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EXPLORING THE SPECTRUM OF EXPORT DESTINATION: THE GEOGRAPHIC SPREAD OF KOREAN EXPORTS, ITS DETERMINANTS, AND POLICY IMPLICATIONS

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Recent research in international trade has explored the stylized facts and causes and effects of export diversification. A simple model in this paper drawing on the work of Melitz suggests that there is an order in which a country spreads its goods to foreign countries. We estimate the order by using a methodology which takes account of the fact that most goods are not exported to several countries in our sample (unbalanced panel). We find that Korea exports its new goods first to the United States, followed by Japan, Hong Kong, and Singapore, and most recently to Bosnia-Herzegovina. Finally we find that the countries that Korea has exported to first are those with large GDP, low tariff rates, geographic proximity, language familiarity, in-country Korean export promotion offices, and high-quality institutions.

Keywords: Export; Geographic spread; Export diversification; Ranking; Trade determinants

JEL classification: F10, F14

I. INTRODUCTION

MUCH recent research in international trade has explored the stylized facts and causes of export diversification, and the impact of diversification on a country's trade and economic growth. One strand of the literature has focused on export product diversification in terms of export growth at its extensive margin (new products), which has benefited from the seminal work of Feenstra (1994).[1] Hummels and Klenow (2005) provide information on extensive margin

[1] Feenstra (1994) derives the exact price index from the CES (constant elasticity of substitution) unit cost function, allowing for the new product varieties and taste or quality change. The measures extended from Feenstra (1994) have so far applied in the empirical studies. The consistent references for the measure of extensive margin are the worldwide exports from all countries to all (Hummels and Klenow 2005), from all countries to an investing country (Feenstra and Kee 2008; Kehoe and Ruhl 2002), and from a country to all its destinations (Kang 2004).

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growth across 126 exporting and 59 importing countries. They find that larger, richer countries trade in a wider range of products. Kehoe and Ruhl (2002) present evidence of growth in extensive margins following trade liberalization. Feenstra and Kee (2008) show how export variety affects productivity, using a cross-section of advanced and developing countries.[2] Other studies make arguments on the evolution of export product diversification along the path of economic developments. Imbs and Wacziarg (2003) found a non-monotonic path of diversification, as a function of per-capita incomes. Klinger and Lederman (2004, 2006) show similar results on export data.

Another strand of the literature has focused on geographic diversification in terms of entering international markets, i.e., the disappearance of numerous zeros in bilateral trade matrices. Some studies provide insight into why some producers export and others do not, and the role of market-entry costs in shaping export dynamics. Roberts and Tybout (1997a), Clerides, Lach, and Tybout (1998), Bernard and Jensen (2004), Das, Roberts, and Tybout (2007) explore the effect of sunk costs and learning-by-doing on the decision of export participation. Other recent works suggest that the relationship between firm performance and exporting does depend on the destination of the exports. Evenett and Venables (2002) focused on the changing number of zeros in bilateral trade matrices. They show that one-third of the growth of 23 developing countries' export is accounted for by sales to new trading partners. Product-line analysis suggests that export growth is enhanced by market size and proximity, and also by the experience gained in the destination and nearby markets. Kang (2004, 2006) suggests the rankings of export destination and product measured by the methodology of Feenstra and Rose (2000).[3]

Recently Eaton, Kortum, and Kramarz (2008) decompose export growth into two parts: changes in sales volume among incumbent exporters (intensive

[2] Kang (2004) strongly suggests that exports from Korea and Taiwan to the world have shown increasing extensive and decreasing intensive margins with some variations over the sample period, 1980–96. Korea and Taiwan have exported more varieties to large and rich countries. Debaere and Mostashari (2005) and Feenstra and Kee (2007) find the effect of tariff reduction on the extensive margin. Feenstra, Yang, and Hamilton (1999) show that changes in relative variety have a positive and significant effect on total factor productivity, using the sectoral data for Korea and Taiwan. Funke and Ruhwedel (2001a, 2001b) find that a country's export variety is a significant determinant of its per capita GDP and export performance for the OECD and the East Asian countries.

[3] He suggests the rankings of export destination and product measured by the methodology of Feenstra and Rose (2000). The paper links the overall destination rankings to destination income measures such as per capita GDP or GDP, and extensive and intensive margins. The destination countries to which products are exported earlier tend to have more variety and larger quantities as well as export volume. The destination countries supplied first and most highly ranked tend to be large and high-income economies.

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margin) and changes in the set of export firms (extensive margin). They find that new exporters begin in a single foreign market and, if they survive, gradually expand into additional destinations. The geographic expansion paths they follow, and their likelihood of survival as exporters, depend on their initial destination market. Neighboring markets appear to act as stepping stones for other markets. It is important to investigate which destination is first served. Borchert (2007) suggests evidence of a path-dependent expansion of exports. The paper demonstrates that export flows from Mexico to the United States have predictive power for subsequent shipments of those products to additional markets. He argues that once a given product is being shipped overseas, it becomes easier to export it to additional destinations. Firms might extend their exports in a geographical manner when tapping overseas markets, which initially involves some sort of fixed costs.

Melitz (2003) develops a theoretical framework that explains the presence and disappearance of zeros in the trade matrix.[4] The model by Kang (2004), which benefited from the work of Melitz (2003), corroborated the export dynamics in determining which destination is first served. Because of the fixed cost associated with the entry into export and per-unit trade costs, the profit from exports is positive only when the income in exporting markets is relatively large. Thus new commodities produced by a country are first exported to large countries and then to relatively small countries. The model implies that there is a order of destinations that an exporting county begins with to export its goods. This paper therefore examines the order in which a country spreads its exports, and the factors that might be responsible for the geographic spread of trade.

In order to identify the order of geographic spread of a country's exports, this research modifies the idea of Feenstra and Rose (2000).[5] They rank commodities exported to the United States and their countries of origin, and will investigate "the first year of exporting": the year in which a country first exported its commodities to destination countries. However, the data set causes difficulty when trying to identify the first year of exporting. We cannot examine the first year of exporting for all export products across all destinations since there are many countries to which many commodities are not exported. We can say that partial data is missing nonrandomly since the missing data depends on countries and possibly

[4] Haveman and Hummels (2004) were the first to point out just how many zeros there were in bilateral trade matrices.

[5] For each good and country, they find the first year of export to the United States. There is an ordering of goods that a country exports (product cycle). The ranking of goods in the order they are exported provides a measure of their sophistication. Countries that begin exporting earlier are considered to be more advanced. Finally they show that the country rankings are correlated with macroeconomic phenomena such as productivity and growth rate.

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commodities as well. The difficulty in dealing with this missing nonrandom data can be solved by the techniques suggested by Feenstra and Rose (2000).[6]

We show that a commodity made in Korea is first exported to the United States, followed by Japan, Hong Kong, Singapore, Thailand, and Germany, and lately to Bosnia-Herzegovina, using both fixed-effect and simple average methods. We link the ranking to some trade determinants such as the destination's GDP, tariff and non-tariff barriers, distance, language, export promotion agencies overseas, infrastructure, and institution quality. Korea has exported its goods sooner to countries with large GDP, low tariff rates, geographic proximity, language familiarity, their own export promotion offices, and high-quality institutions.

This paper is organized as follows. Section II looks at previous literature and a simple model dealing with geographic spread dynamics. Section III suggests a methodology to estimate rankings, and presents the rankings measured by averaging the unbalanced rankings and the fixed-effect method. Section IV links the ranking to trade determinants. Section V concludes the paper and suggests policy implications.

II. THEORETICAL BACKGROUND

This section first reviews the theoretical literature on the pattern and determinants of the "geographic spread of trade." Earlier research by Baldwin (1988), Baldwin and Krugman (1989), and Dixit (1989) developed a dynamic partial equilibrium model of the discrete choice to export. The model considered the export decisions of firms with fixed costs in entering and remaining in international markets, but only focused on export participation in response to largely exogenous changes in exchange rates. However, recent models[7] have extended the model to allow for heterogeneity across firms. Particularly, Melitz (2003) developed a theoretical framework that explains the presence and disappearance of the zeros in the trade matrix. Kang (2004), using Melitz's (2003) heterogeneous-firm model of trade, allowed for asymmetries in country income, market entry costs, and trade costs. The research by Kang (2004) proposes a simple monopolistic competition model with a constant elasticity of substitution (CES) function and fixed costs in exporting to account for market entry. Heterogeneous firms provide their own horizontally differentiated goods with international markets if destination incomes are above a cutoff level due to per-period fixed costs and per-unit trade costs.

