10-1986

Determinants of Bilateral Trade Flows

Rajendra Kumar SRIVASTAVA
Singapore Management University, rajs@smu.edu.sg

Robert T. Green

Citation

SRIVASTAVA, Rajendra Kumar and Green, Robert T.. Determinants of Bilateral Trade Flows. (1986). *The Journal of Business*. 59, (4), 623-640.
Available at: https://ink.library.smu.edu.sg/lkcsb_research/4130

Rajendra K. Srivastava
Robert T. Green
University of Texas at Austin

Determinants of Bilateral Trade Flows*

What factors influence the level of trade flows that occur between nations? Past studies have answered this question primarily in terms of distance and economic size. The present study considers additional variables as potential determinants of trade relations between nations. Also, trade flows are analyzed by the type of products being exported and imported. The findings show that several additional variables are significant determinants of the level of bilateral trade relations between nations. In addition, it is found that models of trade flows are more appropriate for manufactured goods than they are for basic commodities.

What factors determine the level of trade that occurs between nations? Why does any given nation trade more with some nations than with others? Are bilateral trade flows of manufactured items explained by the same factors as are raw materials? These questions have received little attention in international trade research. Considerable efforts have been made to understand the composition and the volume of nations' exports and imports (see, e.g., Warner and Kreinin 1983). Yet the question, Why does country X trade more with country Y than with country Z? remains relatively less researched.

The study reported in this paper represents an attempt to understand the relative level of trade flows that occur between nations and their trading partners. It examines the bilateral trade flows between 45 exporting nations and 82 importing nations in an effort to provide insights on the questions posed above. The effects of multiple determinants of trade suggested by past literature are investigated in this study: distance, product category, political instability, cultural similarity, colonial past, membership in an economic union, and standard demographic variables such as GDP and population.

* The authors wish to extend their appreciation to Tammy B. Cornwell for assistance provided during all stages of this project. The authors also acknowledge the support of the ICC Institute and the Graduate School of Business of the University of Texas at Austin.

(*Journal of Business*, 1986, vol. 59, no. 4, pt. 1)

0021-9398/86/5904-0006$01.50

The results of the study suggest relations between the level of bilateral trade flows and the foregoing factors that have not been demonstrated previously. For instance, these factors have greater explanatory power for relative trade flows of manufactured goods than of such basic products as food and raw materials. In addition, political instability is found to have a significant influence on exports but little effect on imports. Cultural similarity appears to have a more pronounced effect on relative trade flows than does shared membership in an economic union. Further, the GDP of the exporting country is found to be a powerful explanatory variable in the relative intensity of bilateral trade relations. The preceding findings are coupled with others that replicate the findings of past research concerning such relations as those between distance and trade intensity.

The Determinants of Trade: Past Research

Early studies on the determinants of trade focused primarily on the relation between distance and trade. In general, it has been well established that distance is a strong determinant of the intensity of trade flows that occur between nations; nations that are geographically proximate will tend to trade relatively more than will nations that are further apart (see, e.g., Beckerman 1956; Ullman 1956; Smith 1964; Linneman 1969; Yeats 1969). There has been some controversy about the precise nature of the relation between trade and distance, that is, whether it follows the classic gravity model or a variation of the gravity model (see, e.g., Alcaly 1967; Black 1971). Nevertheless, a strong relation has been found between distance and trade flows among nations.

Other studies have been more multivariate in nature. Perhaps the most widely quoted study on the determinants of trade was conducted by Linneman (1966). Linneman applied an econometric model to study the factors that determined the trade flows between 80 nations in 1959. The independent variables in the model were GNP, population, distance, and a preferential trade factor. The preferential trade factor refers to a dummy variable denoting whether the nation was in the British, French, or Belgian or Portugese sphere of influence. Linneman ran his regression on both exports and imports (separately). He found that all the variables had a statistically significant relation with the volume of imports and the volume of exports flowing between the pairs of nations. The variables with the greatest explanatory power were GNP (of both the importing and the exporting nations) and the distance between the two nations. The other variables, while statistically significant, were of more limited explanatory value.

In explaining the variance that was not accounted for by the variables of his model, Linneman identified several factors. One factor was

the commodity composition of trade between pairs of nations, which is to say that the volume of trade between any pair of nations will be affected by the nature of the production in the two nations. Two nations that produce primarily corn will not trade with each other. Other factors not accounted for in his model were seen to be political forces (internal and external), the "psychic distance" that exists between pairs of countries (see Beckerman 1956), and the existence of economic alliances between nations.

