7a (market size measured using GDP), for treatment industries in the top 15% of transport costs, the coefficient on relative exporter GDPs is positive in 87% of cases and positive and statistically significant in 74% of cases. For treatment industries in the next 20% of transport costs, the coefficient on relative exporter GDPs is positive in 59% of cases and positive and statistically significant in 37% of cases. In Table 7b (market size measured using market potential), for treatment industries in the top 15% of transport costs, the coefficient on relative exporter GDPs is positive in 31% of cases and positive and statistically significant in 21% of cases. And for treatment industries in the next 20% of transport costs, the coefficient on relative exporter GDPs is positive in 88% of cases and positive and statistically significant in 72% of cases.

In Table 8, we try alternative specifications and sample restrictions. First, we

restrict the sample of importers to be the seven largest importing countries. Relative to samples used in Tables 5-7, this sample contains fewer observations with zero bilateral industry trade values. These results are quite similar to those already reported. Second, we drop from the sample of exporters countries in Europe with relatively low per capita incomes (Greece, Ireland, Portugal, Spain). This has very little impact on the results. This finding is helpful in that it suggests that our controls for relative production costs do a reasonably adequate job of controlling for differences in comparative advantage across countries. Third, we use alternative measures of market potential. We allow λ, the coefficient on distance in equation (10), to be as large as 1 or as small as 0.84, which represents an increase or decrease of λ by two-standard deviations based on Hummels' (1999) gravity estimates. These results are very similar to those in Table 6a. Fourth, in constructing the market-potential measure, we experiment with changing the definition of a country's distance to itself. We set this distance equal to one, rather than $\pi^{-0.5}$(land area)$^{.5}$ (see note 9). This specification produces results very similar to Table 5a. This alternative definition of market potential places a greater weight on national market size than does the definition used in the regressions in Tables 6 and 7, and so yields results that are similar to using national GDPs as the measure of exporter size.

In unreported results, we dropped the comparative advantage variables from the estimation. This had the general effect of increasing estimated coefficients on relative exporter size (making negative coefficients smaller in absolute value or positive and making positive coefficients larger). We are skeptical of these results due to the possibility that relative capital or skill abundance may be positively correlated with relative GDP. In this case, it would seem likely that dropping the comparative advantage

variables could produce spurious findings of home-market effects.

4.4 Discussion

Previous empirical literature has sought to identify home-market effects either by (a) comparing gravity-model estimation results for an aggregate of differentiated-product industries with an aggregate of homogeneous-product industries, or (b) estimating the cross-country correlation between industry output and the demand for industry output. Relative to the first body of work, we allow for greater industry heterogeneity in the strength of home-market effects. Our findings strongly suggest that such industry heterogeneity is important empirically. The second body of work, like ours, tests for the presence of home-market effects at the level of individual industries. As we have mentioned, one concern about this second approach is that it requires strong assumptions on the orthogonality of industry demand and supply shocks. A justification for our approach is that it appears to be relatively free from concerns about simultaneity bias. These concerns are moot, of course, if the two approaches yield similar results. To see whether or not this is the case, we compare our results with representative results using the industry supply-industry demand approach.

In one prominent example of this approach, Davis and Weinstein (2002) find evidence consistent with home-market effects for many industries, including food products, textiles, leather, and wood products. These are industries with high-transport costs, small average plant sizes, and large estimated substitution elasticities (see notes 16 and 19). Since these are industries with high-transport costs but presumably weak scale economies, our selection criterion would suggest that they would be poor candidates for

either treatment or control industries. These are not industries that theory would suggest are subject to home-market effects. Based on our approach, we would interpret evidence of home-market effects for these industries as at best as neutral support for the proposition that increasing returns influence trade patterns. Davis and Weinstein (2002) find evidence inconsistent with home-market effects for other industries, including paper and pulp, industrial chemicals, other chemicals, non-metallic mineral products, non-electric machinery, electrical machinery, and transportation equipment.[22] Of this group, our selection criterion identifies pulp and paper, industrial chemicals, and non-metallic mineral products as containing good candidates for treatment industries. We find evidence consistent with home-market effects for some three- or four-digit industries (paper, glassware, inorganic chemicals, clay) within these three industries.

Thus, our approach, which is based on a difference-in-difference gravity specification, yields results that are quite different from the industry supply-industry-demand approach. While a full evaluation of competing approaches to test for home-market effects is beyond the scope of this paper, it is clear that the strategy one takes to identify home-market effects matters greatly for what one finds.

5. Conclusion

In this paper, we test for home-market effects using a difference-in-difference gravity specification. Home-market effects exist when relatively large countries have relatively high exports of goods with high-transport costs and strong scale economies.

[22] In David and Weinstein (2002), there are a third set of industries (including beverage industries and fabricated metals) for which results on home-market effects are inconclusive. The results of theirs that we cite are for two-digit industries. They also report results for three-digit industries, but since these estimates are based on very small sample sizes we do not dwell on them here.

