REGIONAL ECONOMIC INTEGRATION

AND THE APPLICABILITY OF

THE GRAVITY MODEL

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CHAPTER I

INTRODUCTION

Economic integration has drawn increasing attention both in the business world and in related disciplines since the Second World War. It is one of the major international economic topics that frequently appears in the business news media and academic literature. Keen interest in trading blocs, free trade areas, and economic integration has been renewed in recent years as the North America Free Trade Area (NAFTA) is being negotiated between the United States, Mexico, and Canada,[1] and as the European Economic Community (EEC) attempts to complete a single internal market by the end of 1992. The success of the EEC is obvious as other European countries apply for membership. The recent proliferation of economic integration issues is largely derived from the fact that its economic and political consequences for both participating and non-participating countries are fairly important. As the importance of economic integration grew in the related fields since the postwar, research and writings have increased enormously.

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[1]In 1988, the United States-Canada Free Trade Agreement established the world's largest and most comprehensive bilateral free trade area.

The word 'integration' means the combining of parts into a whole in everyday life, and in the economic literature economic integration mostly replaces the single word, integration. The process of international economic integration is the combining of nations together, and the final aim could be to achieve an economic union. This is the last stage of economic integration in the theory of international trade. The meaning of economic integration, however, is not clear-cut, because some writers, even in the sphere of economics, include social and political integration in the same category. Other authors include different forms of international cooperation under this heading, and "the argument has also been advanced that the mere existence of trade relations between independent national economies is a sign of integration."[2]

The implications of economic integration are extended to other social science disciplines which deal with economic integration from their perspective. For example, political science deals with economic integration in the name of regionalism, and devotes attention to regional cooperation among national states. By the 1960s, a number of important changes in international politics such as the independence of poor countries from colonial empires, the relative easing

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[2]Balassa, Bela, The Theory of Economic Integration. Homewood, Illinois: Richard D. Irwin, Inc., 1961, p. 1.

of the intensity of the Cold War,[3] and the success of European integration had raised a new range of questions about regionalism. The growing success of European regionalism and the vast increase in the less-developed countries' membership of regional groupings in the 1960s had stimulated scholarly interest in the problems of relating the European success to other parts of the world. The number of international arrangements has increased since World War II. According to Nye[4], 23 regional groupings showed up in the 1960s, and only one international arrangement—the inter-American system existed before World War II. He also points out that 92 countries belonged to one or more of the 9 regional organizations with mutual commitments in the 1960s.

Balassa[5] defines economic integration as two distinctive components, the process of integration and its state of affairs.[6] As a process, it has the goal of breaking down the barriers and abolishing discrimination between nation states. As a state of affairs, it represents

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[3]The 1950s is sometimes called the Dangerous Decade from the standpoint of the Cold War, and in that respect the Eisenhower administration period (1953-1961) is said to have managed the decade smoothly beginning from the Korean War.

[4]Nye Jr., Joseph S., International Regionalism: Reading. Harvard University: Little, Brown and Company, Inc., 1968, p. v.

[5]Balassa, op. cit., p. 1.

[6]The definition proposed by Balassa is quite popular in the literature.

the abolishment of barriers and discrimination between economies. He further distinguishes between integration and cooperation in interpreting the definition of economic integration. Cooperation includes actions aimed at decreasing discrimination, such as international agreements on trade policies. The process of economic integration includes measures that suppress some forms of discrimination, such as the removal of trade barriers.[7]

Regional economic integration is less frequently, but more preferably used, to add a spatial concept to some authors' arguments or analyses in the literature. On the other hand, since regional economic integration is a synonym for economic integration, it is often used interchangeably. However, in this study economic integration is selectively chosen, because it properly denotes an intermediate level of economic integration, that is, international economic integration. International economic integration, regarded as a term meaning the middle level between interregional integration and worldwide integration, refers to the integration of separate nations in a regional bloc.[8]

For this study, economic integration is examined in terms of an increase in international commodity trade among countries. International trade is the exchange of commodities and services between countries. As the theory

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[7]Balassa, op. cit., p. 2.

[8]Robson, Peter, The Economics of International Integration. Boston: George Allen & Unwin, Ltd., 1980, p. 1.

of international trade implies, many factors affect the direction and volume of international trade. World trade has been rising at a relatively steady rate although fluctuations were often common before the General Agreement on Tariffs and Trade (GATT) system. The GATT was established just after World War II. Postwar international trade has been rapidly rising, and has become an increasingly important component of the world economic activity. The volume of international trade roughly doubled each decade for the postwar period until 1970.[9] The total volume in 1970 reached about 300 billion dollars, then explosively expanded reaching 1.9 trillion dollars in 1980. This was partly due to the 1970s worldwide inflation which largely resulted from two oil shocks. By 1990, world trade volume was recorded at 3.5 trillion dollars[10].

This research analyzes both an international flow of trade and the recent formation of trading zones. It investigates the importance of a geographical factor, in the formation of regional trading blocs, by applying a technique of regional economic analysis, that is, the gravity model.

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[9]International Financial Statistics, Yearbook 1989 and a Dec 1991 Edition.

[10]The precise world trade data in nominal terms are as follows; 1950: $59 billion, 1960: $111.8 billion (131.5 by the Direction of Trade Statistics (DOTS) Yearbook also published by the IMF), 1970: $289.7 billion (280.1 by DOTS), 1980: $1,897 billion (1,867 by DOTS), 1990: $3,450 billion measured by the amount of imports. Between 1950 and 1980, world trade expanded more than 10-fold in real terms according to Cooper (Belous and Hartley, 1990, 30).

According to the gravity model, the sizes of two economies and the distance between them are major determinants of the mutual trade flow. For example, the size of an economy (expressed as GNP) has been proposed as one of the main variables determining the amount of trade volume. Following this hypothesis, trade theorists, development economists, and econometricians have empirically tested the correlation between trade flows and GNP. A reliable positive relationship has been well-established.

Statement of the Problem

The theoretical importance of economic integration has grown in many fields such as economics, politics, commerce, geography, and sociology, since World War II. Each field seems to be concerned with its own methodology and realm. Most fields are sometimes more descriptive than quantitative, disregarding, or not recognizing the importance of distance variables. Moreover, a variety of fields do not pay direct attention to the formation of regional trading blocs as much as managers of international marketing, corporation executives and businessmen do. The issue of the formation of regional trading blocs is included in the theory of regional economic integration. It usually appears as a separate topic which has little to do with regional economic integration. However, in the business literature and in the business news media, the topic of regional trading blocs shows up frequently, and is depicted

as a plausibly-growing force in the global economy. In addition, some researchers specify that "recently a growing number of public and private sector leaders have been flirting with the notion of regional trading blocs."[11]

Trade theory is used to explain economic integration, but it excludes the importance of distance variables, and subsumes a rather comprehensive range of theoretical foundations for economic integration. On the other hand, regional economics has extensively dealt with interregional economic linkages in a national economy by recognizing the spatial factor. International flows of commodities, services, and factors of production are not dealt with empirically in the literature of regional economics in detail. It is often suggested that this could be analyzed by some of the same techniques used in the interregional flow models.

Some authors in the 1960s (e.g. Linnemann, 1966, Tinbergen, 1962, Pulliainen, 1963) presented the effects of GNP and distance on exports and imports of nations in their cross-sectional econometric studies of international trade flows. The early econometric approach is fundamentally the same as the location theory approach to an international flow of trade. Both approaches use trade flows as a

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[11]Belous, Richard S., Rebecca S. Hartley, ed, The Growth of Regional Trading Blocs in the Global Economy. Washington, D.C.: National Planning Association, 1990, p. 1. For a good discussion of the relevant issue, see 'Regional Trading Blocs' in Chapter II.

dependent variable, and GNP and distance as basic explanatory variables. The econometric approach is, however, different from the location theory approach in its perspectives and point of view. Unlike the location theory approach, the econometric approach is frequently quoted in the analyses of trade flows, and even classified as one of the trade flow models. For example, the econometric models completely exclude the concept of region, although they use the geographical distance as a proxy for transportation costs. These models regard distance as a simple unit of measurement with no qualitative characteristics.

In contrast, this is a location theory approach both to the international flow of commodities and to the regional concentration of trade; this research is to show the importance of a spatial factor to international trade flows and the formation of trading blocs in the global economy.

Objectives of the Study

The major purpose of this research is to quantitatively examine regional economic integration of the world using the gravity model. The gravity model is one of the major tools used to explain interregional interactions in location theory. The second objective is to investigate the formation of regional trading blocs within the framework of the gravity model. The third objective is to gain a better understanding of regional economic integration.

In this study the degree of economic interaction and

economic integration will be measured by the size of an international trade flow. A cross-sectional gravity model is used to determine the validity of spatial interactions revealed in the form of trade flows. In the gravity model, closer economic bases are hypothesized to have more intertwined economic and non-economic activities. In addition, a time-series regression analysis is used to investigate the proposition that international trade volume increases as transportation cost declines.

Organization of the Study

Chapter I is an introduction to the broad concepts and issues of regional economic integration, and the problems of the issues. Chapter I also presents the statement of the problem, and the objectives of the study. Chapter II examines the theory of economic integration, and the relevant background about integration. In this chapter, a classification of integration by a geographical scale and forms of economic integration according to the kinds of trading arrangements and the extent to which integration is achieved are presented. This chapter also shows the brief historical development of the theory of economic integration, and a list of regional economic schemes in the global economy. Since economic integration overlaps with other academic areas, a brief discussion of these relationships is included. Finally the concept of regional trading blocs and relevant issues are dealt with. Chapter

III presents the relations between trade and location theory. Because an international trade flow is a concern to both trade flow models in trade theory, and to gravity models in regional economics, the two models are separately reviewed. Finally, the theoretical foundations of the gravity model are reviewed. Chapter IV describes the empirical work of gravity models, and discusses the related references for the setup of the models, variables and data sets. Chapter V gives the interpretation of the empirical results in the context of emerging trading blocs. A general assessment of the gravity models will be also discussed while paying particular attention to the importance of the approach employed. Chapter VI presents relevant policy implications of the study. Finally Chapter VII derives conclusions of the study, and completes the study by providing a variety of suggestions for further research.