It was the Linneman study that provided the basic take-off point for the research reported in this paper. The authors have attempted to extend the findings of the Linneman study in numerous respects. First, the authors have incorporated several of the factors that could affect trade flows but that were omitted from the Linneman study. These factors include political instability, membership in specific economic unions, and such cultural factors as religion and language. Second, the present study controls for variation in the size of nations' economies. A substantial and significant factor in explaining the flow of trade between nations is GNP, a fact that has been well established by past research. On the other hand, the association between GNP and trade flows is obvious (there will of course be a tendency for large nations to trade with large nations because they are large nations), and it could obscure other trade determinants that are simply overwhelmed by the effect of economic size. As explained below, the dependent variable has been constructed in such a way that it controls for the size of the economy and, by so doing, provides a measure of the intensity of bilateral trade relations between nations.

A third way in which the present study represents an extension of the Linneman study is that it provides independent measures for individual product categories as well as for total trade between nations. The inclusion of individual product categories in the analysis overcomes one of the acknowledged weaknesses of the Linneman analysis, for example, that it was unable to account for the commodity composition of trade between nations. The inclusion of product categories also extends the model by determining whether the identified factors are better at explaining trade flows in some categories than in others.

Method

Trade Data

The trade data used in this study were obtained from the United Nations External Trade Extract Data for 1977. These data consist of trade that has occurred between all pairs of reporting nations for all product categories. The trade flows are disaggregated to the 5-digit level of the Standard International Trade Classification (SITC) system.

Because of the large amount of data available and the limited computer storage/processing capacities, this study has been restricted to 45 exporting countries and 82 importing countries (see table A1). This study analyzes total trade flowing from the exporting to the importing countries as well as trade at the 1-digit level of the SITC code. The "miscellaneous" product category (SITC 9) was not employed in the study, resulting in nine product categories. The exporting and importing countries were selected on the basis of their trade volume and to achieve representation from all geographic areas. A few major countries (e.g., China, the Soviet Union, and Eastern bloc nations) are not included in the list of exporters because of a lack of comprehensive data. The chosen set of countries, however, accounts for the overwhelming majority of world trade: the 45 exporting countries accounted for more than 80% of world exports in 1977, while the 82 importing countries accounted for more than 95% of world imports.

The Dependent Variable

For the dependent variable in this study, a Trade Intensity Index was constructed to reflect the strength of trade relations between all pairs of nations within each of the nine SITC product categories. The index number is the ratio of the actual volume of trade between two nations to the expected volume of trade between the two nations. For example, if the United States accounts for 10% of world food exports and if India accounts for 8% of world food imports, then the expected volume of U.S. food exports to India would be 0.8% (.10 × .08) of world food exports. If the actual volume is 1.2%, the index of U.S. food exports to India would be 1.5; if the actual volume is 0.4%, then the index is 0.5. Indices of greater than 1.0 therefore reflect stronger-than-expected trade relations between nations, whereas indices of less than 1.0 reflect weaker-than-expected relations.

The values of the Trade Intensity Index are restricted to a minimum value of zero, while their maximum values are unrestrained. Accordingly, the distribution of these values is positively skewed. It is therefore necessary to use a logarithmic transformation to reduce the skewness since regression analysis assumes a normally distributed dependent variable. The dependent variable used in the regression analysis was the logarithm of one plus 10 times the Trade Intensity Index. This transformation does not interfere with the interpretation of the results because the scaling is monotonic. The logarithm of the Trade Intensity Index is identical to the "mutual information" ratio developed by Theil (1967, p. 358), but the procedure for the prediction of bilateral trade is different. Theil's approach focused on the prediction of period-t flows based on trade during a prior period. This paper focuses on distance and the character of relations between pairs of countries. Theil's objective was to develop forecasts of trade flows. The objective here is to attempt to understand and explain trade flows.

Table 1 presents a sampling of the Trade Intensity Indices (without the logarithmic transformation) for selected nations. For the United States, for instance, it can be seen that the indices are relatively high for Western Hemisphere nations and for other nations with which the United States has special relations, such as Japan, Israel, and Egypt. Conversely, U.S. trade is less than expected with many European nations, Cuba, and Kenya. In the case of India it can be seen that that nation has relatively weak trade relations with much of Europe, although it has strong trade ties with the United Kingdom. Many of the countries with which India has strong trade relations are located in Asia and East Africa. A scanning of the indices associated with the other nations provides further indications of the nature of the dependent variable used in this study.