Such effects are predicted by models of trade based on increasing returns to scale but not by models of trade based on comparative advantage. In our estimation approach, we select pairs of exporting countries that belong to a common preferential trade area and examine their exports of goods with high transport costs and strong scale economies relative to their exports of goods with low transport costs and weak scale economies. Previous tests of home-market effects may be subject to concerns about simultaneity bias, specification bias, or industry heterogeneity. The difference-in-difference gravity specification that we use sweeps out of the regression the effects of import tariffs, home bias in demand, and relative goods' prices in importing countries. As in the estimation of standard gravity models, our specification uses plausibly exogenous regressors.

Empirical support for home-market effects depends on how we measure relative exporter size. When measuring exporter size using national GDP, support for home-market effects is strong for industries with very high transport costs and weak for industries with moderately high transport costs. Alternatively, when measuring exporter size using market potential, which accounts for demand links between nearby countries, the pattern is reversed. Support for home-market effects is weak for the industries with very high transport costs and strong for industries with moderately high transport costs.

Our results suggest that in very high transport cost industries export production tends to concentrate in large countries. For these industries, home-market effects appear to be operative in the standard sense. Relative to small countries, large countries have high exports of goods subject to strong scale economies and high transport costs. For industries with moderately high transport costs, export production appears to concentrate in neighborhoods with strong regional demand. Export production in these industries

may concentrate in small countries, as long as these countries have large neighbors that increase effective demand for goods produced in the country. These results suggest that the potential for falling trade barriers to deindustrialize small economies is weaker than previous theoretical and empirical literature would indicate.

As far as we are aware, the interaction between transport costs, scale economies, and the location of export production that we uncover has not been found in previous studies. One particular feature of our empirical approach may aid in identifying these effects. We select industries that theory suggests are good candidates for home-market effects and we make explicit comparisons between export production in these industries and in a control group of industries. For countries to have excess concentration of production in some industries, they must have an under concentration of production in other industries. Our framework exploits these general equilibrium effects explicitly.

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Appendix: Full Estimation Results for Selected Industries (Single-Difference)

Independent Variables	**662** Clay	**641** Paper	**52** Inorg. Chem.	**68** Sec. Nonf. Metals	**786** Trailers	**898** Music. Instrum.
GDP	1.369	1.323	1.176	1.156	0.930	0.416
	(14.11)	(6.97)	(6.17)	(9.61)	(13.19)	(1.92)
Distance	-0.533	-0.704	-1.957	-0.671	-1.350	-1.413
	(-3.84)	(-4.11)	(-11.82)	(-6.31)	(-8.68)	(-8.44)
Common Language	0.398	0.660	1.449	-0.227	1.659	1.861
	(1.83)	(2.12)	(5.31)	(-0.97)	(9.34)	(9.86)
Common Border	1.379	1.044	-0.543	0.988	0.643	-0.793
	(8.98)	(4.57)	(-2.59)	(6.68)	(3.64)	(-3.93)
Capital/Worker	0.350	3.654	2.934	3.198	1.945	-2.362
	(0.80)	(4.95)	(4.35)	(9.43)	(6.65)	(-3.40)
Wage in Low-Skill Ind.	0.574	2.113	1.094	-1.135	2.715	2.704
	(1.77)	(3.39)	(1.79)	(-4.21)	(13.14)	(5.35)
Area/Population	-0.776	0.364	0.078	-0.172	-0.547	-0.660
	(-7.74)	(2.02)	(0.44)	(-1.55)	(-8.46)	(-3.50)
Average Education	-3.001	4.659	0.079	1.125	3.321	1.373
	(-4.00)	(3.88)	(0.08)	(2.23)	(7.20)	(1.59)
Constant	-0.094	0.275	0.441	-0.029	0.286	0.016
	(-0.75)	(1.22)	(2.02)	(-0.23)	(3.42)	(0.07)
R^2	0.704	0.669	0.654	0.663	0.749	0.625

Notes: This table shows the coefficient estimates on all independent variables from regressions in which the dependent variable is log relative industry exports for a pair of countries for select industries. T-statistics (calculated from standard errors that have been adjusted for correlation of the errors across observations that share the same pair of exporting countries) are in parentheses. For each industry, the sample is relative bilateral exports by 107 country pairs to 15 large importing countries (1262 observations).