CHAPTER II

REGIONAL ECONOMIC INTEGRATION AND REGIONAL TRADING BLOCS

Forms of Economic Integration

In a general study of economic integration, economic integration is usefully classified by three categories: (1) Interregional integration (or national integration), which is the integration of various regions within the boundaries of a national state, is the smallest scale. This has been mainly the topic of regional economics, and regional science. (2) International (economic) integration refers to the economic integration of various countries into a bloc. Often-called regional international economic integration, this refers to the integration of different nations into a geographical bloc, or zone. (3) Worldwide integration, which is the integration on a worldwide level[1]. All three levels of integration can be further classified according to their sector or industry. This study is concerned with both the second and the third integration although more emphasis is placed on international integration.

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[1]Robson, Peter, The Economics of International Integration. Boston: George Allen & Unwin, Ltd., 1980, p. 1.

Integration as a process suppresses discrimination between countries. Arrangements and measures for international economic integration take a variety of forms. Trade theory generally classifies these forms into six categories:[2] (1) preferential tariff agreement between countries; (2) free trade areas that eliminate tariffs among the participating nations, but maintain their own tariff schedule against non-participating nations; (3) customs unions[3] that eliminate tariffs among the member nations, and establish a common tariff schedule (i.e. common external tariff—CET) against non-member nations; (4) common markets[4] that eliminate non-tariff restrictions on factor movements (i.e. labor) as well as the elimination of tariffs; (5) economic unions where national economic policies are integrated; and (6) total economic integration that assumes a unification of all economic policies such as fiscal, monetary and employment policy, and also assumes a setup of supranational institutions which govern all member countries.

History of the Theory of International Economic Integration

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[2]Balassa, op. cit., p. 2.

[3]By establishing the same level of tariff on trade with non-member countries, a customs union is a higher level of integration than a free trade area.

[4]In a common market all barriers to factor movements are removed. Thus, it is a more-developed level of integration than a customs union.

Trade theory provides a theoretical foundation for international economic integration. Though the qualifying theory on customs unions showed up relatively late in terms of the history of economic thought, similar ideas underlying the core of economic integration had existed. For example, sixteen customs unions were established between 1818 and 1924, and they became relevant areas of study for classical and neoclassical economists. Economic history tells us that the classical economists discussed the effects of preferential commercial treaties such as the Methuen Treaty of 1703 and the Cobden Treaty of 1860. The evidence of classical economists' interests in the customs unions formation comes from the fact that Adam Smith (1776), David Ricardo (1817), and others criticized the Methuen Treaty, because the treaty caused trade diverting effects. In the Continent, German economist Friedrich List (1885) viewed customs unions as effective measures for protecting infant industries with different traditional backgrounds from the Anglo-Saxon. Harry G. Johnson and others mainly indicated that List's ideas are known to have initiated a modern stream of customs union theory.[5]

The very core of the topic of customs unions theory has been well-organized with the publication of Jacob Viner's

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[5]Ibid., p. 5.

famous book in 1950.[6] Viner's theory of customs unions has been widely introduced and accepted as a theoretical foundation on the subject since the late 1950s. However, ever since O'Brien (1976) presented a critique on the theory Viner's theory, it has been questioned by many researchers.[7]

As Viner's theory is regarded as the pioneering study, the literature on the theory of customs unions prior to Viner in the 20th century had been rare. Although Haberler and Gregory wrote previously representing the pre-Vinerian period,[8] Viner's theory is more developed.

Examples of Economic Integration

The most significant post World War II exercises in economic integration are a multilateral reduction in developed countries' tariffs on manufactured commodities initiated by the GATT. GATT provisions allow customs unions or free trade areas as the only forms of preferential tariff reduction except for developing countries. This reduction has brought about economic integration by lowering tariffs on goods traded among the developed countries. The GATT-sponsored multilateral reduction in tariffs has also contributed to the development of free trade over the global

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[6]The Customs Union issue. New York: Carnegie Endowment for International Peace, 1950.

[7]Robson, op. cit., p. 4.

[8]Ibid., p. 4.

level, but the enormous system allowed some exceptions, and could not accommodate some of the significant developments in the formation of customs unions.

Since the postwar period, there have been many preferential arrangements for international economic integration, and those arrangements usually have been revealed in the forms of free trade areas and customs unions. The changes in the world economy justifies Haberler's characterization of the period as 'the age of integration'.[9]

The most successful attempts at economic integration have been made in Europe, which consists of many developed countries with long common historical backgrounds and relatively smaller territorial sizes. As the most prominent example of economic integration, the European Economic Community (EEC) has attracted a great deal of attention from economists and researchers. The EEC originated from the Treaty of Rome in 1957 by West Germany, France, Italy, Belgium, Netherlands, and Luxembourg. The EEC was first enlarged in 1972 with the addition of the United Kingdom, Denmark, and Ireland—the First Enlargement. A subsequent enlargement was made in the 1980s with the entry of Greece in 1981, and the inclusion of Spain and Portugal on the first of January 1986.

The EEC has established a common market, having common

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[9]Ibid., p. 6.

external tariffs and removing a variety of barriers to the free movement of labor and capital among member countries. But, it is currently more than a common market due to the development of economic integration itself. The EEC—now called EC (European Community)—is being reinforced by the emphasis on the completion of the internal market by the end of 1992. Thus, the EEC is moving beyond the stage of common market, and reaching the ultimate goal—an economic union.

The European Free Trade Association (EFTA) is the second manifestation of forming a trading bloc in Europe, and was proposed by the United Kingdom. After a few years' negotiation, the EFTA was finally established in 1960, and the members included the United Kingdom, Switzerland, Austria, Sweden, Denmark, Norway, and Portugal making seven countries, "the Outer Seven". In 1961 Finland joined as an associate member,[10] and in 1970 Iceland joined the group. Because the United Kingdom, and Denmark entered the EEC in 1973, and Portugal followed in 1986, the EFTA's importance has decreased considerably. However, the remaining six countries have been connected with the enlarged EEC by a series of free trade agreements, and recent negotiations to combine the two systems into one body is in progress. The prospective integration will make a huge European trading

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[10]The status of an associate member ended in 1985. Refer to: Hunter, Brian, ed., The Statesman's Year-book 1991-92. New York: St. Martin's Press, 1991.

bloc.

The planned economies of eastern Europe and Russia also have shown economic integration. The establishment of the Council for Mutual Economic Assistance (CMEA, or COMECON[11]) in 1949 was an example of forming a trading bloc in that area.

There are numerous instances of free trade areas and customs unions outside Europe in less-developed areas of the world; especially in the African continent and in Latin America. Some examples in Africa include the West African Economic Community (CEAO—Communaute Economique de l'Afriqué de l'Ouest) with Mali, Ivory Coast, Mauritania, Niger, Senegal, and Upper Volta (Burkina Faso[12]). CEAO was originally established in 1959 as UDEAO (Customs Union of West African Countries), and reorganized in May, 1970. A second group which consists of former French colonies is the Union of Central African States (UDEAC[13]) including Cameroon, Gabon, the Central African Republic, and the People's Republic of the Congo. The Economic Community of West African States (ECOWAS) was set up by a treaty signed by fifteen countries in 1975. Some of the member countries

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[11]Member countries were the USSR, East Germany, Hungary, Czechoslovakia, Poland, Romania and Bulgaria.

[12]The new name, Burkina Faso was adopted in 1984.

[13]Chad was a member before 1968, and has been an observer since 1975.

also are included in CEAO.[14] The Economic Community of the Countries of the Great Lakes (CEPGL) was set up by Zaire, Rwanda, and Burundi in 1976. One of the more effective regional integration groups, the East African Community, or East African Common Market (EACM),[15] including Kenya, Uganda, and Tanzania, was dissolved due to political disagreement between participating countries in 1978.

In Latin America and the Caribbean, there exist four regional economic organizations. The Latin American Free Trade Association (LAFTA),[16] was established by the Treaty of Montevideo in 1960. LAFTA which includes Mexico and all of the South American countries except for Guyana, French Guiana and Surinam, made considerable progress toward its goal to gradually eliminate all types of duties and restrictions that affect the importation of commodities originating in the region. A subgroup, the Andean Group ('Grupo Andino'), which was set up under the Cartegena Agreement[17] in 1969, comprises Bolivia, Colombia, Ecuador,

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[14]The 15 members are Benin, Gambia, Ghana, Guinea, Guinea-Bissau, Nigeria, Liberia, Sierra-Loene, and Togo including 6 CEAO countries—Ivory Coast, Mali, Mauritania, Niger, Senegal, Burkina Faso.

[15]Established in June 1967 as the successor to East African Common Services Organization, which was set up in December 1961.

[16]Member countries are Argentina, Bolivia, Brazil, Chile, Colombia, Ecuador, Mexico, paraguay, Peru, Uruguay, and Venezuela.

[17]Chile was an original member, but withdrew in October 1976, and never joined again.

Peru and Venezuela.[18] The Central American Common Market (CACM) set up under the Managua Treaty in 1960 encompasses 5 small countries[19] in the region. The Caribbean Common Market (CARICOM) established as a successor to the Caribbean Free Trade Association (CARIFTA) in 1973 includes the four initial countries such as Trinidad and Tobago, Barbados, Jamaica, Guyana, and eight other members[20] in the Caribbean Sea region.

In Asia, the Association of Southeast Asian Nations (ASEAN), which was set up under the ASEAN Declaration or the Bangkok Declaration in 1967 includes Singapore, Malaysia, Thailand, Indonesia, and the Philippines. This organization shows a most promising integration among the less developed countries' groupings.