[6] There are several methods for the analysis of partially missing data. Most simply, we can discard incompletely recorded units and analyze only the units with complete data. It is generally easy to carry out and may be satisfactory with small amounts of missing data.

[7] See for example, Bernard *et al*. (2003), Helpman, Melitz, and Yeaple (2004), Ghironi and Melitz (2005), and Chaney (2008).

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The preference in every country is given by the CES function for each period t:

$$U_t = \left[\sum_{i \in \tilde{I}_t} (q_{i,t})^{\frac{\sigma-1}{\sigma}} \right]^{\frac{\sigma}{\sigma-1}}, \tag{1}$$

where $q_{i,t}$ is the export quantity of the good i in time t, and $\tilde{I}_t$ represents the available set of goods. The goods are substitutes, and the elasticity of substitution between any two goods $\sigma > 1$ and is constant over time and across countries. The aggregate CES price is then

$$P_t = \left[\sum_{i \in \tilde{I}_t} (p_{i,t})^{1-\sigma} \right]^{\frac{1}{1-\sigma}}, \tag{2}$$

where $p_{i,t}$ is the export price of the good i in time t. There are many monopolistically competitive firms with their own productivity, a_i, each producing a different variety. Labor (l) is the only input and is a linear function of output and the wage (w) is normalized to one. Each firm requires labor to produce the output of $q_{i,t}$:

$$l_{i,t} = f_t + \frac{q_{i,t}}{a_i},$$

where f_t is the fixed labor cost and $1/a_i$ is the constant marginal labor cost for production. Each monopolistically competitive firm maximizes its own profit, since marginal revenue is equal to the marginal cost. Y_t is the aggregate expenditure or income in each country.

The price is

$$p_{i,t} = \frac{w_t}{\rho a_i},$$

where $\rho = \left(\dfrac{\sigma}{\sigma - 1} \right)$.

The revenue and profit, respectively, are given by:

$$\begin{aligned} r_{i,t} &= Y_t (P_t \rho a_i)^{\sigma-1}, \\ \pi_{i,t} &= \frac{Y_t}{\sigma} (P_t \rho a_i)^{\sigma-1} - f_t. \end{aligned} \tag{3}$$

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Heterogeneous firms provide their own horizontally differentiated goods for the domestic market if their productivities are above a cutoff level due to the fixed cost. A firm entering with less than the cutoff level of productivity immediately exits the domestic market.[8] Let a_t^* be the lowest productivity level of producing firms, which yields $\pi_{i,t}(a_t^*) = 0$. Rearranging for a zero-profit condition gives:

$$a_t^* = \frac{1}{P_t \rho}\left(\frac{f_t \sigma}{Y_t}\right)^{\frac{1}{\sigma-1}}. \tag{4}$$

An entering firm with $a_i > a_t^*$ produces. Even if the firms' productivities do not change over time, the cutoff productivity for zero profit decreases due to an increase in domestic income or decrease in fixed production cost over time. Thus more firms produce for their domestic market.

In order for firms to enter international markets, they have to pay a fixed entry cost which does not vary with export volume or per-unit cost. The per-unit cost, τ_t^c is modeled by the formation of Samuelson's iceberg assumption. This paper is trying to identify market entry and expansion of extensive margins for several destination countries, $c \in (1, \ldots, C)$. The profit ($\pi_{i,t}$) from the domestic market and exports to all destinations is

$$\pi_{i,t} = \pi_{i,t}^d + \sum_{c=1}^{C} \pi_{i,t}^c. \tag{5}$$

The prices in the domestic and destination markets, respectively, are

$$p_{i,t}^d = \frac{1}{\rho a_i} \text{ and } p_{i,t}^c = \frac{\tau_t^c}{\rho a_i},$$

where $c \in (1, \ldots, C)$.

The firm's profit from destination $c\left(\pi_{i,t}^c\right)$ is

$$\pi_{i,t}^c = \frac{Y_t^c \left(\tau_t^c\right)^{1-\sigma} \left(P_t^c \rho a_i\right)^{\sigma-1}}{\sigma} - f_t^c, \tag{6}$$

where Y_t^c is the income in destination country c, P_t^c is the overall price, τ_t^c is the per-unit trade cost, f_t^c is the per-period fixed cost associated with entry, a_i is the

[8] As in Melitz (2003), this paper considers steady-state equilibria in which each firm's productivity does not change over time. Thus an entering firm would immediately exit if its profit were negative.

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exporting firm i's productivity, and σ is the elasticity of substitution between varieties.

Let $Y_{i,t}^{c*}$ be the lowest destination income level of exporting firm i for each destination c in period t, which yields $\pi_{i,t}^{c}\left(Y_{i,t}^{c*}\right)=0$:

$$\pi_{i,t}^{c}\left(Y_{i,t}^{c*}\right)=\frac{Y_{i,t}^{c*}\left(\tau_t^c\right)^{1-\sigma}\left(P_t^c\rho a_i\right)^{\sigma-1}}{\sigma}-f_t^c=0,$$

$$Y_{i,t}^{c*}=\frac{\sigma f_t^c\left(\tau_t^c\right)^{\sigma-1}}{\left(P_t^c\rho a_i\right)^{\sigma-1}}. \tag{7}$$

The cutoff income in each destination for each firm is decided by a different productivity and export cost. The firms export their products to countries with more than the cutoff income level: $Y_t^c > Y_{i,t}^{c*}$ since the profits from foreign markets are non-negative. The countries with income greatly above the cutoff level attract a large number of varieties, since they provide the monopolistically competitive firms with positive profits. The simple model suggests that a firm first exports its variety to large economies.

First we examine the effect of increasing the destination income on the destination diversification, with the assumption that fixed and trade costs are constant over time. Consider a situation where, because of low income (Y_t^c), high per-unit trade (τ_t^c), and fixed entry costs (f_t^c) in period t, country c's income is less than the cutoff level: $Y_t^c < Y_{i,t}^{c*}$. Therefore foreign firms do not supply country c. As the income in country c increases over time, however, profit might be positive in the period $t+1$. Since the destination income is higher than the required cutoff level ($Y_{t+1}^c > Y_{i,t+1}^{c*}$), foreign firms provide their goods to the destination in period $t+1$. The zero-profit function is as shown in Figure 1. Country incomes increase along the Y^c-axis, while profits are plotted on the π^c-axis. With increasing income levels, profits also increase, and more destinations are served.

Second, we identify the effect of lower trade barriers on the choice of export destinations. A decrease in trade cost ($\tau_{t+1}^c < \tau_t^c$) reduces the cutoff level of destination income ($Y_{i,t+1}^{c*} < Y_{i,t}^{c*}$). Trade liberalization allows firms to enter export markets not supplied previously. Figure 2 shows the path-dependent expansion of destinations in the presence of trade liberalization. The slope of the zero-profit function becomes steeper as trade cost is reduced. The number of destinations supplied increases along the Y^c-axis.

Third, we assume that the fixed entry cost depends on the export market and falls over the time. Many papers identify substantial fixed export market entry costs, which are significant enough to generate large hysteresis effects associated with

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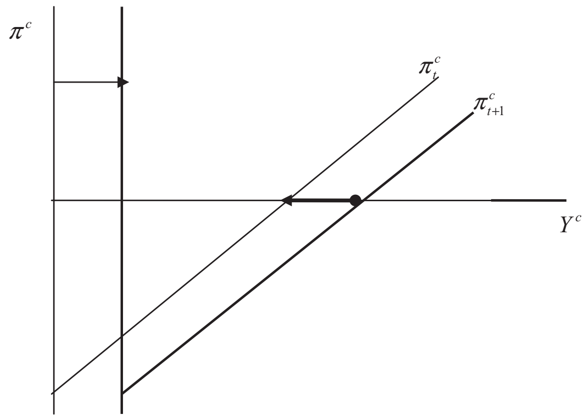
Fig. 1. The Effect of Increasing Income on Geographic Diversification



Note: The arrow shows the increase of range of destinations supplied.

foreign markets, and suggest that fixed costs could be decreased.[9] A decrease in per-period fixed entry cost ($f_{t+1}^c < f_t^c$) reduces the cutoff level for the destination income ($Y_{i,t+1}^{c*} < Y_{i,t}^{c*}$). As in Figure 3, the zero-profit function shifts upward when the fixed entry cost is reduced. The cutoff income level is then lower. The number of destinations supplied is put along the Y^c-axis.