Table 1: Summary Statistics

Variable	Mean	Standard Deviation
Exports	-0.056	4.021
GDP	0.261	1.564
Market Potential	-0.096	0.440
Distance	0.103	0.715
Common Language	-0.006	0.353
Common Border	-0.040	0.346
Capital per Worker	-0.175	0.508
Wage in Low-Skill Industries	-0.044	0.507
Land Area/Population	0.115	1.531
Average Education	-0.070	0.314

Notes: All variables are differences in log values for pairs of exporting countries (except for common language and common border, which are level differences in dummy variables). The exporter pairs are Australia-New Zealand, Canada-United States, and all pair wise combinations of the set, Austria, Belgium-Luxembourg, Denmark, Finland, France, Germany, Great Britain, Greece, Italy, Ireland, the Netherlands, Norway, Portugal, Spain, and Sweden. The importing countries are Australia, Austria, Belgium-Luxembourg, Denmark, France, Germany, Italy, Japan, the Netherlands, Spain, Sweden, Switzerland, the United Kingdom, and the United States. (In this table, exports are log differences for one industry; in most regressions, exports are double-log differences.)

Table 2: Industry Average Plant Size and Freight Costs

SIC Industry	SITC Industry	Low-Transport Cost Industries	Freight Cost	Plant Size	σ
334	68	Secondary nonferrous metals	0.014	35.1	6.7
382, 384, 385	87	Measuring devices, medical instruments	0.023	57.7	6.7
3554	725	Paper industries machinery	0.024	54.7	8.5
237	848	Fur goods	0.027	4.7	5.6
387	885	Watches and clocks	0.027	42.2	8.1
354	736, 737	Metalworking machinery	0.027	22.2	8.1
3792	786	Trailers and campers	0.027	50.3	7.1
3552	724	Textile machinery	0.028	29.6	8.5
358	741	Refrigeration machinery	0.030	77.6	7.0
393	898	Musical instruments	0.030	26.5	4.9
353	723	Construction machinery	0.035	53.8	8.5
352	721	Farm machinery	0.035	48.6	8.5
395	895	Pens, pencils, and office supplies	0.035	28.5	4.9
		High-Transport Cost Industries			
2621, 2631	641	Paper and paperboard	0.058	359.5	4.3
332	671, 672	Iron and steel founded products	0.062	104.3	3.5
3315	677	Steel wire and related products	0.066	70.8	3.5
281	52	Inorganic chemicals	0.070	72.4	1.4
322	665	Glassware and Glass Containers	0.070	125.9	2.7
3317	678	Steel pipes and tubes	0.079	101.7	3.5
3312	674	Blast furnace and steel mill products	0.079	786.2	3.5
325	662	Structural clay products	0.158	56.6	2.7

Notes: Freight costs equal (c.i.f. industry imports/customs value of industry imports)-1, and are based on U.S. imports in 1990 from Feenstra (1996). Plant size is industry average workers per establishment, based on the 1992 U.S. Census of Manufacturers. σ is the OLS estimate of the elasticity of substitution in Hummels (1999) for the corresponding two-digit SITC industry. All estimates are statistically significant at the 5% level. See his paper for more details on the estimation technique.

Table 3: Quantiles for Industry Freight Costs and Plant Size

Percentile	Freight Cost	Plant Size
5	0.015	15.3
15	0.026	27.1
25	0.032	36.2
35	0.037	44.8
50	0.048	62.2
65	0.058	84.0
75	0.066	107.8
85	0.074	150.3
95	0.113	318.9

Notes: See Table 2 for variable definitions and sources.

Table 4: Single-Difference Gravity Estimation

	Relative Exporter Size			Relative Exporter Size	
High-Transport Cost Industries	GDP	Market Potential	Low-Transport Cost Industries	GDP	Market Potential
641	1.323	2.967	**68**	1.156	0.345
Paper	(6.97)	(2.70)	Sec. Nonf. Met.	(9.60)	(0.56)
671, 672	1.329	3.632	**87**	0.848	1.562
Iron Prod.	(6.71)	(3.26)	Med. Instrum.	(7.12)	(1.76)
677	1.419	3.413	**725**	1.548	-0.639
Steel Wire	(7.57)	(2.94)	Paper Machin.	(10.70)	(-0.78)
52	1.176	5.967	**724**	1.242	-0.111
In. Chem.	(6.17)	(4.13)	Textile Machin.	(12.85)	(-0.15)
665	1.202	2.411	**848**	1.211	-3.844
Glassware	(7.93)	(2.37)	Fur Clothing	(8.41)	(-6.07)
678	1.731	-1.051	**885**	1.43	0.367
Steel Pipe	(13.28)	(-1.27)	Watches, Clocks	(21.56)	(0.49)
674	2.345	-0.965	**736, 737**	1.534	0.106
Steel Mill	(9.77)	(-0.86)	Machine Tools	(13.95)	(0.12)
662	1.369	-2.560	**786**	0.93	0.721
Clay	(14.11)	(-3.39)	Trailers	(13.19)	(1.10)
			741	0.915	1.153
			Refrig. Equip.	(6.02)	(1.27)
			898	0.416	3.274
			Music. Instrum.	(1.92)	(3.14)
			723	1.648	3.696
			Constr. Machin.	(10.77)	(2.77)
			721	0.494	2.494
			Farm Machin.	(4.27)	(2.73)
			895	0.922	1.921
			Pens, Pencils	(5.09)	(1.48)