Theory of Economic Integration

The theory of international economic integration is more comprehensive than the theory of customs unions. A customs union involves the elimination of tariffs on imports from member countries and the adoption of common barriers against the rest of the world. Economic integration might involve the same factors as well as a reduction in barriers

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[18]Venezuela later joined in 1973.

[19]Five member countries are Costa Rica, El Salvador, Guatemala, Honduras, and Nicaragua.

[20]Belize, Antigua, Dominica, St. Lucia, St. Kitts-Nevis-Anquilla, St. Vincent, Montserrat, and Grenada.

to factor mobility and a harmonization of macroeconomic policies among member countries. The theory of economic integration is concerned with free international factor movements, because factor mobility creates a larger integrated economy out of smaller national economies. If free international factor movements are maintained, it is difficult for individual countries to implement national economic policies independently. The economic integration theory also deals closely with arrangements for the integration of national economic policies. Since monetary and fiscal policies influence factor movements as well as trade flows, these policies are a concern of economic integration theory. Finally, modern economic integration theory embraces a broader set of goals than the theory of allocative efficiency, which is the main consideration of orthodox customs union theory.

Robson summarizes three important reasons why the theory of economic integration extends beyond customs union theory: "(1) it takes account of international factor movements; (2) it envisages the co-ordinated use of instruments of national economic policy other than commercial ones, including those of a monetary and fiscal nature; and (3) it evaluates integration by reference to criteria other than that of efficiency in resource allocation."[21]

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[21]Robson, op. cit., p. 3.

Orthodox customs union theory uses dichotomous terminology; trade creation vs trade diversion. The theory suggests the two trade effects take place after member countries in a customs union remove internal tariffs. Trade creation occurs when consumers in each country in the customs union find that imports from other member countries are cheaper relative to both domestic goods and imports from member countries. When trade creation occurs, each member country concentrates more on producing the commodities in which it has a comparative advantage relative to other member countries. Trade creation effect causes an expansion of international trade.

Trade diversion occurs when a country in the customs union diverts its imports from nonmember countries to one of the member countries. Since the price of imports from nonmember countries was initially cheaper than that from member countries, this effect causes inefficiency. The gain from trade depends on the two concepts of trade creation and trade diversion. If the effect of trade creation is greater than that of trade diversion, the total effect is favorable or effective. Aside from this static gain, dynamic gains are derived from a number of sources: (1) economies of scale which increases production; (2) increased output arising from specialization according to comparative advantage; (3) a rise in efficiency caused by increased competition within the customs union; (4) a larger expanding market which is conductive to a greater level of domestic and foreign

investment within the customs union area; (5) improvements in the terms of trade of the customs union members with the rest of the world; (6) an increase in the rate of technological advance arising from the expansion of the internal market; and (7) a decrease in uncertainty which hurts international trade flows due to higher involved risks.[22]

Regional Trading Blocs

A regional trading bloc is a narrower definition of the term trading bloc, but many authors use them interchangeably. Defining regional trading bloc precisely is necessary to escape ambiguity and confusion in this study. A regional trading bloc is a phenomenon which develops in a region of the globe, or has at least some similar geographical characteristics shared among the participating countries. Proximity is one of several basic characteristics of trading blocs.[23] For simplicity, a trading bloc can be defined as an association of countries that cuts down intra-regional impediments to the free flow of commodities (and sometimes services, investment, and capital flows as well).[24] The purpose of a trading bloc is

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[22]Robson, op. cit., pp. 2-3., and Park, J. K., International Economics. Seoul: Park-young Company, 1984, pp. 353-357.

[23]Schott, Jeffrey J., "Trading Blocs and the World Trading System", World Economy, vol. 14, iss. 1, (Mar) 1991, pp. 2-3.

[24]Ibid., p. 1.

"to 'give smaller economies the large region and market they need to create the critical mass of production and sales needed to be competitive' (Drucker, 1989, 131). Trading blocs seek to (1) generate welfare gains through income and efficiency effects and trade creation; (2) augment negotiating leverage with third countries; and (3) sometimes promote regional political cooperation."[25]

To clarify the definition of a trading bloc, it is necessary to first elaborate the etymology of 'bloc', and to secondly look into the related terminology. A dictionary definition of a bloc is a combination of countries associated to further their joint interests.[26] In economics, a 'bloc' is a term frequently applied to limited economic grouping of countries. A currency bloc, the francophone bloc in Africa and developing countries(LDCs) bloc are good examples. In its most general form, 'an economic bloc' parallel to a political bloc was used by a researcher in the early 1970s,[27] though it has not been popularized in the literature. In a similar fashion, the

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[25]Ibid., pp. 1-2.

[26]Preeg, Ernest H., Economic Blocs and U. S. Foreign Policy. Washington D. C.: National Planning Association, 1974, p. 7.

[27]Ibid., pp. 7-11. Jeffrey E. Garten (1989, 15) used the term, 'economic bloc' in his paper written in 1989, but he rather favored the 'superbloc' instead of economic bloc.

term 'trade bloc'[28] used by some authors in the early 1970s has been largely replaced by the term, trading bloc. A criterion of a trading bloc is that there exists a discriminatory application of some form of economic policy among members of the grouping. Another criterion may be the existence of a discriminatory policy against nonmember countries. Since the definition of a trading bloc is couched in trade arrangements, the idea of 'natural' trading areas used by Paul Krugman[29] is not the same. In other words, natural trading areas are not official trading blocs because no political commitment exists. The prospective trading blocs mostly fall along the lines of natural trading areas. To illustrate, the basic elements of a trading bloc such as geographical proximity, homogeneity, and cultural similarity can be seen in certain natural trading areas. In daily life usage, trading blocs are known to concentrate on discriminatory border restrictions, mainly tariffs.

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[28]Ibid., p. 29.

Fred C. Bergsten, currently director of Institute for International Economics based in Washington D. C., also used the term, 'trade bloc' in his book published in the early 1970s; The Future of the International Economic Order: An Agenda for Research. Lexington, Massachusetts: D. C. Health and Company, 1973, pp. 208, 215. Furthermore, he still keeps using the term in a commentary (1991) even in response to Paul Krugman's paper (The Move Toward Free Trade Zones, 1991) which employs the term, 'trading bloc'.

Alan Oxley, managing director of International Trade Strategies based in Melbourne, also uses 'trade bloc' instead; "Folly of Trade Blocs", Far Eastern Economic Review, vol. 149, August 23, 1990, p. 60.

[29]Krugman, Paul, Geography and Trade. Cambridge, Massachusetts: The MIT Press, 1991, p. 20.

Correspondingly, trading blocs affect the quantity and prices of internationally exchanged commodities or factors of production.

A regional trading bloc and economic integration have a close relationship, but the terms are not synonymous. Economic integration subsumes the formation of regional trading blocs, and involves some of the trading activities and trading functions. The meaning of a trading bloc is more extensive as the frequent use of the term in reality suggests. A trading bloc has a political characteristic (i.e. a political commitment to regional organization or dilution of national sovereignty in favor of broader regional policies[30]). No matter how extensive the issue of a trading bloc is in practice, it can be dealt with within the scope of economic integration, since economic integration constitutes international cooperation.

The relations between a trading bloc and a free trade area, for example, are partly revealed in that the establishment of a trade bloc requires two measures: a reduction of trade barriers among members, and discrimination against the rest of the world.[31] The formation of a regional trading bloc is more concerned with a harmonization of trade policy of member countries.

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[30]Ibid., p. 2. In addition, Schott states three more basic characteristics: similar levels of per capita GNP, geographical proximity, similar or compatible trading regimes.

[31]Oxley, Alan, "Folly of Trade Blocs", Far Eastern Economic Review, v. 149, 23 August, 1990, p. 60.

However, as the formation develops, it tends to extend its initial trade policies so as to reach a higher consolidation, or integration. The most successful trading bloc, the EEC began as a common market which removed internal tariffs within its boundaries while establishing common external tariffs on trade with nonmembers. Currently it is approaching the status of a supranational authority which unifies internal and external economic policies of the member countries. Two other trading blocs are the North America bloc and the East Asia bloc.[32] These three blocs are called tripolar blocs or three superblocs[33] by some authors. They are also named as the Big Three by others (Bergsten, 1991, 35 and Brand, 1991, 158).

As an ongoing issue in the circle of commerce and

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[32]Finn Jr. states that " ... a world that seems to be grouping into three main trading blocs ... is an emerging reality. During the past two years, the broad outlines of these blocs have started to emerge." Finn Jr. Edwin A., "Sons of Smoot-Hawley", Forbes, vol. 143, iss. 3, February 6, 1989, p. 38.

Garten states that "In the late twentieth century, there is a strong tendency for three major parts of the world to form regional economic blocs-superblocs. There is one forming in West Europe, one in North America including Mexico and the Caribbean, and one in East Asia."

Garten, Jeffrey E., "Trading Blocs and the Evolving World Economy", Current History, vol. 88, January 1989, p. 15.

Thurow refers that "A single polar world economy centered around the United States has been replaced with a multipolar economic world in which Europe, Japan and the United States are nearly economic peers." Thurow, Lester C., "GATT Is Dead", Journal of Accountancy, vol. 170, September, 1990, p. 36.

[33]Refer to the above footnote. Garten, op. cit., p. 15.

business, Belous and Hartley[34] point out:

> While economic, political and technological forces have internationalized many markets, these same forces also appear to be expanding the role of regional trading blocs. The multilateral trading system, as embodied in the GATT since the 1940s, is not the only trade strategy currently being considered by governments, corporations and labor unions.

Belous and Hartley further note an interesting result of a survey done by the National Planning Association (NPA): 88 percent of the members of NPA policy committees, many of whom are chairs, vice chairs and presidents of leading American corporations (Fortune 500 corporations) believe that the global economy is shifting more in the direction of regional trading blocs. In addition, approximately 75 percent of them view the GATT system as being eroded by this trend. The GATT has attempted to establish the international rules of world trade ever since the postwar.[35]

From a somewhat different standpoint, Brand[36] refers to the trading bloc issue as follows:

> As the old world dies, a new one rises, for what we see today are the empires of trade... Our world today is dividing into trading blocs. Some have the superstructure

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[34]Belous, Richard S., Rebecca S. Hartley, ed, The Growth of Regional Trading Blocs in the Global Economy. Washington, D.C.: National Planning Association, 1990, p. vii.