The Independent Variables

A summary statement of the independent variables employed in this study, as well as their sources and the way they are measured, is presented in table A2. These variables have been classified in ways that are consistent with the past literature. First, there are the demographic variables—GDP and population—which relate to the size and stage of economic development of exporting and importing countries. These factors are included in the study despite the controlling effect of the dependent variable to determine whether the size of an economy has an independent influence on trade relations aside from the obvious one associated with relative buying power. The second group of independent variables comprises the political variables—political instability, membership in a particular economic union, and colonial heritage. The third group comprises the cultural variables—religion and language—and the final variable is geographic distance.

Statistical Analysis

The strength of association between the dependent variable (trade intensity) and the predictors (the determinants of trade) was examined via a linear-in-logs regression model. Ten separate regression equations were estimated, one for total trade and one for trade in each of the 1-digit SITC categories. The linear-in-logs regression model was used because interactions and multiplicative relations were anticipated between the independent variables. For example, if the geodesic distance between two trading countries is large, the other predictors, such as culture, would have little effect.

Since a linear-in-logs model was used, all dummy variable predictor variables were coded on a 1–2 scale rather than on a 0–1 scale. For example, if the pair of countries had a colonial relation or belonged to the same economic union, the corresponding dummy variable was coded as 2 (1 otherwise). Because the correlation between language and religion was leading to unstable coefficients, these two cultural

TABLE 1 **Trade Intensity Indices for a Sample of Country Pairs**

	Exporting Country					
	United States	Japan	West Germany	India	Spain	Mexico
Importing country:						
Strong relations	Canada (5.5)	Hong Kong (13.8)	Austria (4.0)	Kenya (4.4)	Algeria (3.9)	United States (4.9)
	Mexico (5.1)	Thailand (4.0)	France (1.8)	Kuwait (5.3)	France (2.4)	Cuba (5.0)
	Chile (2.0)	Cuba (2.8)	Switzerland (2.2)	Japan (2.0)	Argentina (3.4)	Brazil (3.3)
	Israel (1.9)	Australia (2.5)	Yugoslavia (2.5)	Soviet Union (6.1)	Brazil (1.0)	Chile (3.0)
	Japan (1.7)	Kenya (1.6)	Czechoslovakia (2.4)	Egypt (2.7)	Cuba (9.3)	Colombia (3.3)
	Egypt (1.6)	Saudi Arabia (1.6)	South Africa (1.4)	Britain (1.8)	Chile (2.5)	Venezuela (2.2)
Weak relations	West Germany (.5)	France (.1)	United States (.4)	France (.4)	Belgium (.7)	Canada (.2)
	France (.4)	West Germany (.4)	Canada (.2)	West Germany (.5)	India (.3)	France (.1)
	Kenya (.5)	East Germany (.1)	Mexico (.3)	Mexico (.0)	United States (.7)	West Germany (.2)
	Romania (.7)	Jamaica (.2)	India (.8)	United States (.9)	Canada (.2)	Spain (.9)
	Britain (.8)	Poland (.5)	Thailand (.4)	Canada (.2)	Australia (.3)	Kenya (.0)
	Cuba (.0)	Canada (.5)	Australia (.6)	Brazil (.1)	Japan (.2)	Thailand (.0)

variables were combined. If two countries had both language and religion in common, the dummy variable was coded as 2 (1 otherwise). Finally, the political instability of exporting and importing countries was also coded as dummy variables (1 if there was no irregular transfer of power, 2 if there was one or more irregular transfers).

Summaries of the resulting regression equations are provided in tables 2–3. Because of the large number of data points involved (45 exporting countries × 82 importing countries = 3,690) it is advisable that stringent significance levels be applied. Thus, although all relations significant at $\alpha < .05$ or better are reported, only those significant at $\alpha < .005$ are likely to contribute substantially to explained variance. Table 2 presents the standardized regression coefficients. The relative importance of the predictor variables is proportional to the square of these coefficients. Thus, for total trade, the GDP of the exporting country is approximately four times as important as colonial status. Table 3 presents the unstandardized regression coefficients for only the significant predictors. Because the regression model estimated was linear in logs, the relation between trade intensity (TI) and the determinants of trade can be expressed as (for "total trade," e.g.)

$$\mathrm{TI} = \frac{k(\mathrm{GDP}_e)^{.201}(\mathrm{POP}_i)^{.079}(\mathrm{LR})^{.297}(\mathrm{CS})^{1.828}}{(\mathrm{D})^{1.496}(\mathrm{INST}_e)^{.321}},$$

where k is a constant, e and i are subscripts denoting exporting and importing countries, CS = colonial status, POP = population, D = distance, INST = political instability, and LR = commonality of language and religion.