Notes: This table shows coefficient estimates on log relative exporter size (measured either as GDP or market potential) from regressions in which the dependent variable is log relative industry exports for a pair of countries. T-statistics (calculated from standard errors that have been adjusted for correlation of the errors across observations that share the same pair of exporting countries) are shown in parentheses. Coefficient estimates on other regressors (see text or notes to Table 5a for details) are suppressed. For each industry, the sample is relative bilateral exports by 107 country pairs to 15 large importing countries (1262 observations)

Table 5a: Difference-in-Difference Gravity Estimation for Relative Exporter GDP

High Tr. Cost	**641**	**671, 672**	**677**	**52**	**665**	**678**	**674**	**662**
Low Tr. Cost	Paper	Iron Prod.	Steel Wire	In. Chem.	Glassware	Steel Pipe	Steel Mill	Clay
68	0.167	0.174	0.264	0.021	0.046	0.575	1.189	0.213
Sec. Nonf. Met.	(1.02)	(1.23)	(1.63)	(0.08)	(0.23)	(5.87)	(7.37)	(1.23)
87	0.475	0.481	0.571	0.328	0.353	0.882	1.497	0.521
Med. Instrum.	(2.23)	(1.86)	(2.81)	(2.29)	(2.97)	(4.44)	(4.65)	(3.89)
725	-0.225	-0.219	-0.129	-0.372	-0.347	0.183	0.797	-0.179
Paper Machin.	(-1.90)	(-0.98)	(-0.75)	(-1.58)	(-2.70)	(1.58)	(3.83)	(-1.22)
848	0.112	0.119	0.209	-0.034	-0.009	0.520	1.134	0.158
Fur Clothing	(0.50)	(0.47)	(1.12)	(-0.11)	(-0.04)	(4.03)	(6.10)	(1.06)
885	-0.107	-0.101	-0.010	-0.254	-0.228	0.301	0.915	-0.061
Watches, Clocks	(-0.50)	(-0.44)	(-0.06)	(-1.33)	(-1.61)	(1.97)	(3.35)	(-0.66)
736, 737	-0.211	-0.204	-0.114	-0.357	-0.332	0.197	0.811	-0.165
Machine Tools	(-1.17)	(-0.83)	(-0.70)	(-2.07)	(-4.16)	(1.37)	(3.05)	(-2.11)
786	0.394	0.40	0.490	0.247	0.272	0.801	1.416	0.439
Trailers	(2.27)	(2.28)	(2.67)	(1.52)	(1.72)	(5.53)	(5.32)	(3.53)
724	0.081	0.087	0.177	-0.066	-0.041	0.489	1.103	0.127
Textile Machin.	(0.37)	(0.37)	(1.12)	(-0.33)	(-0.29)	(3.17)	(3.86)	(1.56)
741	0.409	0.415	0.505	0.262	0.287	0.816	1.431	0.454
Refrig. Equip.	(1.71)	(1.44)	(2.31)	(1.78)	(2.32)	(3.72)	(4.18)	(3.39)
898	0.907	0.914	1.004	0.761	0.786	1.315	1.929	0.953
Music. Instrum.	(2.99)	(2.65)	(3.40)	(4.92)	(4.00)	(4.42)	(4.61)	(4.40)
723	-0.324	-0.318	-0.228	-0.471	-0.446	0.083	0.698	-0.279
Constr. Machin.	(-2.15)	(-1.75)	(-1.51)	(-3.14)	(-3.36)	(0.51)	(2.71)	(-1.62)
721	0.829	0.835	0.926	0.682	0.708	1.237	1.851	0.875
Farm Machin.	(4.78)	(3.95)	(5.41)	(4.91)	(5.66)	(7.21)	(6.37)	(6.46)
895	0.401	0.408	0.498	0.255	0.280	0.809	1.423	0.447
Pens, Pencils	(1.72)	(1.39)	(2.32)	(1.44)	(1.97)	(3.64)	(4.05)	(2.74)

Notes to Table 5a:

This table shows coefficient estimates on relative log exporter GDP for the specification shown in equation (9). T-statistics (calculated from standard errors that have been adjusted for correlation of the errors across observations that share the same pair of exporting countries) are shown in parentheses. Coefficient estimates and t-statistics for other variables in the regressions are suppressed. Some results are presented in an appendix.