[35]Ibid., p. ix.

[36]Brand, Joseph L., "The New World Order; Regional Trading Blocs", Vital Speech of the Day, vol. 58, Iss. 5, Dec 15, 1991, pp. 155-156.

> of nation states... These blocs, however strong or week, are growing all around the world.

In addition, Lester Thurow[37] states the issue clearly:

> If you look around the world at the moment, you see all kinds of places where we are essentially breaking up into trading blocs... Everybody in the world knows that this is happening, but nobody wants to face reality.[38]

He[39] is viewed to have guided policy makers in the public sector and business executives in the private sector, both of whom are facing a new international economic environment or new international economic order (NIEO). As he points out, casual observations of daily life can also lead to the confirmation of the phenomenon.

One way to approach the basics of regional trading blocs is to compare them with the GATT system. The GATT provides useful standards to distinguish some preferential

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[37]Sometimes called the John Kenneth Galbraith of his generation as one of the prominent economists in the current period and Dean of MIT's Sloan School of Management. Galbraith was born in 1908, and Thurow was born in 1938 exactly 30 years—one generation—later.

[38]Thurow, Lester, World Link, June 1989, p. 9.

[39]Along with this somewhat pithy remark, Thurow, as a freelance journalist, has continued publishing a number of columns relevant to the integration matter in various periodicals. In doing so, Thurow, is also called a futurist. For some major recent columns are as follows: Thurow, Lester C., "GATT is dead", Journal of Accountancy, vol. 170, September, 1990, pp. 36-39; "Economic Viewpoint: Europe's 1992 unification symbolizes end of a century", Electronic Business, vol. 15, December 11, 1989, pp. 20-21. Randall, Robert M., "Dean Thurow's "Historian of the Future" solves an economic mystery", Planning Review, vol. 18, iss. 4, Jul/Aug., 1990, pp. 40-47.

trade relations, since its cornerstone for commercial policies is basically free-trade oriented. Moreover, it requires all contracting countries observe the most-favored-nation (MFN) clause. The key principle and spirit behind the multilateral GATT system is nondiscrimination and free trade. The doctrine of the multilateral GATT system is often called multilateralism and, sometimes globalism.[40] On the other hand, the principle of regional trading blocs is preferential trading arrangements, and is reflected in regionalism (or bilateralism). Hence protectionism is implied in the spirit of regionalism with the contention that regional trading blocs may hurt worldwide free trade. The contention is, however, an ongoing controversial issue regarding the current trend of forming trading blocs in the global economy.

The opposite argument is that regional economic integration promotes free trade within a bloc and helps build a multilateral system through trade negotiations among a smaller number of larger regional groups in the long run. Instead, it is more difficult to reach an overall agreement

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[40]Promfret says that economists appear to favor the GATT approach to world free trade, though American policy-makers in the Congress are tilting towards the bilateral approach which sometimes accompanies trade threat and other trade retaliations or the like. Pomfret, Richard, "The Theory of Preferential Trading Arrangements", in the book of Jacquemin, Alexis and Sapir, Andre, ed., The European Internal Market: Trade and Competition, Selected Readings. Oxford, England: Oxford University Press, 1989, p. 63.

in multicountry trade negotiations.[41]

Belous and Hartley simplify the difference between multilateralism and regionalism as follows:

> Backers of multilateralism tend to base their views on concepts such as free trade, comparative advantage and economic liberalism. Backers of regional trading blocs—which often take the form of free trade areas, customs unions or sectorial agreements —favor free trade in certain cases but also often endorse what is called neomercantilism. They base their economic world view on concepts such as strategic trade theory, managed trade and economic nationalism rather than the traditional concept of comparative advantage.[42]

The GATT is the postwar guardian of liberalizing multilateral trade. The multilateral agreement—effective since 1948—sets forth general rules of conduct for trade among member countries. The objectives of the GATT[43] are to provide a forum for trade liberalization and the resolution of disputes on international trade among contracting parties. Though the GATT has made considerable contributions to the liberalization of world trade causing a

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[41]Pomfret notes that in a two-country model a negotiated agreement must be derived based on the Nash equilibrium outcome of a tariff war (Mayer, 1981). He also notes that in a multi-country world a negotiated agreement is not, however, easily derived because one country's imposition of costs on a partner country through tariff hikes leads to the numerous substitution of export market by the partner country. Pomfret, ibid., p. 63.

[42]Belous and Hartley, op. cit., p. ix.

[43]The number of contracting countries was 96 at the end of 1988, and 9 more countries were seeking accession. The number of membership has grown continually from the initial 23 parties in 1947.

remarkable increase in trade volume, a steady erosion has taken place since the early 1970s (Brock and Hormats, 148). An inadequate and weakened GATT has allowed the pursuit of alternatives to multilateralism and been weakened further by that pursuit. Protectionism has eroded the GATT taking the form of nontariff measures such as quantitative restrictions (quotas), trade-distorting subsidies, voluntary export restraints, etc.[44] Facing new protectionism and revealed trade distortions, the GATT is currently pursuing the Uruguay Round[45]—the eighth round of multilateral trade negotiations since its inception. The general objectives of the negotiations are to liberalize trade, and salvage the GATT.

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[44]According to the GATT (1984), developed countries employs more than 40 nontariff measures to obstruct international trade (Greenaway and Others, 224).

[45]In an attempt to strengthen the existing GATT system, a meeting of GATT trade ministers initiated the talks at Punta del Este in Uruguay on September 15-20, 1986. These negotiations conducted by 105 countries (108 by 1991) were originally scheduled to be completed by 1990 by the resulting Ministerial Declaration. Disputes between DCs and LDCs have arisen as to the opening of trade in services, which was favored by DCs. In addition, the issue of agricultural production subsidies being practiced in EC has been another obstacle to progress. Though the Uruguay Round negotiations have proceeded continuously as shown in the example of the ministerial-level midterm review in Montreal in December 1988, the talks have floundered for so long as implied by the overdue deadline—1990, and are still continuing.

TABLE I

A COMPARISON OF THE PRINCIPLES AND CHARACTERISTICS OF THE GATT AND THE REGIONAL TRADING BLOCS

GATT Principles and Characteristics	Regional Trading Bloc Principles and Characteristics
1. Trade is based on the principle of nondiscrimination.	1. Trade is based on the principle of discrimination.
2. All members are bound to grant as favorable treatment to each other as they give to any other member, i.e., MFN status.	2. Nations within the bloc share special preferences not granted to nations outside the bloc.
3. To the maximum extent possible, protection should be provided only through tariffs	3. Protection is often provided through quantitative restrictions as well as tariff.
4. Basic ideas include economic liberalism, multilateralism and free trade based on comparative advantage.	4. Basic ideas include economic nationalism or regionalism, bilateralism, and trade often based on strategic trade theory and neomercantilism.
5. The system is designed as a community open to all who are willing to follow membership rules.	5. The bloc may not be open to all who wish to join and are willing to follow membership rules.
6. The goal is to build a unified and integrated global system.	6. The bloc may function as an exclusive club that generates a "them versus us" psychology.
7. Under Article XXIV, the system provides a three-part test to determine if a regional trading bloc is consistent with the GATT.	7. In the view of some advocates, blocs are a way of building a stronger multilateral system in the long run.

Source: Belous, Richard S., Rebecca S. Hartley, ed, The Growth of Regional Trading Blocs in the Global Economy. Washington, D.C.: National Planning Association, 1990, p., 3.

CHAPTER III

REVIEW OF RELATED LITERATURE

Trade and Location Theory

A clear distinction must be made between location theory and regional economics. Location theory, a major part of regional economics[1], is the oldest branch of regional economics. Its history dates back into the nineteenth century.[2] The seminal contributors to the development of location theory are Weber, Hotelling, Thunen, and Losch. In 1911, Alfred Weber pointed out that classical trade theory completely ignored transportation costs involved in space.[3] Weber criticizes the classical trade theorists for "overlooking the large portion of

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[1]Regional studies that adopt the economic viewpoint may be considered as studies in regional economics. According to Vinod Dubey, regional economics is "the study, from the viewpoint of economics, of the differentiation and interrelationships of areas in a universe of unevenly distributed and imperfectly mobile resources ..." Dubey, Vinod, "The Definition of Regional Economics", Journal of Regional Science, vol. V, no. 2, 1964, p. 28.

[2]Richardson, Harry W., Regional Economics. Urbana, Illinois: University of Illinois, 1979, p. 53.

[3]Isard, Walter, Location and Space-Economy. Cambridge, Massachusetts: The M.I.T. Press, 1968, p. 50. He is well-known as the famous interpreter of Weber.

internationally distributed industry which is transport-oriented and which seeks the minimum transport cost point with respect to raw materials and market, and for attributing to international division of labor and capital the international distribution of transport-oriented industry".[4] Thereafter, other location theorists emphasized the interrelation of trade theory and location theory. However, until the publication of Ohlin's 'Interregional and International Trade',[5] integrating the two theories had not been successfully attempted.

One of Ohlin's aims is revealed in the following expression; "...to demonstrate that the theory of international trade is only part of a general localization theory, wherein the space aspects of pricing are taken into full account, and to frame certain fundamentals of such a theory as a background for a theory of international trade,..."[6] Though Ohlin is said to have first developed a general localization theory, he also faces criticism because of unrealistic hypotheses.[7] One agreeable critic keeps the viewpoint that Ohlin did not successfully bridge the gap between two theories, and thus did not make a unified

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[4]Ibid., p. 50.

[5]Ohlin, Bertil. G., Interregional and International Trade. Cambridge, Mass.: Harvard University Press, 1933.