Figure 4 represents the simultaneous effects of increasing income and decreasing trade and fixed costs on cutoff income. As destination incomes increase, and trade and market entry costs decrease, firms export to more destinations because the required level of cutoff income decreases. In this situation, firms may be prompted to extend their products geographically.

Even though the theoretical review implies that there is an order of geographic spread of a country's exports and suggests some factors that may determine the order, as yet we have shown no empirical evidence. In the next two sections, this paper will present such evidence.

[9] See Bernard and Jensen (2004), Bernard and Wagner (2001), Das, Roberts, and Tybout (2007), and Roberts and Tybout (1997a, 1997b). Particularly in Roberts and Tybout (1997a), interviews with managers making export decisions confirm that firms in differentiated product markets face significant fixed costs. A firm must find and inform foreign buyers and learn about the foreign market. It must research the foreign regulatory environment and adapt its product to ensure conformity to foreign standards such as testing, packaging, and labeling requirements. An exporting firm must also set up new distribution channels and conform to the shipping rule specified by the foreign customs agency (Ghironi and Melitz 2005).

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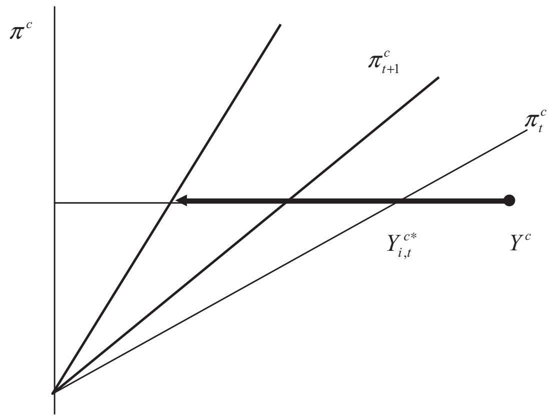
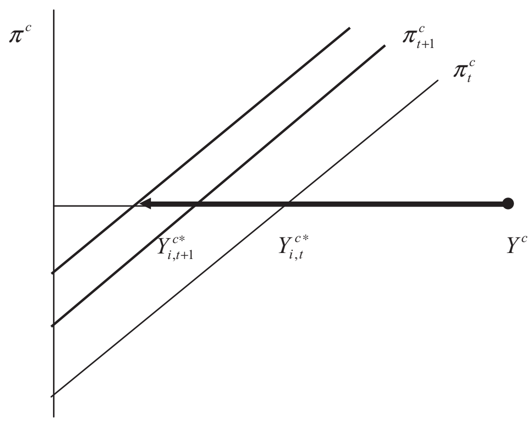
Fig. 2. The Effect of Trade Liberalization on Geographic Diversification



Note: The arrow shows the range of destinations supplied.

Fig. 3. The Effect of Falling Fixed Costs on Geographic Diversification



Note: The arrow shows the range of destinations supplied.

III. RANKING THE ORDER OF GEOGRAPHIC SPREAD

A. *Ranking Methodology*

1. *Data set*

This paper focuses on Korean exports because they have dramatically increased over the last decades, and as a consequence there is considerable interest in understanding the order in which they have spread to other countries. To identify

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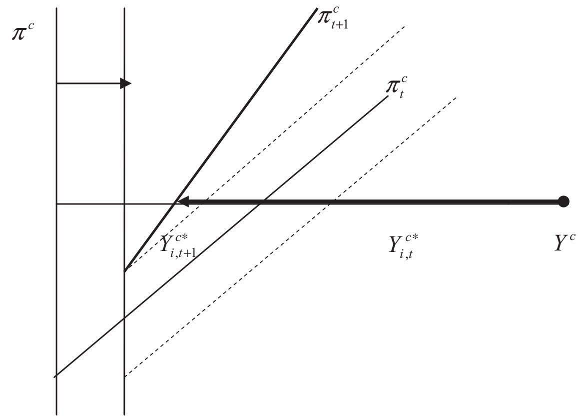
Fig. 4. Geographic Diversification



Note: The arrow shows the range of destinations supplied.

the order of export destinations, we employ world bilateral trade flows as found in Feenstra *et al.* (2005),[10] which allow us to examine the first year of exporting categories at a four-digit level of the Standard International Trade Classification (SITC), revision 2, between 1962 and 2000.[11] A more disaggregated data set is desirable for the measurement of the export destination ranking. To the best of our knowledge, Feenstra *et al.* ([2005) gives the most consistent and comparable data set, even with the problems with the reclassification of goods (Kehoe and Ruhl 2002), and covers the longest period (1962–2000) in the disaggregated data sets.

The data set causes difficulty when we are trying to find the first year of exporting. There are many countries to which many commodities are not exported over the sample period (1962–2000). This paper covers 176 destinations and 671 categories. If Korea had exported each commodity to all destinations at least once during the sample period, the data set would have 118,096 entries. However, only 38,330 of the entries are non-zero. There are several reasons for this: as a first example, it may be that export of a commodity to a country had ceased before the start of the sample period; as a second example, the commodity may be exported

10 Kang (2004, 2006) uses two databases dealing with world bilateral trade flows: "World Trade Flows (1970–92)" by Feenstra, Lipsey, and Bowen (1997) and "World Trade Flows 1980–97" by Feenstra (2000), which allows examination of the first year of exporting categories at four-digit level of Standard International Trade Classification (SITC), revision 2 between 1970 and 1996.

11 For example, "natural or artificial abrasive powder or grain" (SITC 6632) has been exported from Korea to 96 countries over 1962–2000. Korea began to export to the United States in 1971, Japan in 1972, Hong Kong in 1973, Philippines in 1977, India in 1987, Mozambique in 1991, Cyprus in 1995, and Laos in 1996.

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in future to countries that have not imported it by the end of the sample period. Such difficulties in dealing with an unbalanced panel can be resolved by the techniques suggested by Feenstra and Rose (2000), where missing observations are imputed to construct a complete balanced panel.

2. *Complete and incomplete data*

Let m ($m = 1, \ldots, M$) denote a commodity exported to all countries ($n = 1, \ldots, N$) during the period 1962–2000 and then let the rank order be x_{mn}. It is possible to observe the rank order by year of export for all commodities. The overall export destination ranking, X_n is determined by these commodity rankings. Suppose that the data set is completely balanced. A country has exported all its commodities to all destinations at least once over a sample period. For each commodity we can examine the first year of export. Countries that begin to be destinations earlier are highly ranked. If there is a full sample of observation without any "missing observations," the average ranking across all commodities gives the best overall rankings (Kendall and Gibbons 1990).

It is no surprising that there is an imperfect correlation between the commodity ranking and overall ranking.[12]

$$x_{mn} = X_n \text{ for } \rho_m N \text{ observations, and}$$

$$E\left[x_{mn} - \frac{N+1}{2}\right]\left[X_n - \frac{N+1}{2}\right] = 0 \quad \text{for } (1-\rho_m)N \text{ observations.}$$

Even if the actual ranking in each commodity is not equal to the overall destination ranking, the objective of this paper is to find a meaningful overall ranking for exporting destinations. The average-ranking method is meaningful when we have a complete and balanced data set, which is shown below (Kendall and Gibbons 1990). The example is as follows:

Example 1

	USA	UK	Philippines	Chile	Sri Lanka
Good 1 (x_{1n})	1	2	3	4	5
Good 2 (x_{2n})	1	3	2	4	5
Good 3 (x_{3n})	1	2	4	3	5
Good 4 (x_{4n})	1	2	3	5	4
Good 5 (x_{5n})	2	1	3	5	4
Average ranking	1.2	2	3.2	4.2	4.7
Overall ranking (X_n)	1	2	3	4	5

[12] As Feenstra and Rose (2000) said, the similarity between commodity rankings might depend on the characteristics of goods: vertically or horizontally differentiated, and consumption or capital goods.