All regressions are estimated separately for each pair of industries (which includes one high-transport cost industry and one low-transport industry). For each industry pair, the sample is 1262 observations on relative exports by 107 high-income country pairs to 15 large importing countries. High-transport cost industries are arrayed (in ascending order of transport costs) across the columns; low-transport cost industries are arrayed (in ascending order of transport costs) down the rows. The dependent variable is, for a given pair of exporters, the log difference in their exports of the high-transport cost good minus the log difference in their exports of the low-transport cost good. The independent variables are the log difference in the exporters' GDPs, the log difference in the exporters' distances to the importing country, the difference in dummy variables for whether the exporters are adjacent to the importer, the difference in dummy variables for whether the exporters share a common language with the importer, the log difference in the exporters' capital per worker, the log difference in the exporters' average years of education among the adult population, the log difference in the exporters' land area per population, and the log difference in the exporters' average wage in low-skill industries.

Table 5b:
Summary of Regression Results

	High-Transport Cost Industries					
	Transport costs in top 15%			Transport costs in next 20%		
Low-Transport Cost Industries	No. of Cases	Share of regressions with β>0	Share of regressions with p-value<0.1	No. of Cases	Share of regressions with β>0	Share of regressions with p-value<0.1
All industries	39	0.872	0.744	65	0.585	0.369
Average size in bottom 25%	18	0.889	0.778	30	0.567	0.300
Average size in next 25%	21	0.857	0.714	35	0.600	0.429
Transport costs in bottom 15%	21	0.810	0.667	35	0.486	0.343
Transport costs in next 20%	18	0.944	0.833	30	0.700	0.400

Notes: This table summarizes the regression results in Table 5a. Table 5a shows estimated coefficients on log relative exporter GDP from 104 regressions, where each regression matches a high-transport cost industry to a low-transport cost industry. This table shows, for subsets of industry matches, the fractions of regressions with a positive coefficient estimate and with a positive coefficient estimate that is statistically significant at the 10% level.

Table 6a: Difference-in-Difference Gravity Estimation, Relative Market Potential

High Tr. Cost	**641**	**671, 672**	**677**	**52**	**665**	**678**	**674**	**662**
Low Tr. Cost	Paper	Iron Prod.	Steel Wire	In. Chem.	Glassware	Steel Pipe	Steel Mill	Clay
68	2.622	3.287	3.069	5.622	2.066	-1.395	-1.309	-2.904
Sec. Nonf. Met.	(3.08)	(5.05)	(3.52)	(4.65)	(2.35)	(-2.32)	(-1.69)	(-3.73)
87	1.405	2.070	1.851	4.405	0.849	-2.613	-2.527	-4.122
Med. Instrum.	(2.13)	(2.43)	(2.32)	(6.60)	(1.87)	(-2.89)	(-1.97)	(-4.46)
725	3.605	4.270	4.052	6.605	3.049	-0.412	-0.326	-1.921
Paper Machin.	(6.52)	(5.00)	(4.84)	(6.51)	(5.18)	(-0.86)	(-0.39)	(-3.38)
848	6.811	7.476	7.257	9.811	6.255	2.793	2.879	1.284
Fur Clothing	(5.27)	(5.98)	(5.72)	(5.70)	(5.10)	(4.04)	(3.53)	(1.97)
885	2.60	3.265	3.046	5.600	2.044	-1.418	-1.332	-2.927
Watches, Clocks	(3.13)	(4.02)	(3.73)	(5.46)	(2.96)	(-2.66)	(-1.48)	(-5.23)
736, 737	2.860	3.525	3.307	5.861	2.305	-1.157	-1.071	-2.666
Machine Tools	(4.63)	(4.05)	(4.66)	(6.54)	(5.06)	(-2.13)	(-1.14)	(-4.95)
786	2.246	2.911	2.692	5.246	1.690	-1.772	-1.686	-3.281
Trailers	(3.19)	(4.42)	(3.38)	(5.72)	(2.53)	(-2.61)	(-1.59)	(-4.39)
724	3.078	3.743	3.524	6.078	2.522	-0.939	-0.853	-2.449
Textile Machin.	(3.62)	(4.20)	(4.64)	(5.56)	(3.71)	(-1.81)	(-0.87)	(-5.06)
741	1.814	2.479	2.260	4.814	1.258	-2.204	-2.118	-3.713
Refrig. Equip.	(2.77)	(2.65)	(3.09)	(6.38)	(3.36)	(-2.68)	(-1.72)	(-4.78)
898	-0.307	0.358	0.139	2.693	-0.863	-4.324	-4.238	-5.834
Music. Instrum.	(-0.35)	(0.32)	(0.14)	(3.65)	(-1.37)	(-3.80)	(-2.77)	(-5.26)
723	-0.729	-0.064	-0.283	2.271	-1.285	-4.747	-4.661	-6.256
Constr. Machin.	(-1.19)	(-0.10)	(-0.51)	(3.69)	(-2.11)	(-4.57)	(-3.79)	(-5.25)
721	0.473	1.138	0.919	3.473	-0.083	-3.544	-3.458	-5.054
Farm Machin.	(0.76)	(1.34)	(1.33)	(4.91)	(-0.17)	(-3.61)	(-2.56)	(-5.06)
895	1.046	1.711	1.492	4.046	0.490	-2.972	-2.886	-4.481
Pens, Pencils	(1.28)	(1.61)	(1.64)	(7.20)	(0.77)	(-2.42)	(-1.80)	(-3.53)

Notes to Table 6a:

The sample of exporting and importing countries is identical to that in Table 5a. The only change is that the measure of relative exporter size is relative exporter market potential (instead of relative exporter GDP).