Findings

The standardized regression coefficients and r^2 values presented in table 2 depict the associations between each of the independent variables and the dependent variable for the individual product categories. The first column of numbers represents the regression findings for total trade between pairs of countries. Here it can be seen that the independent variables explain 30.95% of the variance and that six of the independent variables are significantly related to the intensity of total trade flows between nations. The r^2 compares favorably with that obtained by Linneman despite the fact that the dependent variable controls for much of the effect of economic size, the primary contributor in the Linneman model. The size of the r^2 is undoubtedly affected by the use of more explanatory variables in the present study and by the nature of the dependent variable.

An examination of the product-specific findings shows that there are considerable differences in explained variance across product catego-

TABLE 2 **Standardized Regression Coefficients and R^2 Values for Independent Variables Associated with Product Categories**

Product Category	Total Trade	SITC 0 Food	SITC 1 Beverage/ Tobacco	SITC 2 Raw Materials	SITC 3 Oil/ Energy	SITC 4 Animal/ Vegetable Fats	SITC 5 Chemicals	SITC 6 Manufactures by Materials	SITC 7 Machines/ Transport	SITC 8 Miscellaneous Manufactures
Distance	−.449****	−.362****	−.246****	−.421****	−.407****	−.311****	−.440****	−.431****	−.394****	−.384****
Demographic variables:										
GDP (exporter)	.218****	.151****	.225****	.091****	.256****	.237****	.237****	.210****	.302****	.269****
GDP (importer)	.012	.120****	.134****	.115****	.034	.112****	−.083****	.037	−.057***	.037
Population (exporter)	−.004	.044	−.014	.076****	−.104****	−.031	−.044*	.058***	−.036	.008
Population (importer)	.089****	−.108****	−.061**	−.029	.006	−.024	.110****	.018	.062***	.006
Cultural similarity:										
Language/religion	.050****	.046****	.060****	.022	−.012	.030	.138****	.125****	.149****	.194****
Political variables:										
Instability (exporter)	−.090****	−.073****	.009	−.093****	−.038	−.065****	−.081****	−.104****	−.158****	−.126****
Instability (importer)	.003	−.104	−.055***	.045**	−.015	−.025	−.020	−.022	.016	.003
Economic union	.019	.062****	.093****	−.004	.020	.051***	.036*	.025	.073****	.064****
Former colony	.109****	.111****	.137****	.105****	.055****	.116****	.096****	.114****	.118****	.134****
R^2	.3095	.2363	.1947	.2428	.2302	.2134	.3279	.3369	.3740	.3767

* Significant at < .05 level.
** Significant at < .01 level.
*** Significant at < .005 level.
**** Significant at < .001 level.

TABLE 3 Regression Coefficients and R^2 Values for Independent Variables Associated with Product Categories

Product Category	Total Trade	SITC 0 Food	SITC 1 Beverage/ Tobacco	SITC 2 Raw Materials	SITC 3 Oil/ Energy	SITC 4 Animal/ Vegetable Fats	SITC 5 Chemicals	SITC 6 Manufactures by Materials	SITC 7 Machines/ Transport	SITC 8 Miscellaneous Manufactures
Distance	−1.496****	−1.342****	−.899****	−1.649****	−1.767****	−1.172****	−1.643****	−1.538****	−1.483****	−1.397****
Demographic variables:										
GDP (exporter)	.201****	.154****	.227****	.099****	.306****	.246****	.244****	.206****	.313****	.270***
GDP (importer)	...	.105****	.115****	.107****	...	.100****	−.073****	...	−.501***	...
Population (exporter)	...	...	...	.082****	−.125****	...	−.045*	.057**	...	...
Population (importer)	.079****	−.106****	−.060**	...	...	...	.139****	...	.062***	...
Cultural similarity:										
Language/religion	.297****	.302****	.394****	...	...	.203****	.924****	.795****	1.004****	1.266****
Political variables:										
Instability (exporter)	−.321****	−.292****	...	−.390****	...	−.264****	−.326****	−.399****	−.637****	−.491****
Instability (importer)	...	...	−.213***	.186**	...	...	...	...	...	...
Economic union	...	.678****	1.000****	...	...	.572***	.399*	...	.815****	.684****
Former colony	1.828****	2.077****	2.524****	2.065****	1.150****	2.198****	1.807****	2.054****	2.234****	2.457****
Constant	1.232	1.482	.842	1.370	1.775	.986	1.213	1.125	1.195	1.101
R^2	.3095	.2363	.1947	.2428	.2302	.2134	.3279	.3369	.3740	.3767