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This country first exported its goods to the United States and then the United Kingdom, the Philippines, Chile, and Sri Lanka.

But a country does not export every commodity to all countries. The method suggested by Kendall and Gibbons (1990) for an unbalanced data set is not adequate. Another example is given below:

Example 2

	USA	UK	Philippines	Chile	Sri Lanka
Good 1 (x_{1n})	1	2	3	4	5
Good 2 (x_{2n})	1		2	3	
Good 3 (x_{3n})	1	2	3	4	
Good 4 (x_{4n})	1	2		4	3
Good 5 (x_{5n})	2	4	1	5	3
Average ranking	1.1	2.5	2.2	4	3.6
Overall ranking (X_n)	1	3	2	5	4

In the above example, simply taking the average of commodity rankings tells us that the country first exported its goods to the United States and then to the Philippines, the United Kingdom, Sri Lanka, and Chile. The result is not convincing because the Philippines (Sri Lanka), with extremely low economic growth, is higher ranked than the United Kingdom (Chile).

This paper follows the method of Feenstra and Rose (2000) to develop statistical techniques to overcome the problem of unbalanced panel data. The entire set of countries is $I = [1, \ldots, N]$ and I_m denotes the set of countries importing good m from a country over the sample period: $I_m \subseteq I$, $N_m \leq N$. The rank of first year of export to is denoted by $x_{mn}(I_m)$ and found for country n for each commodity m. The paper is trying to determine an overall ranking of destinations $X_n(I)$over the set I_m, actually supplied destinations. To this end, the imperfect correlation above is modified to

$$x_{mn}(I_m) = X_n(I_m) \quad \text{for } \rho_m N_m \text{ observations, and}$$

$$E\left[x_{mn}(I_m) - \frac{N_m+1}{2}\right]\left[X_n(I_m) - \frac{N_m+1}{2}\right] = 0 \quad \text{for } (1-\rho_m)N \text{ observations.}$$

Feenstra and Rose (2000) apply the same objective function as Kendall and Gibbons (1990), in which the averaging method maximizes the average of the rank correlations between each country's ranking and the overall ranking even with

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unbalanced panel data, and then present a solution using econometric analogies (see Appendix A).[13]

Since a commodity is not exported to all destination countries, there are "missing" observations: $N_m < N$. Adopting the same objective function even when the set of countries for each commodity differs, we can consider choosing the country ranking to maximize the function. Following Feenstra and Rose (2000), the modified imperfect correlation equations can be rewritten.

$$x_{mn}(I_m) - \left(\frac{N_m + 1}{2}\right) = \rho_m \left[X_n(I_m) - \left(\frac{N_m + 1}{2}\right) \right] + \varepsilon_{mn},$$

where $\varepsilon_{mn} \equiv (1 - \rho_m)\left[X_n(I_m) - \left(\frac{N_m + 1}{2}\right) \right]$ for $\rho_m N_m$ observations, and $\varepsilon_{mn} \equiv x_{mn}(I_m) - \left(\frac{N_m + 1}{2}\right) - \rho_m \left[X_n(I_m) - \left(\frac{N_m + 1}{2}\right) \right] + \varepsilon_{mn}$ for $(1 - \rho_m)N_m$ observations.

Minimizing the sum of squared residuals for the modified equation yields the rank correlation coefficient as the estimates for ρ_m.[14] The minimization can be used to find the overall destination ranking $X_n(I)$ (see Appendix B, Proposition 1).

There are some reasons why a commodity, m, might not have been exported to all the sample countries from 1962 to 2000. First, export of the commodity to some countries may have occurred in the past but ceased before the start of the sample period. We can denote the country rankings in the commodity by $(1, 2, \ldots, \tilde{x}_m)$ where $\tilde{x}_m$ will be estimated. Second, it may be that the commodity will be exported in the future to countries that have not yet imported it before the end of the sample period. Here we can denote the country rankings as $(\tilde{x}_m + N_m + 1, \tilde{x}_m + N_m + 2, \ldots, \tilde{x}_m + N)$, given the assumption that there are no omitted countries in the middle of the actually supplied country rankings.

$$1, 2, \ldots, \tilde{x}_m, \underbrace{\tilde{x}_m + 1, \tilde{x}_m + 2, \ldots, \tilde{x}_m + N_m}_{x_{mn}(I_m)}, N_m + \tilde{x}_m + 1, N_m + \tilde{x}_m + 2, \ldots, N.$$

[13] The working paper version of Feenstra and Rose (1997) shows that the solution numerically maximizes the objective function. However, the numerical approach does not guarantee a global maximum, and is computationally difficult.

[14] Feenstra and Rose (2000) argue that the errors are orthogonal to the regessor in expected value. The correlation between the error term and the regressor will be zero by the summation across the observations (commodities for each destination): $E\left(\sum_{n \in I_m} \varepsilon_{mn} X_n(I_m)\right) = 0$.

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We denote the country ranking defined over all the sample countries for countries actually exported to and rewrite the suggested model pooling over all commodities.

$$x_{mn}(I) = x_{mn}(I_m) + \tilde{x}_m \text{ for } n \in I_m,$$

$$x_{mn}(I) - \left(\frac{N+1}{2}\right) = \rho\left[X_n(I) - \left(\frac{N+1}{2}\right)\right] + \varepsilon_{mn} \text{ for } n \in I_m \text{ and } m = 1, \ldots, M.$$

We can rewrite

$$x_{mn}(I_m) - \left(\frac{N+1}{2}\right) = -\tilde{x}_m + \rho\left[X_n(I) - \left(\frac{N+1}{2}\right)\right] + \varepsilon_{mn} \text{ for } n \in I_m \text{ and } m = 1, \ldots, M,$$

where $-\tilde{x}_m$ can be estimated from the commodity fixed effects in this regression equation. It is possible to estimate the overall destination rankings, $X_n(I)$, as the destination-fixed effects, which are chosen by taking the average residual of zero across actually supplied commodities for each destination. The destination-fixed effect is

$$X_n(I) = \frac{1}{M_n} \frac{\sum_{m \in M_n} (x_{mn}(I_m) + \tilde{x}_m)}{\rho}.$$

We can simply rank the value of $\frac{1}{M_n} \sum_{m \in M_n} (x_{mn}(I_m) + \tilde{x}_m)$, provided that the estimate of ρ is positive (see Appendix B, proposition 2).

The optimal destination ranking is obtained as the average ranking for each commodity over the countries that have actually been supplied by a country. To obtain a solution, Feenstra and Rose (2000) use iterative estimation. The procedure proceeds as follows:

Step 1. Start with a guess for the overall ranking $X_n(I)$.
Step 2. Run the suggested equation to estimate $\tilde{x}_m$.
Step 3. Calculate a new ranking by averaging $(x_{mn}(I_m) + \tilde{x}_m)$.
Step 4. Return to step 2 until convergence is reached.

The procedure is given by the following example:

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Example 3

	USA	UK	Philippines	Chile	Sri Lanka
Good 1 (x_{1n})	1	2	3	4	5
Good 2 (x_{2n})	1		2	3	4
Good 3 (x_{3n})	1	2	3	4	
Good 4 (x_{4n})		1	3	2	4
Good 5 (x_{5n})	1	2	3		
Average ranking	1.1	1.7	2.8	3.7	4.3
Overall ranking (X_n)	1	2	3	4	5

This example also shows the problem of the simple averaging method. Following the suggested procedure, first we apply the regression equation and then obtain

$$\tilde{x}_{1n} = -0.451, \tilde{x}_{2n} = 0.360, \tilde{x}_{3n} = -0.504, \tilde{x}_{4n} = 0.535, \text{and } \tilde{x}_{5n} = -0.266.$$

Second we add these values to the initial rankings for each good, and calculate the new average ranking, (0.78, 1.57, 2.73, 3.23, 4.48), and the new overall ranking, (1, 2, 3, 4, 5).