Table 6b:
Summary of Regression Results

	High-Transport Cost Industries					
	Transport costs in top 15%			Transport costs in next 20%		
Low-Transport Cost Industries	No. of Cases	Share of regressions with $\beta>0$	Share of regressions with p-value<0.1	No. of Cases	Share of regressions with $\beta>0$	Share of regressions with p-value<0.1
All industries	39	0.077	0.077	65	0.892	0.754
Average size in bottom 25%	18	0.077	0.077	30	0.933	0.733
Average size in next 25%	21	0.000	0.000	35	0.857	0.771
Transport costs in bottom 15%	21	0.077	0.077	35	1.000	1.000
Transport costs in next 20%	18	0.000	0.000	30	0.767	0.467

Notes: This table summarizes the regression results in Table 6a. It follows the same format as Table 5b.

Summary of Regression Results with Expanded Importer Sample

Table 7a: Relative GDP as Measure of Exporter Size

	High-Transport Cost Industries					
	Transport costs in top 15%			Transport costs in next 20%		
Low-Transport Cost Industries	No. of Cases	Share of regressions with b>0	Share of regressions with p-value<0.1	No. of Cases	Share of regressions with b>0	Share of regressions with p-value<0.1
All industries	39	0.872	0.744	65	0.585	0.369
Average size in bottom 25%	18	0.889	0.778	30	0.567	0.300
Average size in next 25%	21	0.857	0.714	35	0.600	0.429
Transport costs in bottom 15%	21	0.810	0.667	35	0.486	0.343
Transport costs in next 20%	18	0.944	0.833	30	0.700	0.400

Table 7b: Relative Market Potential as Measure of Exporter Size

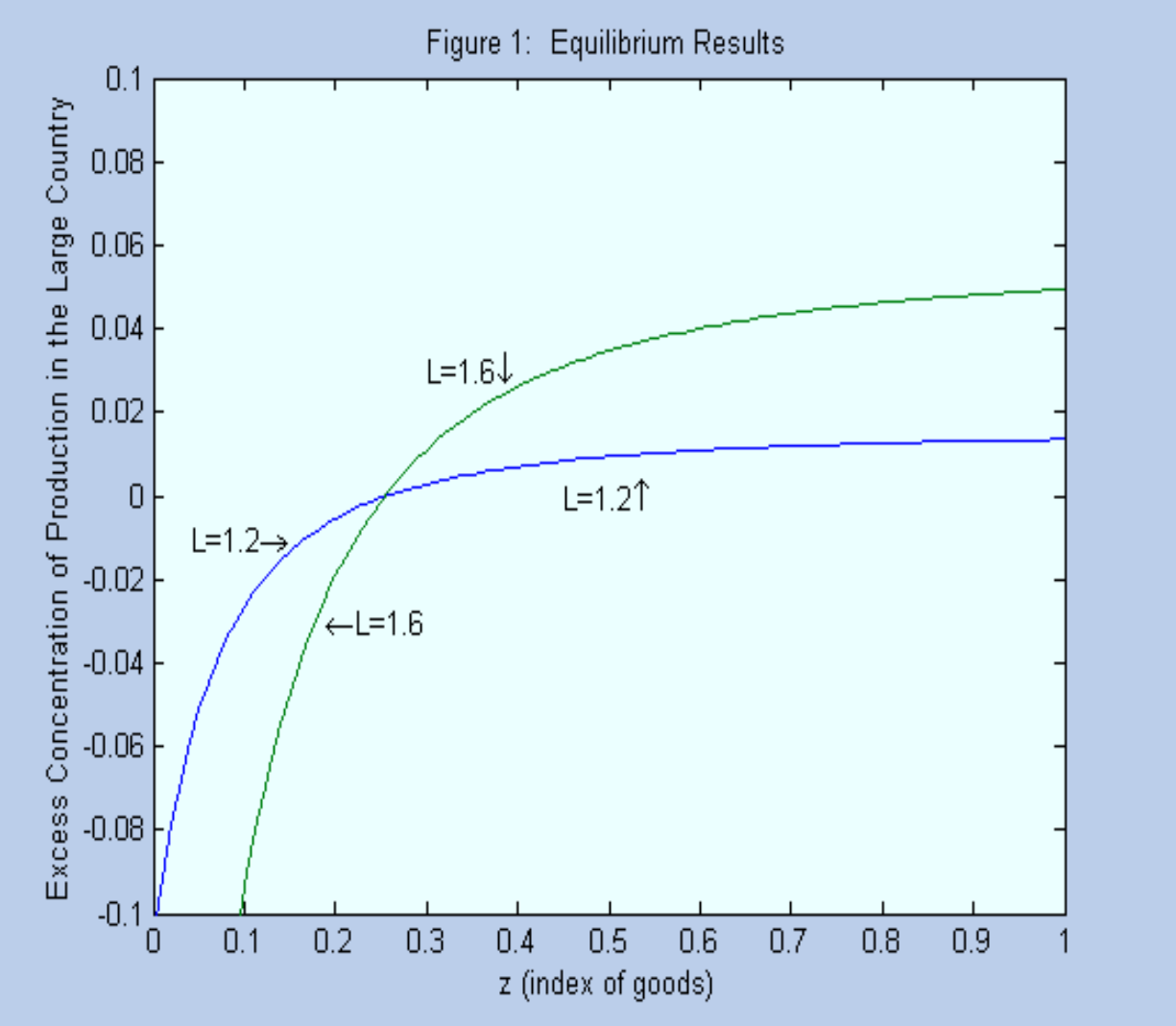
	High-Transport Cost Industries					
Low-Transport Cost Industries	No. of Cases	Share of regressions with b>0	Share of regressions with p-value<0.1	No. of Cases	Share of regressions with b>0	Share of regressions with p-value<0.1
All industries	39	0.308	0.205	65	0.877	0.723
Average size in bottom 25%	18	0.333	0.333	30	0.900	0.767
Average size in next 25%	21	0.286	0.095	35	0.857	0.686
Transport costs in bottom 15%	21	0.286	0.286	35	0.914	0.829
Transport costs in next 20%	18	0.333	0.111	30	0.833	0.600