[6]Ibid., p. vii.

[7]He is criticized for somewhat casuistry employed in his book.

theory.

Nevertheless, it is possible to view trade theory and general location theory or space-economy as synonymous. For this reason, the distinction between the two theories is sometimes regarded as a matter of definition. The reason for the two theories being seen as synonymous is enumerated as follows: "(1) location cannot be explained unless at the same time trade is accounted for; (2) trade cannot be explained without the simultaneous determination of locations."[8]

In economic integration, factors of location theory have been neglected in the theory of customs union. For instance, trade theorists have not dealt with transportation costs separately. They sometimes include transportation costs in the costs of production rather than recognize them as an independent element. By neglecting the location elements, they tend to overlook the advantages of geographical proximity in judging the desirability of economic integration. The trade theorists' standpoint is revealed in the following remark of Viner; "it is not evident that contiguity or proximity has sufficient economic significance of itself to justify special sanction for tariff preferences on that score."[9] Viner's viewpoint is also revealed in his cynical remark about Ohlin's dictum

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[8]Isard, op. cit., p. 53.

[9]Viner, op. cit., p. 122.

that international trade theory is nothing but international location theory. However, Viner's remark is viewed by Isard as unnecessary, and further evaluated that Viner got confused or failed to appreciate the scope of location theory.[10] On the other hand, Krugman, a trade theorist, admits that space matters. In addition, he states:

> The lines between international economics and regional economics are becoming blurred in some important cases. One need only mention 1992 in Europe: as Europe becomes a unified market, with free movement of capital and labor, it will make less and less sense to think of the relation between its component nations in terms of the standard paradigm of international trade. Instead the issues will be those of regional economics..."[11]

Trade Flow Models[12]

A time-series approach to the analysis of a single country's exports and imports is different from a cross-sectional approach to the analysis of international trade. A time-series approach evaluates quantitatively the separate influences of supply and demand on international trade. A cross-sectional approach does not pay attention to the separate influences of demand and supply. Since the cross-

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[10]Isard, ibid., p. 53.

[11]Krugman, Paul, Geography and Trade. Cambridge, Massachusetts: The MIT Press, 1991, p. 8.

[12]This section mainly reviews Leamer and Stern's book; Chapter 6 Theory and Measurement of Trade Dependence and Interdependence. Leamer, Edward E., and Stern, Robert M., Quantitative International Economics. Boston: Allyn & Bacon, Inc., 1970.

sectional approach deals with the analysis of trade for a number of countries at a single point in time, it is more appropriately cast in a general equilibrium setting. A time-series approach is more appropriately used in the analysis of the trade of a country, while a cross-sectional approach is more adequately employed in the analysis of multicountry trade flows.

Trade theory is somewhat different from trade flow theory in the sense that trade theorists have generally focused on a typical two-country model while neglecting multicountry trade flows. In a two-country world, the determinants of trade flows are the same as the determinants of imports. "Trade theorists have consequently offered few suggestions as to why pairs of countries become trading partners. Investigators of trade flows therefore have had to construct and test their own theories."[13]

Characteristics of trade flows in a general equilibrium setting are: (1) the use of cross-sectional data; (2) the exclusion of price, or exchange rate variables; and (3) the inclusion of static variables, or qualitative variables. The adoption of cross-sectional data is derived from the nature of inter-country trade flows. The exclusion of price variables is derived from the nature of the general equilibrium setting. In a general equilibrium world, prices are endogenous variables, and adjust to the point where

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[13]Ibid., p. 146.

quantity supplied is equal to quantity demanded. Thus prices are not an appropriate explanatory variable in a general equilibrium setting. Some authors, however, use a price-related variable, that is, exchange rate volatility (Brocker and Rohweder, 1990). For example, if exchange rate is used to reflect a set of attributes (i.e. a high and low volatility), it can not be treated as a price variable. The third distinguishing characteristic of trade flow models is the adoption of static or fixed variables such as geographic distance and preferential relations. Those fixed variables are improper in the analysis of a time-series data, because they do not vary considerably over time. In cross-section models, geographic distance has been readily used as a proxy for transportation cost. The difference between CIF[14](cost, insurance and freight) and FOB[15](free on board) trade values of an individual country is another proxy for transportation cost from a theoretical standpoint[16] The difference between CIF-expressed imports and FOB-expressed imports represents the cost of freight and insurance.[17]

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[14]A quotation of a price for goods covering the price from warehouse, and including delivery to the docks of an importer and insurance, but excluding delivery from the docks to the importer's premises.

[15]A quotation of a price for goods covering delivery only from the exporter's premises to a port where the goods are to be shipped. The remainder of the cost of delivery is to be borne by the importer of the goods.

[16]See Beckerman (1956) and Balassa (1961, 42).

[17]Refer to 'The Time-series Gravity Model' in Chapter IV.

The difference between the two trade values is changeable over time, therefore the difference between them can be used in a time-series analysis whereas the static distance variable can not (Geraci and Prewo, 1977). However, the geographic distance variable has been more frequently employed.

Leamer and Stern summarizes their theoretical trade flow model as follows:

(3.1) $V^x_i = V^m_i = F_i = f(Y_i)$

where V^x_i = the value of export of country *i*

V^m_i = the value of import of country *i*

F_i = the value of foreign sector

Y_i = the GNP of country *i*

The equation indicates that V^x_i equals V^m_i is also equal to F_i, and the value of the foreign sector, F_i is a function country *i*'s GNP. Since the above equation is too simple to reflect the reality, they modify the equation:

(3.2) $F_i = f(Y_i, E_i, U_i, R_i)$

(3.3) $V^x_i = g(F_i, B_i)$ $V^m_i = h(F_i, B_i)$

where B = a variable which reflects disequilibrium and capital flows. It stands for balance of payments.

E = resource endowment

F = general-equilibrium value of the foreign sector

R = general resistance to trade

U = utility or demand structure

Equation (3.2) shows that the size of the foreign sector in a general equilibrium is a function of GNP, resource endowment, demand structure, and trade resistance factors. GNP has an increasing effect on the size of trade flows while the other variables have a decreasing effect on the size of foreign sector. Equation (3.3) says that the actual value of exports or imports is a function of the value of the foreign sector and any current disequilibrium. As to the disequilibrium, it indicates that those countries that have more capital inflow than outflow due to accommodating adjustments in a disequilibrium period seem likely to have a trade deficit or greater imports. The opposite is true for the capital outflow case; a trade surplus most likely exists.

As pointed out, the above model is too general to be statistically applied. Thus, the authors suggest that since the three major variables, resource endowment, utility, and resistance to trade, collectively represent the influences, they should be more specifically delineated as long as data are available. They suggest using a specific variable that directly measures one of these influences. For example, as a resource endowment variable, they point out the following elements may be used; geographical area, capital stock, expenditures on research and development (R & D), average temperature, and average rainfall. They further add that:

To date this has not been the procedure

> followed. Rather, it has been argued that all countries have roughly the same resource endowments and demand structures except as the countries differ in population and income. Accordingly, population and income are used as proxies for resource endowment and utility structure.[18]

Population is associated with both the utility structure and the resource endowment. The rationale considers both the demands and supplies. On the demand side, countries with much greater population tend to have greater demands for home goods which otherwise could be exported. On the supply side, countries with a much smaller population will incline toward exporting more home goods, since a very small population indicates light demands for home goods.

There are two ways to measure a size of trade flows; one is to directly use the values of exports and imports as explanatory variables, the other is to determine jointly the levels of imports and exports, and the values of the trade flows by using more fundamental variables such as income and population.[19]

With regard to trade models, Leamer and Stern point out three kinds of models which have been used to depict trade flows. The first one is a gravity model. The name is used, since it is derived from the physical law of gravitation by social scientists. The gravity model indicates that "the

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[18]Ibid., p. 152.

[19]Ibid., p. 157.

flow of goods from country *i* to country *j* equals the product of the potential trade or trade capacity measured by *F*, the value of the foreign sector at the two points (F_i x F_j), divided by the resistance or distance (perhaps squared)."[20]

The second type of trade model, employed by Linnemann, is based on a Walrasian general-equilibrium model where each country has its own supply and a set of demands for the commodities of all other countries. In spite of the nature of the general equilibrium model, which implies trade flows depend on everything else, they believe that a particular trade flow between two countries would be most influenced by supply factors in the exporting country and demand factors in the importing country. As a result, the authors use a mathematical equation to describe this relationship;

$$(3.4)\quad V_{ij} = h(F_i, F_j)$$
$$= h[f(Y_i, E_i, U_i, R_i), f(Y_j, E_j, U_j, R_j)]$$

They also suggest that geographical distance (R_{ij}) as one kind of general resistance to trade (R) could be included in the equation to accommodate the level of trade resistance between country *i* and country *j*.

The third approach to trade flows is based on a probability model. This model is characterized by the fact that demanders are assigned to suppliers in a random fashion. It has the advantages that there are no statistical problems of heteroscedasticity and

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[20]Ibid., p. 158.

autocorrelation. However, further description of the probability model is not necessary, since it is not the model to be used in this study.

In addition, Taplin[21] examines four more trade models which primarily investigate "'the main relationships between the level of domestic economic activities in the various countries and their international transactions' so as to see how fluctuations in the former affect the latter."[22] However, these models (Metzler model, Neisser-Modigliani model, Polak model, and Rhomberg model) only focus on a specific interest excluding a general trade-impeding factor.

Review of Gravity Models

The gravity model, as an econometric tool in trade flow analyses, has had a long existing tradition beginning with Tinbergen[23] and Linnemann[24] It has been long recognized for its consistent empirical success in explaining many different types of flows such as human migration, tourist

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[21]Taplin, Grant B., "Models of World Trade", IMF Staff Papers, XIV, Nov. 1967, pp. 433-455.

[22]Ibid., p. 443.

[23]Tinbergen, Jan, Shaping the World economy: Suggestions for an International Economic Policy. New York: The Twentieth Century Fund, 1962.