Returning to step 2 gives us

$$\tilde{x}_{1n} = -0.026, \tilde{x}_{2n} = -0.016, \tilde{x}_{3n} = -0.052, \tilde{x}_{4n} = -0.027, \text{and } \tilde{x}_{5n} = -0.052.$$

The new average ranking, (0.73, 2.03, 2.53, 3.74, 4.51), is obtained by adding the values to the rankings for each destination. The procedure then converges, so the optimal ranking is (1, 2, 3, 4, 5).

B. *Ranking Results*

Table 1 presents two different sets of country rankings: those measured by the fixed-effect method and those measured by the simply averaged method (in parentheses). The above procedure quickly shifted from the initial ranking to the neighborhood of the final ranking. Convergence was within four iterations with small oscillations. A commodity is first exported to the United States, followed by Japan, Hong Kong, Singapore, Thailand, and then Germany, and lastly exported to Bosnia-Herzegovina in both the fixed-effect and simply averaged methods.[15] While there are discrepancies between the two rankings, they are quite similar overall.

[15] Kang (2004, 2006) finds the order of export destination and product, using the data for 1976–96. It is different from the order in this paper, using the period 1962–2000. The result using a longer period may be more reliable.

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TABLE 1

Country Rankings

Country	Ranking	Country	Ranking	Country	Ranking
USA	1 (1)	Lebanon	47 (46)	Russian Federation	93 (92)
Japan	2 (2)	Sri Lanka	48 (49)	Afghanistan	94 (94)
Hong Kong	3 (3)	Egypt	49 (48)	Peru	95 (95)
Singapore	4 (4)	China	50 (51)	Senegal	96 (96)
Thailand	5 (5)	Yemen	51 (50)	Cambodia	97 (97)
Germany	6 (6)	Samoa	52 (53)	Suriname	98 (100)
Australia	7 (7)	Gabon	53 (52)	Uruguay	99 (98)
Canada	8 (8)	Iraq	54 (54)	Paraguay	100 (99)
UK	9 (9)	Sudan	55 (55)	Poland	101 (101)
Malaysia	10 (10)	Chile	56 (56)	China (Macau	
Taiwan	11 (11)	Brazil	57 (57)	SAR)	102 (102)
Indonesia	12 (12)	Papua New Guinea	58 (58)	Cote d'Ivoire	103 (103)
Saudi Arabia	13 (13)	Qatar	59 (59)	Bermuda	104 (106)
France	14 (14)	Myanmar	60 (60)	Lao PDR	105 (109)
Netherlands	15 (15)	Kenya	61 (61)	Tanzania	106 (105)
Italy	16 (16)	Turkey	62 (62)	Bolivia	107 (107)
Pakistan	17 (17)	Ethiopia	63 (63)	Republic of the	
Philippines	18 (18)	Ecuador	64 (64)	Congo	108 (108)
Sweden	19 (19)	Argentina	65 (65)	Czechoslovakia	109 (104)
Kuwait	20 (20)	Syria	66 (66)	St. Kitts and Nevis	110 (110)
Belgium	21 (21)	Oman	67 (68)	Niger	111 (111)
Iran	22 (22)	Cyprus	68 (67)	Malta	112 (112)
Zambia	23 (24)	Cameroon	69 (69)	Central African	
South Africa	24 (23)	Ghana	70 (71)	Republic	113 (114)
Bahrain	25 (25)	Portugal	71 (70)	Guinea	114 (113)
Spain	26 (26)	Cuba	72 (73)	Nicaragua	115 (116)
UAE	27 (27)	Costa Rica	73 (72)	Hungary	116 (115)
Switzerland &		Jamaica	74 (74)	Togo	117 (118)
Liechtenstein	28 (28)	Guatemala	75 (75)	Tunisia	118 (117)
Denmark	29 (29)	Trinidad & Tobago	76 (76)	Yugoslavia	119 (119)
Vietnam	30 (30)	Fiji	77 (77)	New Caledonia	120 (120)
New Zealand	31 (31)	Greenland	78 (79)	Madagascar	121 (121)
Nigeria	32 (32)	Sierra Leone	79 (80)	Benin	122 (122)
Libya	33 (33)	Colombia	80 (78)	Bahamas	123 (123)
Austria	34 (34)	Nepal	81 (81)	Mozambique	124 (125)
India	35 (36)	Dominican Republic	82 (82)	Algeria	125 (124)
Norway	36 (35)	Netherlands Antilles		Angola	126 (126)
Ireland	37 (37)	& Aruba	83 (84)	Gambia	127 (129)
Mexico	38 (38)	El Salvador	84 (83)	Romania	128 (127)
Jordan	39 (39)	Barbados	85 (85)	Uganda	129 (128)
Bangladesh	40 (40)	Honduras	86 (86)	Malawi	130 (131)
Finland	41 (41)	Haiti	87 (87)	Uzbekistan	131 (130)
Panama	42 (42)	Somalia	88 (90)	Kazakhstan	132 (132)
Greece	43 (43)	Mauritius	89 (89)	Mauritania	133 (133)
Israel	44 (44)	Morocco	90 (88)	Mongolia	134 (134)
Liberia	45 (45)	Iceland	91 (91)	Congo	135 (137)
Venezuela	46 (47)	Guyana	92 (93)	Djibouti	136 (136)

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TABLE 1 (Continued)

Country	Ranking	Country	Ranking	Country	Ranking
Mali	137 (138)	Tajikistan	151 (151)	Azerbaijan	164 (163)
Falkland Islands	138 (139)	Ukraine	152 (153)	Burundi	165 (166)
Albania	139 (135)	Belize	153 (152)	Chad	166 (167)
Gibraltar	140 (142)	Other Oceania	154 (154)	Belarus	167 (165)
Guadeloupe	141 (140)	St. Pierre & Martinique	155 (155)	Georgia	168 (168)
French India	142 (143)			Turkmenistan	169 (169)
Burkina Faso	143 (145)	Kiribati	156 (157)	Estonia	170 (170)
DPR Korea	144 (141)	Kyrgyzstan	157 (156)	Latvia	171 (171)
Bulgaria	145 (144)	Slovakia	158 (158)	St. Helena	172 (172)
French Guiana	146 (146)	Zimbabwe	159 (159)	Moldova	173 (173)
Seychelles	147 (148)	Croatia	160 (160)	FYR Macedonia	174 (174)
Rwanda	148 (150)	Guinea-Bissau	161 (161)	Armenia	175 (175)
Czech Republic	149 (147)	Lithuania	162 (162)	Bosnia-Herzegovina	176 (176)
Slovenia	150 (149)	Equatorial Guinea	163 (164)		

Note: Rankings are those measured by the fixed-effect method. The simply averaged rankings are in parentheses.

Spearman rank correlations between the rankings are quite high (0.999) and statistically significant.

To check the sensitivity of the results, the country ranking is also derived only for manufacturing goods (SITC code 5 to 8) since the missing observations are relatively small.[16] Appendix Table 1 presents two different sets of country rankings for manufacturing goods. The United States is the first-ranked country, followed by Japan, Hong Kong, Singapore, Thailand, and Canada. Still, the rankings by the fixed-effect and simply averaged methods are also quite similar. The rankings for manufacturing goods are slightly different from those for all goods—for example, Canada captures sixth place—but the two rankings are quite similar overall.

Several features are characterized by the rankings. First, large countries tend to be highly ranked and vice versa. Korea first exported its commodities to large countries and then to relatively small countries. Second, Asian countries tend to be highly ranked and Latin American countries tend to be lower ranked. This may well have to do with proximity to Korea. Thailand is ranked 5th and Malaysia 10th, while Mexico is ranked 38th and Brazil 57th. Third, developed countries tend to be highly ranked while developing countries tend to be lower ranked. For developed countries, improvements in infrastructure and institution might reduce transport and fixed costs.

[16] The data set has 38,330 non-zero-entries of the total 118,096 (32.4%), while the data set only for manufacturing sectors has 33,996 non-zero-entries of the total 94,336 (36.0%).