Notes: For both tables, the specification and sample of exporting countries is identical to that in Tables 5 and 6. The only change is that the sample of importing countries is now enlarged to be the 58 countries with the highest total value of manufacturing imports in 1990. The sample for each regression is 5115 observations on exporter-pair, importing-country combinations

Table 8: Sensitivity Analysis

Low-Transport Cost Industries	High-Transport Cost Industries: Transport costs in top 15% — No. of Cases	Share of regressions with β>0	Share of regressions with p-value<0.1	Transport costs in next 20% — No. of Cases	Share of regressions with β>0	Share of regressions with p-value<0.1
Sample with 7 Largest Importers						
GDP	39	0.897	0.744	65	0.615	0.323
Market Potential	39	0.154	0.077	65	0.938	0.738
Sample with Rich Exporters Only						
GDP	39	0.769	0.385	65	0.523	0.277
Market Potential	39	0.410	0.205	65	0.846	0.677
Alternative λ Values for Market Potential						
λ=1	39	0.077	0.077	65	0.892	0.785
λ=0.84	39	0.077	0.077	65	0.892	0.754
Alternative Market Potential Measure	39	0.897	0.718	65	0.662	0.369

Notes: This table summarizes the results from sensitivity analysis. This table shows, for each case, the fractions of regressions with a positive coefficient estimate on relative exporter size and with a positive coefficient estimate that is statistically significant at the 10% level. The 7-importer sample has U.S., Germany, Japan, France, U.K., Italy and Canada with 597 observations. The rich-exporter sample has 762 observations and the following exporter pairs: Australia-New Zealand, Canada-United States, and all pair wise combinations of the set, Austria, Belgium-Luxembourg, Denmark, Finland, France, Germany, Great Britain, Italy, the Netherlands, Norway and Sweden. The alternative market potential measure sets a country's distance to itself equal to 1.


Figure 1: Equilibrium Results
Excess Concentration of Production in the Large Country
z (index of goods)
L=1.6↓
L=1.2↑
L=1.2→
←L=1.6
0.1
0.08
0.06
0.04
0.02
0
-0.02
-0.04
-0.06
-0.08
-0.1
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1