* Significant at < .05 level.
** Significant at < .01 level.
*** Significant at < .005 level.
**** Significant at < .001 level.

ries. The most striking difference occurs between manufactured goods (SITC 5, 6, 7, and 8) and the nonmanufactured product categories. The independent variables used in the present study explain substantially greater amounts of variance for manufactured goods than they do for food, beverages and tobacco, raw materials, fuels, and animal and vegetable fats. The differences here are pronounced, with all the r^2 values in the manufactured goods categories being greater than 0.30. The nonmanufactured product categories all have values less than 0.30, and one is even less than 0.20. While some of the independent variables are significant across all product categories, there are large variations in their levels of contribution to the explained variance across product categories. The following discussion will consider the individual groups of independent variables and will discuss their effect within the different product categories.

Distance

Distance is the single most important determinant of trade intensity among nations of the variables employed in the regression. This finding applies to all the product categories as well as to the total trade category. The importance of distance had been anticipated, given previous findings. In fact, the correlation coefficient between trade and distance is considerably higher in the present study than had been found in the Linneman study. This difference seems primarily due to the nature of the dependent variable. Since Linneman used the absolute volume of trade between nations as the dependent variable, it would be expected that the large trade flows that occur between highly developed but distant nations (e.g., the United States and Germany) would override the smaller but higher-intensity trade that occurs between neighboring nations (e.g., Switzerland and Germany).

Although distance has the largest standardized regression coefficient within each of the product categories, the size of the regression coefficient varies across the product categories. In general, distance accounts for approximately 50% of the total explained variation in the individual product categories. There are some notable exceptions to this rule, however. With regard to raw materials, distance accounts for almost two-thirds of the explained variance. Conversely, for two categories of manufactures (SITC 7 and 8) distance accounts for only 40% or less of the explained variance.

The product category findings for distance appear to portray statistically one of the classic relations defined in location theory: industries that produce products characterized by low value-to-bulk ratios tend to be located closer to their markets than do industries whose products have high value-to-bulk ratios (see, e.g., Hoover 1948; Isard 1956). Root (1984, p. 232) noted the need to integrate location and trade theories. The findings presented here have statistically demonstrated a link that exists between the two areas.

Demographic Variables

As noted above, demographic variables relating to the population and economic size of importers and exporters were included in the analysis because of their significance in past research. Their inclusion, despite a dependent variable that controls for size, was intended to determine whether size (economic, population, or both) has an independent influence on the intensity of bilateral trade flows.

With regard to total trade flows, only the GDP of the exporting country (a supply factor) and the population of the importing country (a demand factor) have a significant relation with the dependent variable. These findings may be influenced by the correlations that exist between the GDP and population of the exporter (0.32) and the GDP and population of the importer (0.33). These correlations, however, are not large enough to cause any major estimation problems.

The findings within product categories provide more revealing insights into bilateral trade relations. The significance of the exporting country's GDP exists across each of the nine product categories. Of equal importance, the relation between trade intensity and exporter's GDP exists without any consistent relation to the population of the exporting country. This finding may reflect the market power exerted by large economies and the corresponding lack of market power of small economies.[1] Nations with large economies tend to have large firms that diversify their exports across a number of importing nations. Smaller nations may tend to be dependent on a limited number of markets for their exports. While these smaller nations may have very high trade intensities with a limited number of countries, with the vast majority of nations their trade relations (and thus intensities) are almost nonexistent. The foregoing explanation is not intended to be definitive. The rationale for the relation between exporter's GDP and trade intensity deserves additional study by trade researchers.

The findings within product categories also uncover some interesting relations between importer's GDP and trade intensity that had been masked in the aggregate analysis. For all nonmanufactured product categories except SITC 3 (oil and other energy-related products) there is a significant positive relation between trade intensity and importer's GDP. For the two categories of manufactured goods that contain the largest concentration of technology-intensive goods (SITC 5 and 7), there is a negative relation between trade intensity and importer's GDP.

1. The strong relation between trade intensity and the GDP of the exporting country was unanticipated and led the authors to conduct subsequent tests to determine whether this finding was due primarily to the effect of the United States on trade relations. The United States was removed from the analysis, and the tests were rerun. Even with the United States excluded, the relation between trade intensity and exporter GDP remained, thus supporting the general nature of the observed relation.

The positive relation between trade intensities of basic products and importer's GDP may to a large extent reflect the fact that large economies tend to be more diverse and industrialized, therefore representing markets for diverse sources of raw materials to support their industry. Trade intensities would therefore be higher across a broader cross section of trading partners.