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The rankings seem sensible, appearing to be associated with concepts such as economies of scale, distance, and fixed entry costs. The relationship between the rankings and these concepts is a topic worthy of investigation in itself.

IV. REGRESSING THE ORDER ON TRADE DETERMINANTS

A. *Estimation Strategies*

This paper links the order of the geographic spread of export goods to some factors presented by trade theories as trade determinants. As implied by the literature review in Section II, our destination rankings can be significantly related to (i) economic mass, such as importer's GDP; (ii) per-unit trade costs, including tariff and non-tariff barriers, freight costs, and local distribution costs (wholesale and retail); and (iii) fixed costs including costs associated with the use of different languages, contract enforcement costs, legal and regulatory costs, and information costs.

Because of data availability, we use some proxies. Distance between countries can serve as a proxy for freight costs, and infrastructure such as airport facilities, paved roads, and phone can be a proxy for distribution costs. A language dummy variable is taken into account in order to control fixed costs resulting from the use of different languages. If there is an export promotion agency (EPA) overseas which searches for information on the local market, fixed costs are reduced. The existence of an EPA overseas might be an important factor, so a dummy variable for an overseas EPA is added. Institution quality, such as regulatory quality, rule of law, government efficiency, and control of corruption, can be a proxy for fixed costs, including contract enforcement costs and legal and regulatory costs.

This paper will estimate the following cross-sectional equation:

$$\begin{aligned}\ln(Rank_{ij}) = \beta_0 + \beta_1 \ln(GDP_j) + \beta_2 \ln(Tar_{ij}) + \beta_3 \ln(NTB_{ij}) \\ + \beta_4 \ln(Dis_{ij}) + \beta_5 Lang_{ij} + \beta_6 EPAO_{ij} + \beta_7 \ln(Infra_{ij}) \\ + \beta_8 \ln(InsQuali_j) + \varepsilon_{ij},\end{aligned}$$

where i denotes the exporter, j denotes the importer, and the variables are defined as:

$Rank_{ij}$: ranking of j importing goods from i.
GDP_j: j's GDP in dollar.
Tar_{ij}: tariffs of i's goods in j.
NTB_{ij}: non-tariff barrier of i's goods in j.
Dis_{ij}: the distance between i and j.
$Lang_{ij}$: a binary variable which is 1 if j uses a language which is familiar to i.
$EPAO_{ij}$: a binary variable which is 1 if i has an export promotion agency in j.
$Infra_{ij}$: infrastructure level, which represents the distribution costs of i's goods in j.

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$InsQual_j$: a measure of institution quality in j.

Tar_{ij}, MTB_{ij}, and Dis_{ij} are expected to have positive coefficients, since counties with small values of these might be highly ranked. The rest are expected to have negative coefficients.

The GDP data are taken from the IMF's International Financial Statistics (IFS) database. We consider taking the average of the GDP variables for 1980, 1990, and 2000 because the period for the dependent variable is 1962–2000. Tariff rates, non-tariff barriers, and gravity-related data such as distance and language are from the World Bank. All tariff rates are based on unweighted averages for all goods in ad valorem rates, or applied rates, or MFN rates. We use the average tariff rate for the years 1981, 1990, and 2000.[17] Data on non-tariff barriers is based on unweighted and imported weighted averages of core NTBs which are defined as including quantity and price restrictions. Because of data availability, the statistics on NTBs are calculated using different years.[18]

Because (South) Korea and North Korea both use the Korean language, the binary dummy variable between them is 1. Most high schools in Korea have chosen English as the first foreign language taught, and another language such as Chinese, Spanish, Japanese, French, or German as the second foreign language taught. Therefore, the binary dummy variable's value is 1 if Korea's destination country uses one of the languages English, Chinese, Spanish, Japanese, French, or German, and 0 if the destination country uses another language. The data on overseas EPAs comes from the Korea Trade-Investment Promotion Agency (KOTRA). The binary variable takes the value 1 if KOTRA had established its own foreign office in a particular destination in 1990.

To control for fixed costs associated with local distribution, we use three proxies: airport infrastructure, phone services, and paved roads. First we use the "foreign airport infrastructure index" which is obtained from Micco and Serebrisky (2004). This index corresponds to the logarithm of the ratio of the square of the

[17] Tariff data is available from 1981 to 2005, so we choose the three years, while non-tariff data is available for a specific year.

[18] We have to use: year 1992 NTBs for Trinidad and Tobago; 1993 NTBs for Kenya, Uganda, and Zambia; 1994 NTBs for Rwanda Gabon, Sri Lanka, Hong Kong, and China; 1995 NTBs for Ethiopia, Madagascar, Moldova, and Mauritius; 1996 NTBs for Belarus Estonia, Latvia, Israel, Norway, and Switzerland; 1997 NTBs for Burkina Faso, Cameroon, India, Papua New Guinea, Albania, El Salvador, Russian Federation, Turkey, and Ukraine; 1998 NTBs for Costa Rica, Guatemala, and Honduras; 1999 NTBs for Bhutan, Czech Republic, Hungary, Indonesia, Kazakhstan, Lebanon, Lithuania, Oman, Poland, South Africa, Tunisia, Bahrain, Saudi Arabia, Slovenia, Australia, European Union, New Zealand, and United States; 2000 NTBs for Bangladesh and Canada; 2001 NTBs for Côte d'Ivoire, Nicaragua, Nigeria, Senegal, Sudan, Tanzania, Algeria, Argentina, Bolivia, Brazil, Chile, China, Colombia, Ecuador, Egypt, Jordan, Malaysia, Mexico, Morocco, Paraguay, Peru, Philippines, Thailand, Uruguay, Venezuela, Singapore, Taiwan, China, and Japan.

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number of airports with runways at least 1,500 m long in a country to the product of the country's area and population. The information used to calculate values of the index was obtained from the Central Intelligence Agency (CIA), *World Fact Book*, 1990–2001 editions. The data on phone services are taken from the World Bank, *World Development Indicators* (*WDI*), and we use an average value over the years 1980, 1990, and 2000. The phone variable corresponds to the number of fixed lines and mobile phone subscribers per 100 people. The data on paved roads are also taken from *WDI,* using an average value over the years 1990 and 2000.

Institution quality variables averaged for 1996 and 2000 are obtained from Kaufmann, Kraay, and Mastruzzi (2003).[19] "Regulatory quality" measures the extent of market-friendly policies such as price controls or inadequate bank supervision, as well as perceptions of the burdens imposed by excessive regulation in areas such as foreign trade and business development. "Rule of law" measures the quality of the enforceability of law through the factors of property rights, black markets, trust in the judiciary, the police, and the legal system. "Government effectiveness" measures the quality of public service provision, the quality of the bureaucracy, the competence of civil servants, the independence of the civil service from political pressures, and the credibility of the government's commitment to policies. "Control of corruption" measures perceptions of corruption, which is determined by various factors such as the frequency of additional payments to get things done, the effects of corruption on the business environment, and corruption in the political arena.

B. *Estimation Results*

We are interested in estimating the effect of trade determinants on the rankings. To this end, we estimate the suggested equation. Table 2 presents the estimation results. We begin by estimating the equation excluding some variables such as EPAs, infrastructure, and institution quality to check how the estimation results are affected by the inclusion of the variables. According to column (1), GDP, tariff, distance, and language have significant coefficients, as expected, while the coefficient for non-tariff barriers (the unweighted averages of core NTBs which are defined as including quantity and price restrictions) is positive, as expected, but insignificant. Even with the use of non-tariff barriers calculated by import-weighted averages, the coefficient is still insignificant as shown in column (2).

[19] Kaufmann, Kraay, and Mastruzzi (2003) presents estimates of six dimensions (voice and accountability, political stability and lack of violence, government effectiveness, regulatory quality, rule of law, and control of corruption) of governance covering 199 countries and territories for four time periods (1996, 1998, 2000, 2002). These indicators are based on several hundred individual variables measuring perceptions of governance, drawn from 25 separate data sources constructed by 18 different organizations.