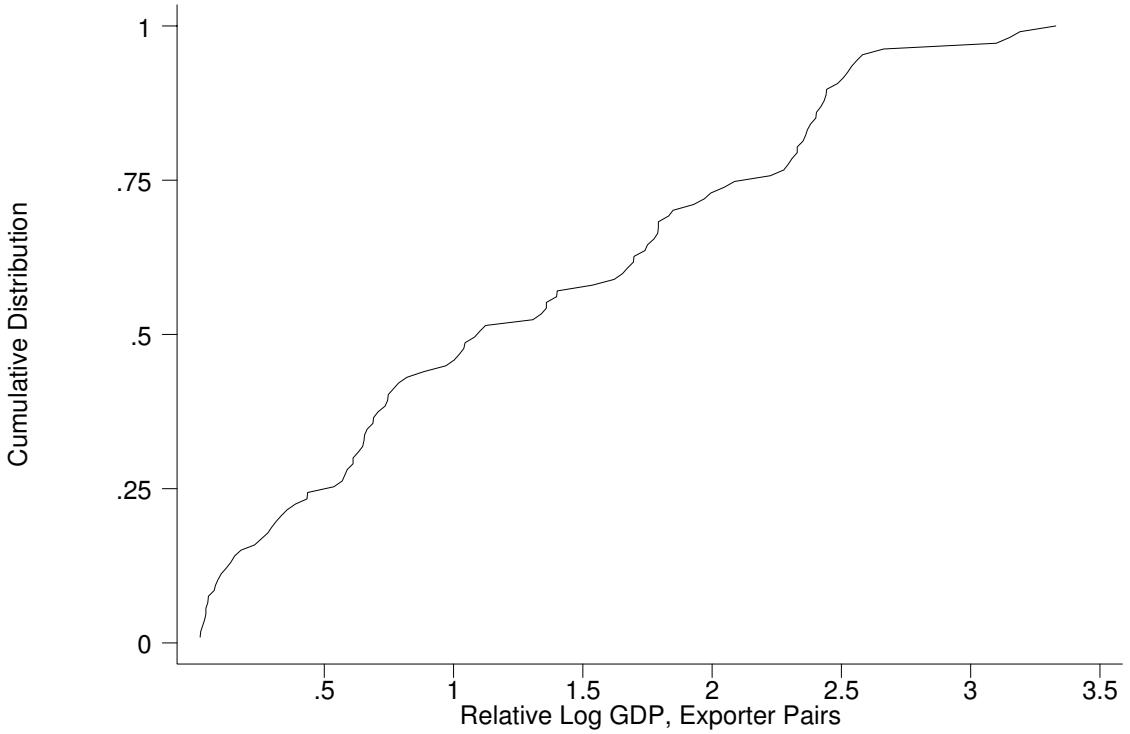


Figure 2: Distribution of Relative Exporter GDP

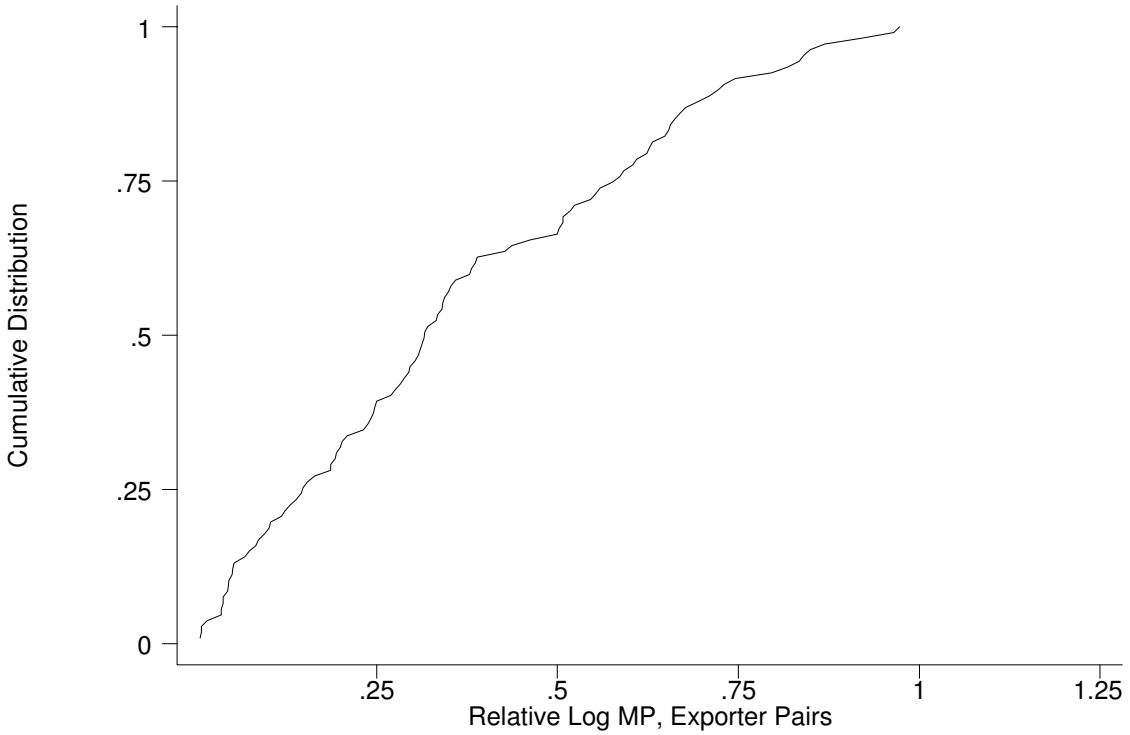


Figure 3: Distribution of Relative Exporter Market Potential (MP)