The negative relation between importer GDP and trade intensity of sophisticated manufactures occurs in conjunction with significant positive relations between population and trade intensities for these goods. These findings appear to depict statistically a classic trade relation between relatively rich and poor nations, that is, sophisticated manufactured goods flowing from more developed nations to less developed nations. The important difference between the findings here and the traditional explanation just presented is that these results may portray the less developed nations as being engaged in more diversified buying across industrialized countries for their sophisticated manufactures. Given the nature of the dependent variable, the significant relations suggest that the less developed nations draw their imports of these products from a more diverse set of sources than do nations with relatively high per capita GDP. This relation is also one that would benefit from more in-depth study.

For three product categories there are not any significant relations between trade intensity and importer-related demographics. Intensity ratios for SITC 3 are unrelated to importer demographics. This finding has face validity since energy products are imported by nations across the full range of GDP and population. In addition, the findings here suggest that overall trade intensities are unrelated to these demographics. Similarly, demographics do not explain the intensity of flows of goods from SITC 6 and 8, two categories of manufactured goods that contain primarily low-technology goods that are imported across the entire spectrum of nations.

Cultural Similarity

Cultural similarity between nations has been proposed by Beckerman (1956) as an important determinant of trade flows between nations. The findings of the present study tend to confirm this postulate, although there is considerable variation among product categories. There is a significant relation between cultural similarity and the intensity level of total trade among nations, although the magnitude of the regression coefficient is relatively small when compared to those of the other independent variables. Likewise there are significant relations between cultural similarity and trade intensity for food and for tobacco and beverages, but the magnitudes of the coefficients are low. The strongest associations with cultural similarity are found within the manufactured products categories. For all the manufactured goods cat-

egories the relation is both significant and relatively substantial: only distance and the GDP of the exporting country rank substantially above cultural similarity in terms of the amount of variation accounted for with respect to trade intensities for manufactured goods. Some qualification therefore seems to be needed when expressing the relation between trade and cultural similarity: it is most pronounced with respect to trade in manufactured goods.

Political Variables

The political variables with significant regression coefficients are the political instability of the exporting nation and the previous colonial relations existing between the exporting and the importing nations. As anticipated, low levels of instability for the exporting nation are associated with high trade intensity indices. This relation is shown to exist for total trade and for all product categories except fuels and beverages and tobacco. Stable nations tend to be the higher-level exporters when bilateral trade relations are examined. Conversely, there is very little effect of the instability of the importing nation on the intensity of trade, this variable being an insignificant determinant of trade in all but a couple of instances.

The former colonial relations between countries is found to be a significant determinant of the intensity of total trade as well as of trade in each of the product categories. Despite the attainment of independence, the ties of former colonial times seem to exert an influence on bilateral trade relations. Such a finding is not surprising since businesses of the former colonists are generally well represented in the previous colonies and, in many cases, since close political ties still exist between nations and their former colonies.

Membership in the same economic union does not have a significant relation with total trade flows, although there are significant relations shown for several of the product categories. The relatively weak effect of membership in the same economic union may be explained at least partially by the relatively large effect of distance on the determination of trade flows. Since most nations in an economic union are in close proximity to each other, a large part of the associated trade ties would have been incorporated in the distance factor.

Limitations

It would be a natural reaction to wonder why the present study has not accounted for a greater portion of the variance in trade flows. Indeed, the authors had wondered the same thing. Several possible explanations could be posited with regard to the variance that has been left unexplained. For one, not all the potential determinants of trade are accounted for in the model. Nations vary in terms of the restrictions placed on trade, a factor that could influence trade flows. There are

also such factors as the historical relations between nations, which have not been quantified to the extent that they can be incorporated into a formal analysis. Many nations that are geographically proximate are in fact hostile to one another (e.g., India and Pakistan, Iraq and Iran), and this factor would undoubtedly contribute to the level of trade between these countries.

A further limitation of the present study that undoubtedly contributed to the unexplained variance concerns the nature of the measures used for some of the independent variables. This limitation applies particularly to cultural similarity and political instability. The measure of cultural similarity—similarity of language and religion— was necessarily aggregate and did not consider the fact that nations may have several major religions (e.g., the United States) or more than one major language (e.g., Belgium). If cultural similarity had been able to be more finely measured, it is likely that this variable would have accounted for a greater portion of variance and thereby increased the total variance explained by the model.