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TABLE 2

Estimation Results

	(1)	(2)	(3)	(4)
GDP_h	–0.167***	–0.170***	–0.162*	–0.184***
	(0.061)	(0.050)	(0.065)	(0.021)
Tar_{ij}	0.018***	0.019***	0.020***	0.013**
	(0.005)	(0.004)	(0.005)	(0.004)
NTB_{ij}	0.000	0.001	0.001	0.009
	(0.006)	(0.005)	(0.006)	(0.005)
Dis_{ij}	0.840***	0.833***	0.783***	0.730***
	(0.160)	(0.156)	(0.160)	(0.177)
$Lang_{ij}$	–0.199**	–0.293**	–0.306***	–0.199**
	(0.107)	(0.112)	(0.120)	(0.096)
$EPAO_{ij}$			–0.540**	–0.308*
			(0.207)	(0.190)
$Infra_{ij}$				–0.121**
				(0.005)
$InsQuali_j$				–0.247***
				(0.080)
R-square	0.58	0.58	0.56	0.66
No. of ob.	74	74	74	73

Note: Column (1): *NTB* = averaged non-tariff barrier.
Column (2): *NTB* = import-weighted averaged non-tariff barrier.
Column (4): $Infra_{ij}$ = airport infrastructure index, $InsQuali_j$ = regulatory quality.
***, **, and * represent statistical significance at the 1%, 5%, and 10% level, respectively.

Korea tends to export its goods earlier to countries with large GDP, low tariff rates, geographic proximity, and language familiarity.

In column (3) we introduce a binary dummy variable for Korea's EPAs overseas. The coefficient is significant, with the expected sign. The export promotion offices overseas play a major role in the geographic spread of Korea's exports.[20] In the last column, the coefficients for infrastructure, measured by the airport infrastructure index, and institution quality, measured by regulatory quality, are significant, with the expected sign. A new good is exported earlier to countries with a large number of airports and market-friendly policies in areas such as foreign trade and business development.

To check the robustness of the estimation results, we estimate the equation using alternative measures for infrastructure and institution quality. Table 3 presents the

[20] As mentioned by Rose (2007) and Gil, Llorca, and Serrano (2008), if the decision to open a foreign trade office is not based on past exports, but on the existence of market opportunity, no endogeneity problem arises. But a reverse causality from the order to the existence of an export promotion office abroad might be minimized because the establishment of export promotion offices mainly depends on the export performance, not the order of export destination.

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TABLE 3

Estimation Results from Alternative Measures

	(1)	(2)	(3)	(4)	(5)
GDP_j	–0.150**	–0.119***	–0.101**	–0.125***	–0.108
	(0.057)	(0.040)	(0.039)	(0.040)	(0.053)
Tar_{ij}	0.013**	0.006**	0.005**	0.005*	0.003
	(0.006)	(0.002)	(0.002)	(0.003)	(0.007)
Dis_{ij}	0.646***	0.652***	0.570***	0.627***	0.421***
	(0.128)	(0.114)	(0.159)	(0.105)	(0.136)
$Lang_{ij}$	–0.212**	–0.172**	–0.172**	–0.160**	–0.204**
	(0.094)	(0.088)	(0.080)	(0.075)	(0.077)
$EPAO_{ij}$	–0.320*	–0.409**	–0.411**	–0.389**	–0.404***
	(0.179)	(0.209)	(0.170)	(0.178)	(0.101)
$Infra_{ij}$	–0.009	0.041*	0.000	–0.017**	0.010
	(0.005)	(0.023)	(0.009)	(0.006)	(0.029)
$InsQuali_j$	–0.167***	–0.396**	–0.405***	–0.249**	–0.279***
	(0.009)	(0.159)	(0.019)	(0.090)	(0.081)
R-square	0.65	0.55	0.55	0.64	0.59
No. of ob.	125	98	98	125	96

Note: Column (1): $Infra_{ij}$ = airport infrastructure, $InsQuali_j$ = rule of law.
Column (2): $Infra_{ij}$ = phones, $InsQuali_j$ = rule of law.
Column (3): $Infra_{ij}$ = paved roads, $InsQuali_j$ = rule of law,
Column (4): $Infra_{ij}$ = airport infrastructure, $InsQuali_j$ = government efficiency
Column (5): $Infra_{ij}$ = airport infrastructure, $InsQuali_j$ = control of corruption
***, **, and * represent statistical significance at the 1%, 5%, and 10% level, respectively.

estimation results from alternative measures. In column (1), we use the "airport infrastructure index" for infrastructure and the "rule of law" for institution quality. All coefficients are significant with similar estimation results to column (4) of Table 2. However, columns (2) and (3) report that the coefficient of "phones" is insignificant with the unexpected sign when we use "phones" or "paved roads" as infrastructure. Column (4) shows that the coefficient of "government efficiency" is significant. "Government efficiency" is an important factor that affects the expansion of trade goods. In column (5) we use "control of corruption" as an institution-quality variable. "Control of corruption" has a significant effect on the rankings.

Overall, the coefficients of GDP, tariff rate, distance, language, EPAs, and institution quality are statistically significant. For infrastructure, the coefficient of the airport infrastructure index is significant but those of phones and paved roads are insignificant. Korea has exported its goods early to countries with large GDP, low tariff rates, geographic proximity, language familiarity, its own export promotion office, and high quality of institutions. The asymmetries in country size, tariff rate, transportation cost (or its proxy, distance), market entry costs (or their proxies, language, EPAs, and institution quality) determine the order of geographic

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spread for export goods. We can provide some studies that may shed light on the plausibility of our estimate. Evenett and Venables (2002) argue that exports are enhanced by market size and proximity. Eaton, Kortum, and Kramarz (2008) find that new exporters begin in a single foreign market and, if they survive, gradually expand into additional destinations.

V. CONCLUSION AND POLICY IMPLICATIONS

This paper contributes to the export diversification literature by finding new facts on the export dynamics implied by the theoretical model of Melitz (2003). The model suggests that heterogeneities in country size, trade costs, and market entry costs determine the pattern of geographic spread of export goods, and that there is an ordering of destinations to which a new commodity begins to be exported. We use a semi-parametric procedure to rank countries, which takes into account non-randomly missing data, and determine sensible rankings. We find that GDP, tariff rates, distance, language, export promotion agencies, and institution quality are correlated with the ranking. Country size, tariff, transportation costs, and market entry costs play a key role in determining the pattern of geographic export diversification.

In this paper, the strong empirical evidence will be of considerable interest to policy makers who are engaged in promoting trade. First, policy makers have to deal with the reduction of trade costs, such as tariff rates, in order to promote geographic diversification. There should also be policy actions taken to reduce transportation costs due to geographic distance. The finding that the ranking is affected by the existence of export promotion offices gives economic justification for government support of exporters by introducing export promotion agencies. Since policy makers cannot affect institution quality or infrastructure, some policy actions that reduce their importance are required. As mentioned in UNCTAD (2002), successful exporting involves more than just increased international market share. Greater export diversification in destinations could be an indication of improved export propensity.

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APPENDIX

A. *Balanced Panel*

For any commodity m, the Spearman rank correlation between a commodity ranking and overall destination ranking is:[21]

$$r_m = \frac{12}{\left(N_m^3 - N_m\right)} \sum_{n \in I_m} \left[X_n(I_m) - \frac{1}{2}(N_m + 1) \right] \left[x_{mn}(I_m) - \frac{1}{2}(N_m + 1) \right].$$

As shown by Feenstra and Rose (2000), $E(r_m) = \rho_m$: the Spearman rank correlation is an unbiased estimate of the fraction of observations for which country rankings in commodities and overall country ranking are equal.

The average rank correlation across all commodities is

$$\frac{\sum_{m=1}^{M} r_m}{M} = \sum_{m=1}^{M} \frac{12}{M\left(N_m^3 - N_m\right)} \sum_{n \in I_m} \left[X_n(I_m) - \frac{1}{2}(N_m + 1) \right] \left[x_{mn}(I_m) - \frac{1}{2}(N_m + 1) \right].$$

The objective of this paper is to choose $X_m(I)$ to maximize the average of the rank correlations between commodity rankings and the overall country ranking.