[24]Linnemann, Hans, An Econometric Study of International Trade Flows. Amsterdam: North-Holland Publishing Company, 1966.

travel and commuting.[25] Papers on the application of the gravity model to international trade flows have been numerous beginning with Tinbergen. Some of the more frequently-quoted articles are Poyhonen (1963), Pulliainen (1963), Aitken (1937), Geraci and Prewo (1977), and Bergstrand (1985 and 1989).

Tinbergen regressed exports on several major explanatory variables in a set of cross-sectional empirical estimations. The first estimation used as explanatory variables nominal GNP of the exporting country, nominal GNP of the importing country, distance, a dummy variable for neighbor countries, a dummy variable for Commonwealth preference, and a dummy variable for Benelux preference. He used 1958 data from 18 countries. The first estimates were 0.74, 0.62, -0.56, 0.02, 0.05, and 0.04 respectively. All of the parameters were significant with $R^2 = 0.84$.[26] Table II shows the comparison of estimated parameters for GNP and distance variables which are to be reviewed hereafter.

The second estimation was regressed on the same three fundamental variables, a dummy variable for neighboring countries, and a dummy variable for preference using 1959

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[25]The gravity model has also been used in the field of political economy. Bergeijk and Oldersma applied a gravity model to explore potential consequences for the world trade system caused by Détente, and German Unification. For that purpose, they included dummy variables for East-East trade, East-West trade, and West-East trade.

[26]Tinbergen, op. cit., p. 270.

TABLE II

COMPARISON OF SOME ESTIMATED PARAMETERS
SUCH AS GNP AND DISTANCE VARIABLES

Author(s)	Year	Data	Year of Sample	Number of Countries	GNP Export Country	GNP Import Country	Distance	Transport Cost
Tinbergen	1962	X	1958	18	0.74	0.62	-0.56	
		X	1959	42	1.00	0.91	-0.78	
		X	1959	28	0.86	0.97	-0.86	
Linnemann	1966	X	1958-60	80	0.99	0.85	-0.81	
		I	1958-60	80	0.98	0.86	-0.77	
		X	1958-60	80	0.91(both combined)		-0.80	
		I	1958-60	80	0.92(both combined)		-0.77	
Geraci & Prewo	1977	X	1970	OECD(18)	0.86(GDP)	0.71(GDP)	-0.06	-10.2
Broker & Rohweder	1990	I	1983	86	-	-	-0.15	
Bikker	1987	I	1974	80	1.02	1.00	-0.89	
Brada &	1983	X	1954-77	46	0.36	0.13	-0.68	
Ménde	1985	X	1976, etc	46	1.03	0.15	-0.47	
Bergstrand	'85	X	1976,etc	OECD(15)	0.84(GDP)	0.69(GDP)	-0.72	
	1989	X	1976,etc	OECD(16)	0.6~1.59*	0.67~1.07	-0.37~ 1.85*	
Summary	1989	X	1982,etc	66	-	0.42(GDP)	-0.43	
		I	1982,etc	66	-	0.12(GDP)	-0.48	

Note: X = exports, I = imports, * indicates the parameter range of 9 same variables.

data from 42 countries. The estimates were similar to the ones of the first estimation (1.00, 0.91, -0.78, 0.24, and 0.47 respectively). All of the coefficients were significant with $R^2 = 0.82$. Tinbergen also estimated a third regression using a measurement of the degree of onesidedness of export products (lack of export diversification). He measured this with the Gini coefficient of export commodity concentration as well as the three same major variables (two GNP variables and distance). The parameter of the fourth variable (the Gini coefficient;[27] degree of onesidedness of export products) was -0.78 with a significant t-value. The parameters of exporter's GNP, importer's GNP, and distance variables have similar figures (0.86, 0.97, and -0.86) to the previous estimations.

Linnemann following the technique of Tinbergen regressed exports and imports separately on the origin country's GNP, destination country's GNP and distance. The two countries' populations were included as variables to reflect the demand or supply structure in the trade flow.

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[27]He used Michaely's method (1958) to calculate the Gini coefficient of export commodity concentration.

$$\sum_{j=1}^{n} \sqrt{\sum_{i=1}^{n} \left(\frac{X_i}{X_j}\right)^2}$$ Gini ratios over countries

where x_i = exports (imports) going to country *i*
X_i = total exports (imports) of country *j*
n = *n*th country

Three preference variables were also included (British Commonwealth preference, French Community preference, and Belgian and portuguese colonial preferences). Two main empirical results were presented from many estimates of the variables using the gravity model with three year average data (1958-1960) from 80 countries. For the case of exports, the results were 0.99, 0.85, -0.2, -0.15, -0.81, 0.94, 2.53, and 6.83 respectively with an $R^2 = 0.79$. All of the parameters show a significant level, and the sizes of the three major parameters have similar results to those of Tinbergen. In the case of imports, the parameters were 0.98, 0.86, -0.21, -0.14, -0.77, 1.27, 2.57, and 6.89. All the parameters are highly significant, and the $R^2 = 0.79$ is exactly the same as with the case of exports above.

In both cases, the parameters of GNPs and populations are not much different from each other, as is theoretically expected. Thus, he tried another estimation applying the condition of a bilaterally balanced trade (trade $flow_{ij}$ = trade $flow_{ji}$). By introducing the restriction that the parameter of the origin country's GNP is equal to that of the destination country's GNP. The parameter of the origin country's population is equal to that of the destination country's population. Linnemann shows the explained trade flow *i* to *j* is necessarily equal to that from *j* to *i*. The parameters in the case of exports are 0.91, -0.18, -0.80, 0.93, 2.51, and 6.80. Because of the restriction, the

number of parameters decreased from 8 to 6. The last three parameters represent trade preference variables in the same order as in the original estimation. In the case of imports, the parameters are as follows; 0.92, -0.17, -0.77, 1.27, 2.56, and 6.88. The parameters in both cases are similar to each other, and the R^2s are equal at 0.79. The values of the new restricted GNP coefficients are approximately equal to the average of the original GNP coefficients in the analyses of both exports and imports. The same is true for the parameters of populations. Thus, he concluded that "the trade equation can easily be made to describe a pattern of balanced trade flows, without too much reducing its accuracy or its power to predict".[28] Linnemann made a significant contribution to initiating the gravity-type approach to international trade flows by extensively exploring the issue of trade flows, and by providing many detailed econometric elaborations.

In the 1970s Geraci and Prewo (1977) utilized to regress exports on GDP_i, GDP_j, tariff, preference group, common language, bordering country, and a transport cost factor by using data from 18 OECD nations (a cross-sectional analysis in nature). The estimated parameters except for the intercept were 0.86, 0.71, -0.03, 0.64, 0.48, 0.10, and -10.17 respectively. The fundamental variables (GDP_i; the origin GDP, GDP_j; the destination GDP) are significant, and

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[28]Linnemann, op. cit., p. 87.

the parameters on tariff (-0.03), preference group (0.64), and common language (0.48) have the expected signs and their standard errors are relatively small. However, the standard error on the parameter of the dummy variable for bordering countries is relatively large. The value itself exceeds that of the coefficient, hence implying that it is not significant due to a low *t*-statistic. Geraci and Prewo argue that the relatively large standard error of the dummy variable for bordering countries may not be surprising, because as Linnemann has indicated, the bordering countries' effect is of minor importance.

The transport factor, as a quantitative resistance variable, is the ratio of the true CIF value to the true FOB value.[29] The factor is measured in two ways: first, the ratio of the observed CIF value for $export_{ij}$ (measured at *j*) to the observed FOB value for $exports_{ij}$ (measured at *i*) is used as a proxy for the factor; second, the factor is specified as a function of the geographical distance between the commercial centers of country *i* and *j*, and the average unit value of exports from country *i*. The transport factor increases at a decreasing rate with the geographical distance, and decreases as the average unit value of exports from country *i* increases. Preference group, common language, and bordering country variables are qualitative in

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[29]Refer to Footnotes 14 and 15 in the preceding section, 'Trade Flow Models'. The true values are not observable, so Geraci and prewo used the observed values.

nature. One thing to be noted is that the paper does not use geographical distance as a proxy for transport cost.

Broker and Rohweder[30] studied aggregated trade flows between 86 countries[31] (COMECON member countries were excluded). They first estimated five cross-sectional analyses using the full sample, then they estimated five cross-sectional analyses using a subsample covering all 21 western industrialized countries[32] out of the full sample. Focusing on barriers to international trade, they excluded the usual income and population variables. The five cross-sectional regressions include the years of 1968, 1972, 1976, 1980, and 1983. Thus there are ten regressions altogether: five for all 86 countries, and five for 21 industrialized countries. Since the regression on the subsample includes only 9 out of the 16 variables used in the full sample, only the empirical results on the full sample in the latest year (1983) will be reviewed here. The explanatory variables and their estimated coefficients are geographical distance (-0.154), the neighborhood dummy variable (0.740), the

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[30]Brocker, Johannes, and Rohweder, Herold C., "Barriers to International Trade: Methods of Measurement and Empirical Evidence", Annals of Regional Science, vol. 24, (Spring) 1990, pp. 289-305.

[31]Luxembourg is not counted, because it is combined with Belgium.