Likewise, the measure of political instability used in the model is subject to limitations. The measure's primary limitation is that it measured instability for a period that ended 10 years prior to the year for which the trade statistics have been analyzed. Some nations that were unstable during the earlier period had attained relative stability by 1977 and vice versa. Despite this limitation, however, instability has been depicted as a significant determinant of trade. Like cultural similarity, it is probable that a better measure of instability would add to the total variation explained by the model.

Discussion

The purpose of this study has been to extend and refine current understanding of the determinants of trade between nations. The primary reference point for this work has been the study of Linneman (1966) since he had performed the most extensive analysis of the subject to date. The main differences between the present study and past studies are found in the number of variables employed, the measure of trade relations between nations, and the product-specific nature of the analysis. The present study incorporated more independent variables into the analysis—including measures of cultural similarity, political instability, and membership in particular economic unions—that had not been formally included in past studies. In addition, the magnitude of trade flows between nations in the present study is measured by the relative strength of trade between nations rather than by the absolute volume of the trade flow. In essence, this study has analyzed the determinants of the relative strength of trade ties between nations, whereas most past studies have been concerned with the determinants of the volume of trade between nations. Finally, whereas past studies have

been concerned with aggregate trade between nations, the present study has examined the determinants of aggregate trade as well as trade in specific product categories.

There are several findings emanating from this study that extend current knowledge of determinants of trade. First, the importance of the individual determinants will depend in part on the type of product being exported. In general, the independent variables employed in this study are better for explaining trade flows of manufactured goods than of nonmanufactured items. The two variables that appear to be responsible for the greater explanatory power for manufactures are the political instability of the exporter and, especially, cultural similarity. These two variables accounted for considerably more variance among manufactured goods than they did among other products. One possible explanation of this finding is that it is likely that a greater number of sources will exist for manufactures than for basic products, which tend to be available only from the limited number of nations in which they are found. Thus the political stability and degree of cultural similarity of sources of supply of basic products are less of a consideration.

A second finding of the present study that extends current understanding of the determinants of trade relates to the effect of the demographic variables of GDP and population. Since past studies had employed total volume of trade as their dependent variable, they had naturally found a strong association between trade flows and such economic size variables as GDP. The present study, by partially controlling for the economic size of the countries via the Trade Intensity Index, has found that the demand variables exert an influence on trade flows that is out of proportion to nations' relative economic size in the international community. This finding is consistent across all product categories and deserves future research to explore the underlying causes of the relation between economic size and trade intensity.

In the manner noted above, the present study has contributed in substantive ways to the understanding of trade relations between nations. In his study Linneman had found that the major contribution to explaining the determinants of trade had been made by GDP and by distance. The other variables used in the study—population, preferential trade with the United Kingdom, France, or Portugal and Belgium—were found to be statistically significant but not important enough to be considered fundamental forces in trade flow determination (see Linneman 1966, p. 88). The present study, however, has identified several forces that go beyond simple GDP or distance in determining the trade ties that exist between nations, especially in the area of manufactured goods. In most cases distance accounted for only half (or less) of the explained variation in the intensity of trade flows between nations; the addition of other factors such as cultural similarity is necessary for a more comprehensive understanding of the strength of trade ties that exist between nations.

Conclusions

The intensity of bilateral trade relations between nations is a multidimensional phenomenon. The present study has demonstrated statistically how several factors are significantly related to the intensity of trade flows between nations. Further improvements in explaining trade flows could be made through refinements in the measures of the individual variables (e.g., political instability and cultural similarity) and through the incorporation of additional variables (e.g., the extent of trade restrictions and the nature of political relations between pairs of nations). The extension of past findings provided by this study has contributed to current understanding of bilateral trade relations between nations and can serve as a takeoff point for further studies in the area.

Appendix

TABLE A1 Countries Included in This Study

South Africa	Cuba	China
Libya*	Dominican Republic	Belgium*
Morocco*	Jamaica	Denmark*
Sudan	Netherlands Antilles	France*
Tunisia*	Trinidad-Tobago	Germany*
Egypt*	Panama	Ireland*
Cameroon	Israel*	Italy*
Gabon*	Japan*	Netherlands*
Zaire	Iran*	United Kingdom*
Ghana	Jordan	Austria*
Algeria*	Kuwait*	Finland*
Ivory Coast*	Lebanon	Norway*
Kenya	Saudi Arabia*	Portugal*
Nigeria*	Syria	Sweden*
Zambia	Yemen	Switzerland*
Canada*	Turkey*	Greece*
United States*	Bangladesh	Spain*
Argentina*	Hong Kong*	Yugoslavia*
Brazil*	India*	Bulgaria
Chile	Indonesia*	Czechoslovakia
Colombia	South Korea*	East Germany
Ecuador	Malaysia*	Hungary
Mexico*	Pakistan	Poland
Peru	Philippines	Romania
Venezuela*	Singapore*	Soviet Union
El Salvador	Thailand*	Australia*
Guatemala	Taiwan	New Zealand

* Denotes countries that were used as both exporting and importing nations in this study.