If there is no missing data, $N_m = N$,

$$\begin{aligned} \frac{\sum_{m=1}^{M} r_m}{M} &= \frac{12}{M\left(N^3 - N\right)} \sum_{n=1}^{N} \left[X_n(I) - \frac{1}{2}(N + 1) \right] \left[\sum_{m=1}^{M} x_{mn}(I) - \frac{1}{2} M(N + 1) \right] \\ &= \frac{12}{\left(N^3 - N\right)} \left[\sum_{n=1}^{N} \left(X_n(I) \left(\frac{\sum_{m=1}^{M} x_{mn}(I)}{M} \right) \right) - \frac{1}{4} MN(N+1)^2 \right]. \end{aligned}$$

[21] The term $12/\left(N_m^3 - N_m\right)$ is the highest value of correlation, obtained when the individual ranking and the overall ranking are equal over all observations.

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The objective function is maximized when the first term in the square bracket is maximized. We have to choose $X_n(I)$ as the rank of the averages $\frac{\sum_{m=1}^{M} x_{mn}(I)}{M}$ because the product is maximized (Kendall and Gibbons 1990).

B. *Unbalanced Panel*

PROPOSITION 1: *The chosen $X_n(I)$ that maximize the objective function and the common coefficient $\rho > 0$ will minimize the weighted sum of the squared residuals (SSR). The SSR over all countries and commodities is*

$$\operatorname*{Min}_{X_n(I),\rho} \sum_{m=1}^{M} \frac{12}{N_m^3 - N_m} \sum_{n \in I_m} \left[x_{mn}(I_m) - \frac{1}{2}(N_m + 1) - \rho\left(X_n(I_m) - \frac{1}{2}(N_m + 1) \right) \right]^2 .$$

The weighting reflects the differing number of destinations within each commodity when adding up across commodities. The striking feature of Feenstra and Rose's (2000) method is the use of regression-based imputation, considering the ranks for the destinations not supplied.

PROPOSITION 2: *The overall destination ranking, $X_n(I)$, with chosen $\tilde{x}_m$ and ρ, minimizes the weighted sum of the squared residuals.*

$$\operatorname*{Min}_{X_n(I),\rho} \sum_{n=1}^{N} \sum_{m \in M_n} \frac{1}{M_n} \left[x_{mn}(I_m) - \frac{1}{2}(N + 1) + \tilde{x}_m - \rho\left(X_n(I) - \frac{1}{2}(N_m + 1) \right) \right]^2$$

For each country n, let $M_n \subseteq \{1, \ldots, M\}$ denote the set of commodities that have been exported. The overall destination ranking is then $\sum_{m \in M_n} M_n^{-1}(x_{mn}(I_m) + \tilde{x}_m)$.

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APPENDIX TABLE 1

Country Rankings (Manufacturing Goods)

Country	Ranking
USA	1 (1)
Japan	2 (2)
Hong Kong	3 (3)
Singapore	4 (4)
Thailand	5 (5)
Canada	6 (6)
UK	7 (7)
Germany	8 (8)
Australia	9 (9)
Malaysia	10 (10)
Indonesia	11 (11)
Taiwan	12 (12)
Saudi Arabia	13 (13)
France	14 (14)
Netherlands	15 (15)
Italy	16 (16)
Philippines	17 (17)
Pakistan	18 (18)
Sweden	19 (19)
Kuwait	20 (20)
Iran	21 (22)
Belgium & Luxembourg	22 (21)
South Africa	23 (23)
Spain	24 (24)
Zambia	25 (28)
Switzerland & Liechtenstein	26 (25)
UAE	27 (26)
Nigeria	28 (27)
Bahrain	29 (30)
Denmark	30 (29)
New Zealand	31 (31)
Libya	32 (32)
Vietnam	33 (33)
Austria	34 (34)
Norway	35 (36)
Mexico	36 (35)
India	37 (39)
Jordan	38 (37)
Ireland	39 (38)
Finland	40 (40)
Bangladesh	41 (41)
Panama	42 (42)
Greece	43 (43)
Lebanon	44 (44)
Israel	45 (45)
Liberia	46 (48)
Venezuela	47 (46)
Egypt	48 (47)
Sri Lanka	49 (49)
Yemen	50 (50)
Chile	51 (51)
Gabon	52 (52)
China	53 (53)
Iraq	54 (56)
Sudan	55 (54)
Qatar	56 (55)
Brazil	57 (57)
Kenya	58 (58)
Ethiopia	59 (60)
Turkey	60 (59)
Myanmar	61 (61)
Samoa	62 (63)
Ecuador	63 (62)
Papua New Guinea	64 (65)
Argentina	65 (64)
Cyprus	66 (66)
Syria	67 (67)
Oman	68 (68)
Ghana	69 (69)
Cameroon	70 (70)
Portugal	71 (71)
Costa Rica	72 (72)
Guatemala	73 (73)
Sierra Leone	74 (76)
Greenland	75 (81)
Cuba	76 (78)
Jamaica	77 (74)
Trinidad & Tobago	78 (77)
Colombia	79 (75)
Dominican Republic	80 (79)
Nepal	81 (80)
El Salvador	82 (82)
Fiji	83 (83)
Haiti	84 (85)
Honduras	85 (84)
Barbados	86 (87)
Morocco	87 (86)
Netherlands Antilles & Aruba	88 (88)
Guyana	89 (89)
Somalia	90 (90)
Iceland	91 (91)
Afghanistan	92 (92)
Peru	93 (93)
Russian Federation	94 (94)
Mauritius	95 (95)
Senegal	96 (96)
Uruguay	97 (97)
Suriname	98 (99)
Poland	99 (98)
Republic of the Congo	100 (101)
Paraguay	101 (100)
Cote d'Ivoire	102 (104)
Bolivia	103 (103)
Tanzania	104 (102)
St. Kitts and Nevis	105 (105)
Bermuda	106 (106)
Niger	107 (107)
Cambodia	108 (109)
Malta	109 (108)
Nicaragua	110 (110)
Guinea	111 (111)
China (Macau SAR)	112 (112)
Tunisia	113 (114)
Hungary	114 (113)
Czechoslovakia	115 (115)
Lao PDR	116 (116)
Togo	117 (117)
Benin	118 (118)
Central African Republic	119 (120)
Yugoslavia	120 (119)
New Caledonia	121 (121)
Bahamas	122 (122)
Mozambique	123 (123)
Gambia	124 (128)
Uganda	125 (126)
Angola	126 (127)
Algeria	127 (124)
Romania	128 (125)
Madagascar	129 (130)
Uzbekistan	130 (129)
Malawi	131 (131)
Kazakhstan	132 (132)
Falkland Islands	133 (134)
Gibraltar	134 (137)

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APPENDIX TABLE 1 (Continued)

Country	Ranking	Country	Ranking	Country	Ranking
Djibouti	135 (135)	DPR Korea	150 (149)	St. Pierre & Martinique	164 (164)
Congo	136 (136)	Ukraine	151 (150)	Azerbaijan	165 (163)
Albania	137 (133)	Rwanda	152 (152)	Chad	166 (166)
Guadeloupe	138 (138)	Other Oceania	153 (153)	Belarus	167 (167)
Mauritania	139 (140)	French Guiana	154 (158)	Georgia	168 (168)
Mongolia	140 (139)	Kiribati	155 (156)	Turkmenistan	169 (169)
French India	141 (142)	Slovakia	156 (155)	Latvia	170 (170)
Czech Republic	142 (141)	Zimbabwe	157 (157)	Estonia	171 (171)
Seychelles	143 (144)	Kyrgyzstan	158 (154)	St. Helena	172 (172)
Burkina Faso	144 (147)	Guinea-Bissau	159 (159)	Moldova	173 (173)
Bulgaria	145 (143)	Croatia	160 (160)	FYR Macedonia	174 (174)
Slovenia	146 (145)	Lithuania	161 (161)	Armenia	175 (175)
Belize	147 (146)	Equatorial Guinea	162 (162)	Bosnia-Herzegovina	176 (176)
Tajikistan	148 (148)	Burundi	163 (165)		
Mali	149 (151)				

Note: Rankings are those measured by the fixed-effect method. The simply averaged rankings are in parentheses.

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