[32]Notably, Japan is not included in the group of industrialized countries.

language dummy[33] (0.415), the dummy variable for colonial relations in the year of 1914 (0.346), the dummy variable for colonial relations in the year of 1957 (0.516). By comparing the two dummies for colonial relations over a long period, we can tell that the two dummy variables are seen to reflect the perpetuation of close relations between countries and their former colonies. Ratio of the levels of development (0.014) is defined as a function of per capita income in countries *i* (YN_i) and *j* (YN_j). Specifically, the ratio is expressed as $\frac{\max(YN_i, YN_j)}{\min(YN_i, YN_j)}$ where max stands for a maximum per capita income out of the two variables, and min stands for a minimum. The ratio reflecting the difference in per capita income of two countries is used as a proxy for the difference between demand patterns in the two countries. They interpret the ratio of the levels of development:

> According to Linder (1961), two countries will trade the more with each other, the closer their demand structures resemble each other. A high similarity enables producers in both countries to adjust supply to demand structures in the other country. A negative coefficient of it would support Linder's hypothesis."[34]

The parameter of the variable indicating similarity of commodity structures between exports from *i* to *j* and exports

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[33]The dummy variable has the value one for a pair of countries with a common official or dominant language and the value zero otherwise

[34]Ibid., p. 299.

from *j* to *i* is 0.056. The similarity[35] is derived being based upon a commodity classification with 26 Standard Industrial Trade Classification (SITC) items. A positive coefficient is assumed to support Linder's hypothesis while a negative coefficient is assumed to support the Heckscher-Ohlin hypothesis.[36] The estimated coefficient is positive and thud supports Linder's hypothesis. Other variables included are volatility of the exchange rate (-5.001), the dummy variable for EFTA (0.324), the dummy variable for LAFTA (-0.340), the dummy variable for ASEAN (0.340), the dummy variable for CACM (0.124), the dummy variable for ECOWAS (1.655), the dummy variable for EC (0.410), the dummy variable for Commonwealth of Nations (-0.062), and finally the dummy variable for the Andean Group (0.170).

Bikker (1987)[37] studied aggregated trade flows between 80 countries for the year 1974. Though he employed Linnemann's procedure, he changed the model. He used both a

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[35]Technically, they assume that a trade flow is a vector in a space of 26 dimensions, and define the variable for the similarity of commodity structures as the cosine of the angle between the vectors representing exports from *i* to *j* and from *j* to *i*.

[36]Ibid., p. 299. The reasoning by the authors is that Linder's hypothesis "predicts higher trade flows between countries trading similar things in both directions, while the Heckscher-Ohlin hypothesis predicts complementarity of mutual trade flow; that is countries are thought to trade more if they have something different to offer, owing to different comparative advantages."

[37]Bikker, Jacob, "An International Trade Flow Model with Substitution: An Extension of the Gravity Model", kyklos, vol. 40, no. 3, 1987, pp. 315-337.

cross-sectional gravity model and an extended gravity model (EGM). The EGM is derived from supply and demand equations as an extension of the traditional gravity model. Since the empirical results of the EGM deviate from those obtained by the gravity model, the results of the latter will be reviewed.

The explanatory variables and their coefficients used in Bikker's analysis are GNP of importing country (1.014), population of importing country (-0.218), GNP of exporting country (1.021), population of exporting country (-0.203), distance (-0.891), a Suez variable (0.160),[38] the dummy variable for between the UK and its former colonies (2.991), the dummy variable for former Commonwealth countries (0.857), the dummy variable for between France and its former colonies (3.038), the dummy variable for former French colonies (2.212), the dummy variable for between Portugal and Belgium respectively, and their former colonies (5.904), dummy for neighboring countries (0.736), dummy for EEC (-0.226), and per capita income (-0.020).

The negative EEC parameter points to a level of EEC trade which is lower than the level of world trade, after

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[38]Ibid., p. 332. "The Suez canal blockade, which lasted until June 1975, has been employed to try to distinguish the physical effect of distance (transportation costs, insurance, deterioration of perishable goods, etc.) from the non-physical effect of distance (information and other costs due to differences in legislation, language, taste, etc). The so-called Suez variable is defined, as the additional distance which had to be covered because of the shipping blockade, divided by the normal distance covered before 1967, when the canal was open."

correction for the size of the countries, GNP and population and distance. The negative and insignificant coefficient of per capita income indicates that Linder's hypothesis is not confirmed.

Brada and Méndez (1983) estimated their model by pooling the observations over a 24 year period (1954-1977) from 46 countries. They focus on the effect of the formation of a preferential trading bloc on the volume of trade among member countries. Except for the 24 dummy variables for the pooled years, they obtained relatively lower coefficients on income (0.357 for $country_i$, 0.131 for $country_j$). They found contradicting larger positive coefficients on populations (0.899, 0.680), but the usual coefficient value for distance (-0.68). Other parameters tested were 5 preference groups; Andean Pact (0.346), Central Common Market (1.916), EEC (2.307), EFTA (2.095), and LAFTA (-1.476).

In a second regression, Brada and Méndez (1985) combined the 5 individual regional preference dummies into one regional integration variable, which gave them a reliable coefficient (4.494). The other coefficients were similar to those in the first regression. They added per capita income (0.136) and a deviant variable measuring the effect of distance on the trade augmenting power of a regional economic integration (-0.75). The deviant variable is derived by multiplying the distance variable to the preference dummy variable. Interestingly, the coefficient

magnitude of the regional integration-distance interaction variable is equal to that of the distance variable. Another deviant variable (regional integration-per capita income interaction variable) has a positive coefficient (0.136).

In a second paper (1985), Brada and Méndez further estimated trade flows from EEC, EFTA, CACM, LAFTA, and the Andean Pact as well as 18 countries (both developed and developing) belonging to no integration scheme. Since the technique and the range of variables are similar to the first paper, the results are consistently similar. Notably, the coefficient of the dummy variable for all preference groups increased among the 3 consecutive cross-section analyses over time (1970; 3.77, 1973; 4.68, 1976; 4.83).

Bergstrand (1985) estimated aggregate trade flow (exports) from 15 OECD countries for 4 consecutive cross-sectional studies. He obtained expected estimates for GNPs, distance, and expected signs for an adjacency dummy variable, an EEC dummy variable and an EFTA dummy variable from the four regressions (1965, 1966, 1975 and 1976). Bergstrand provided microeconomic foundations for the gravity model, and introduced different variables fit in this new framework. The variables and their coefficients are exchange $rate_{ij}$ (0.6 on the average of four estimations, and thereafter), country *i*'s export unit value index (-1.0), country *j*'s import unit value index (1.3), country *i*'s GDP deflator (-1.1), and country *j*'s GDP deflator (0.99).

In a second paper Bergstrand (1989) extended this work

by estimating disaggregated groups of trade flows according to one-digit SITC codes. He found that 40-80 % of the variation across countries in one-digit SITC trade flows is explained empirically by the generalized gravity model. The new variables included in the second paper are: the appreciation of importer's currency (the signs of the parameters are mixed according to SITC codes), the exporter's WPI—wholesale price index (the signs are mixed), and the importer's WPI (six parameters of the groups are positive).

Summary (1989)[39] investigated two years' US exports and imports (1978 & 1982) with trade partners in a political-economic model. In a gravity model, she incorporated 4 metric variables (arms transfer, political rights, civilian employees, and foreign agents) in addition to GDP, distance, and population. Her conclusion was that "Pure economic variables which reflect market forces are not the only factors affecting U.S. bilateral trade. Semi-economic and international political factors are also important."[40] The arms transfers variable she included had a positive coefficient (0.2; the average of 4 regressions). Thus indicated that the USA trades more with politically friendly countries. In other words, non-arms trade flows of

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[39]Summary, Rebecca M., "A Political-Economic Model of U.S. Bilateral Trade", Review of Economics and Statistics, vol. 71, 1989, pp. 179-182.

[40]Ibid., p. 181.

the USA are positively related to the amount of arms trade at a significant level.

As expected, the foreign agent variable had a positive coefficient (0.48, average). The variable indicates the number of foreign agents of country *j* registered in the USA. Summary viewed it as a measure of the degree of political alliance, that is, "country *j*'s opportunity to exert influence on American policy making and ability to establish contracts with American business."[41]

Expectedly, the civilian employees variable has a positive coefficient (0.13, average), since it reflects the number of US government employees in the USA's trading partners. An increase in this coefficient would raise the degree to which the USA is known to, and recognized by the people of country *j*.

The last variable, political rights has a negative sign (-0.12, average), but it is not statistically significant in any of the four regressions. As a result, she concluded that the statistical insignificance "may indicate that the United States is more interested in the "middle range" democracies, and rewards countries as they move from more to less repression. Or, it may simply indicate that American foreign policy does not significantly favor democratic regimes over autocratic or repressive governments."[42]

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[41]Ibid., p. 182.

[42]Ibid., p. 182.

From a theoretical perspective, some authors also contributed to the refinement of the gravity model by bridging the gap between theory and empirical work. Anderson (1979) provided a theoretical foundation for the gravity model by using the properties of expenditure systems which assume homothetic preferences across regions. Broker (1989) extensively surveyed the interrelations between gravity models and the price equilibrium theory of interregional trade. Niedercorn and Bechdolt (1969) provided a theoretical foundation within the framework of utility theory with regard to spatial interactions. However, Niedercorn and Bechdolt's theoretical foundation is not applicable to commodity trade flows, because the method was developed to focus on social spatial interactions. For example, people, not commodities are interacting (or moving) in pursuit of utility maximization.

Theoretical Framework of Gravity Model

Spatial interaction models are used to facilitate the explanation and forecast of social and economic interaction over geographical space. Batten and Boyce:

> Since the late 1940s, geographers and economists have actively promulgated theoretical and empirical research in which concepts drawn from Newtonian physics have been applied to the analysis of socioeconomic interaction in space. The resulting paradigm, known as the Gravity Hypothesis, is not so much a legacy of spatial economic theory but more a product of cross-disciplinary

fertilization.[43]

H. C. Carey defined the "gravity law" of spatial interaction by stating that "the degree of attraction varies directly with the mass, or concentration of persons or things, and inversely with distance."[44] This is based upon Newton's law of universal gravitation which states that the force of attraction, F between two objects i and j is proportional to their respective masses, m_i and m_j, and inversely related to the square of the distance, d_{ij} between masses. The gravity law as one of the spatial models which is used in behavioral science also describes "social phenomena in space, such as population migration, flow of goods, money, and information, traffic movement and tourist travel".[45]

A market area is one of subjects where the gravity law is extensively used. The definition and function of a market area (size) is a well-established terminology in the fields of marketing, industrial organization, and regional science. The use of gravitation to explain human spatial interaction was first suggested by H. C. Carey in the middle of the last century (1858). The force of attraction is an

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[43]Nijkamp, Peter, Handbook of Regional and Urban Economics Volume I Regional Economics. Amsterdam, Holland: Elsevier Science Publishers B. V., 1986, p. 358.