TABLE A2 Independent Variables Employed in This Study

1977 GDP (Business International Corp. 1981)	US$; GDPs of both exporting and importing countries were considered in the analysis
Population in 1975 (Business International Corp. 1981)	Measured in thousands of inhabitants for both exporter and importer
Political instability (Taylor and Hudson 1971)	Number of irregular political power transfers, 1958–67; measures for both exporter and importer
Economic union membership (Ball and McCulloch 1982)	European Economic Community, Association of Southeast Asian Nations, European Free Trade Association, Economic Community of West African States, Andean Common Market, Central American Common Market, Council for Mutual Economic Assistance
Colonial heritage (Bjorklund 1970)	Colonial power administering the nation in 1946
Religion (De Blij 1982)	Predominant religion practiced in the country: mostly Roman Catholic, mostly Protestant, mostly Eastern rites, Sunni Moslem, Shiah Moslem, Hindu, Buddhism, Chinese religions, Shintoism, Judaism, traditional and shamanist religions
Language (De Blij 1982)	Predominant language spoken in the country: Germanic, Baltic, Slavic, Celtic, Romance, Greek, Armenian, Indo-Iranian, Afro-Asiatic, Niger-Congo, Saharan-Sudanic, Khoisan, Ural-Altaic, Sino-Tibetan, Japanese and Korean, and Malay/Polynesian
Distance (National Geographic Society 1981)	Geodesic distance: the shortest distance between boundaries of two countries, coded by a logarithmic, nine-point scale, with 1 = contiguous, 2 = less than 500 miles, 3 = 500–999 miles, 4 = 1,000–1,999 miles, . . . , and 9 = greater than 9,000 miles

References

Alcaly, R. E. 1967. Aggregation and gravity models: Some empirical evidence. *Journal of Regional Science* 7 (Summer): 61–73.

Ball, D. A., and McCulloch, W. H. 1982. *International Business: Introduction and Essentials*. Plano, Tex.: Business Publications.

Beckerman, W. 1956. Distance and the pattern of inter-European trade. *Review of Economics and Statistics* 38:31–40.

Bjorklund, O. 1970. *Historical Atlas of the World*. New York: Barnes & Noble.

Black, W. R. 1971. The utility of the gravity model and estimates of its parameters in commodity flow studies. *Proceedings of the Association of American Geographers* 3:28–32.

Business International Corp. 1981. *Worldwide Economic Indicators Comparative Summary for 131 Countries*. New York: Business International Corp.

De Blij, H. J. 1982. *Human Geography, Culture, Society and Space*. New York: Wiley.

Hoover, Edgar M. 1948. *The Location of Economic Activity*. New York: McGraw-Hill.

Isard, Walter. 1956. *Location and Space-Economy*. Cambridge, Mass.: MIT Press.

Linneman, Hans. 1966. *An Economic Study of International Trade Flows*. Amsterdam: North-Holland.

Linneman, Hans. 1969. Trade flows and geographical distance, or the importance of being neighbors. In H. C. Bos (ed.), *Towards Balanced International Growth: Essays Presented to J. Tinbergen*. Amsterdam: North-Holland.

National Geographic Society. 1981. *Atlas of the World*. Washington, D.C.: National Geographic Society.

Root, Franklin R. 1984. *International Trade and Investment*. 5th ed. Cincinnati: Southwestern.

Smith, R. H. T. 1964. Toward a measure of complementarity. *Economic Geography* 40 (January): 1–8.

Taylor, C. L., and Hudson, M. C. 1971. *World Handbook of Political and Social Indicators II*. New Haven, Conn.: Inter-University Consortium for Political Research.

Theil, Henri. 1967. *Economics and Information Theory*. Chicago: Rand McNally.

Ullman, E. L. 1956. The role of transportation and the bases for interaction. In William L. Thomas (ed.), *Man's Role in Changing the Face of the Earth*. Chicago: University of Chicago Press.

Warner, D., and Kreinin, M. E. 1983. Determinants of international trade flow. *Review of Economics and Statistics* 65 (February): 96–104.

Yeats, M. H. 1969. A note concerning the development of a geographical model of international trade. *Geographic Analysis* 1:399–404.