[44]Niedercorn, J. H. and Bechdolt, Jr. B. V., "An Economic Derivation of the 'Gravity Law' of Spatial Interaction", Journal of Regional Science, vol. 9, 1969, p. 273.

[45]Ibid., p. 273.

increasing function of two masses, and a decreasing function of distance. Mathematically, the formula is expressed as follows:

$$(3.5)\quad F_{ij} = \frac{km_i m_j}{d_{ij}^2} \qquad \text{where } k \text{ is a constant.}$$

This formula is usually modified when it is applied to socioeconomic interactions. The exponent of the distance variable will vary in the applied models of interactions, and is not necessarily fixed at two. Since spatial models are quantitative, they can be expressed in the form of mathematical equations. The typical dependent variable is a quantitative measure of the spatial phenomenon, and is specified to be a function of three variables representing two masses and the force of attraction. Needless to say, proxies for the three elements are used in empirical studies.

Two principal types of models have been developed using this approach: (1) the gravity model and (2) the potential gravity model. The gravity model is used to estimate the number of interactions between two geographical areas or between two points of space. The potential gravity model is used to measure the potential interaction derived by a set of masses on a given point in space or on an area. The total potential at the point i (V_i) is given by

$$(3.6)\quad V_i = k\sum_{j=1}^{n} \frac{m_j}{d_{ij}^c}$$

There is a relationship between the gravity model and the

potential gravity model. Where the gravity model is concerned with the interaction between subarea i and subarea j[46], the potential gravity model deals with the interaction between a single subarea and all other subareas.[47] Thus we would derive the interaction of subarea i with the first subarea (i.e. F_{i1}), the interaction of subarea i with the second subarea (i.e. F_{i2}), ..., and finally the interaction of i with the last of nth subarea (i.e. F_{in}). By adding all the interactions, we obtain the following equation.

$$(3.6.1)\quad F_{i1} + ... + F_{in} = k\frac{m_i m_1}{d_{i1}^c} + ... + k\frac{m_i m_n}{d_{in}^c}$$

By using the summation signs, we change the equation to

$$(3.6.2)\qquad \sum_{j-1}^{n} F_{ij} = k\sum_{j-1}^{n} \frac{m_i m_j}{d_{ij}^c}$$

Since m_i can be factored out from the right-hand side of the two equations, we obtain the following equation by dividing both sides by m_i,

$$(3.6.3)\qquad \sum_{j-1}^{n} \frac{F_{ij}}{m_i} = k\sum_{j-1}^{n} \frac{m_j}{d_{ij}^c}$$

By letting just the above left-hand side of the equation be

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[46] $i \neq j$. That is, subarea i is not identical to subarea j.

[47] According to Table III in the following page, the potential gravity model falls into the category of single-origin with multiple-destination or single-destination with multiple-origin within the range of cross-sectional gravity model.

V_i, the potential gravity equation (3.6) in the above is derived:

$$(3.6.4) \qquad \sum_{j-1}^{n} \frac{F_{ij}}{m_j} = V_i$$

$$(3.6.5) \qquad V_i = k\sum_{j-1}^{n} \frac{m_j}{d_{ij}^c}$$

Equation (3.6.5) is exactly the same as equation (3.6), and it is the basis of potential gravity model as a variation of the gravity model.

A variety of gravity models can be classified according to "(1) the type of data used, (2) the type of interaction being studied, and (3) the point of view from which the interaction is being studied" (Niedercorn and Bechdolt, 1969, 274). Table III shows a comprehensive view of gravity models. In empirical studies, the type of a particular gravity model is determined by the kind of estimation technique, and the type of interactions. For example, in light of interactions this study adopts bidirectional trade flows, because exports from country *i* to country *j* and exports *j* to *i* are combined to constitute a trade $flow_{ij}$. Since a set of bidirectional trade flows is first taken into consideration, cross-sectional or time-series techniques are used. In addition, a given cross-sectional regression determines the type of interaction and the type of link automatically. This is called the Multiple-link Model. The Single-link Model corresponds to the bidirectional time-

series model as shown in the bottom row of Table III.

TABLE III

CLASSIFICATION OF GRAVITY MODELS

Type of Interactions	Type of Data	
	Cross-sectional	Time-series
Unidirectional	Origin-centric Models Single-origin with Multiple-destination Multiple-origin with Multiple-destination Destination-centric Models Single-destination with Multiple-origin Multiple-destination with Multiple-origin	Single-link Model
Bidirectional	Multiple-link Model	Single-link Model

Source: Niedercorn, J. H. and Bechdolt, Jr. B. V., "An Economic Derivation of the 'Gravity Law' of Spatial Interaction", Journal of Regional Science, vol. 9, 1969, p. 274.

CHAPTER IV

PRESENTATION OF THE MODEL

Introduction

The purpose of this chapter is to present the empirical analyses of the models surveyed in Chapter III. Since this study focuses specifically on the spatial approach to the formation of trading blocs, two gravity models are employed. The gravity models presented in Chapter III contain a few fundamental quantitative variables and various qualitative variables, some of which are expected to explain the formation of trading blocs. In this chapter there are two separate gravity models: a cross-sectional gravity model, and a time-series gravity model. A linear version of the two gravity models is developed in this chapter, and the ordinary least squares estimates are presented. The cross-sectional gravity model is developed in detail to empirically test the current formation of regional trading blocs. Thus, related techniques of the regression analysis and explanations on the framework of the model are also presented.

The Cross-sectional Gravity Model

The Model and Its Setup

The trade flow equation discussed in Chapter III now faces empirical testings to see how well reality fits the theory. As discussed previously, this job can be performed appropriately in a cross-sectional analysis. The cross-sectional study takes the form of a multiple regression analysis of a single equation. International trade flows are taken as the dependent variable to be regressed upon a number of independent variables that will be discussed in detail in this section. The goal of the regression analysis is to test whether some relevant explanatory variables explain the current trend of regional economic integration.

The Year Selected for the Study. Data for the year of 1988 are chosen as the basis for research. There are several reasons why the particular year is chosen. First, the decade of the 1980s is the latest decade since World War II that shows the overall cumulated outcome; international economic integration. Second, 1988 is the most current year with available data. Most data used in the study are, however, available for more recent years except the data on the direction of international trade. Third, by using the data as recent as possible, this study will provide more meaningful insights into the ongoing trend of how trade blocs are formed. This will also allow a better comparison of the differences between the landmark empirical results of similar studies done in the 1960s.

International Regions and Countries Included in the Study. It is necessary to survey the definitions of 'region', and select the appropriate ones to be used as a standard classification for the models. The notion of a region, either within a single country or an international region of the world comprising a number of countries, has provided a distinguished tool in the analyses of socio-economic and political research. In the field of international relations, the characteristics of a region are best expressed according to Russett:[1] "Like most ancient implements, originally designed for specific purposes by their inventor, it fairly soon was discovered to be an instrument useful for a wide variety of tasks—chopping, splitting, shaving, and smoothing diverse bodies of sociological data. In time, different workers refined the tool for particular tasks."

Regional economics provides various definitions of 'region'. The usage of the term, however, has several alternative definitions in academia and in the real world. This necessitates a proper definition of region in line with the setup of the gravity model.

The classical method of conceptualizing regions in regional economics is based on three types: homogeneous

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[1]Russett, Bruce M., International Regions and the International System: A Study in Political Ecology. Chicago: Rand McNally & Company, 1967, p. 1.

regions, nodal (or polarized) regions, and planning (or programming) regions. Harry Richardson[2] states:

> The homogeneous region implies that areas cohere together to define a region if they are homogeneous from the point of view of sharing predetermined key criteria. The shared characteristics might be economic, geographical (similar topography or climate, common natural resource), or social and political (a regional 'identity', a common historical development, or allegiance to a particular political ideology).

One might simply find a natural region produced by a definition based upon geographical isolation or separateness. But many social scientists including geographers would not accept this definition. Thus the first type of regions should be areas of relative homogeneity.[3] Secondly, the nodal region deals explicitly with human activities within regions of geographical dimension.

For the nodal region, Richardson states:

> The criterion for including a small area within one region rather than another is whether this area has stronger linkages with larger centres within the region than with other large centres outside. Each region will have one or more dominant nodes (e.g. regional metropolises), and principles of dominance may be used to establish whether peripheral areas fall within the boundary of this region or within another."[4]

The nodality criterion reflects a higher degree of

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[2]Richardson, Harry W., Regional Economics. Urbana, Illinois: University of Illinois, 1979, p. 19.

[3]Russett, op. cit., p. 2.

[4]Richardson, op. cit., p. 21.

interdependence within a region, since nodes are the areas where people are bound together by mutual dependence because of common interests. This definition of a region according to loyalties or patriotism is also well revealed in the following quotation: "an area of which the inhabitants instinctively feel themselves a part".[5]

Finally, the planning region is usually conceived as an area over which economic decisions and policies apply, and varies according to the size of the project or plan. It is also a region over which policy instruments apply, and political or administrative control is placed. In other words, a region is an area of administrative convenience or "a device for effecting control".[6]

As shown in Table IV, delineating an international region relies largely on the first two definitions of regions. The seven regions analyzed in this study are North America (USA, Canada, Mexico), Far East Asia (Japan, Korea, China, Taiwan, Hong Kong), Europe (12 European Community member countries, plus four EFTA countries), Southeastern Asia (five ASEAN member countries), the Oceanian region (Australia and New Zealand), South America (ten member countries of LAFTA or currently the 5 member Andean subregional group or both), and Southeastern Africa (South Africa, Mozambique and three former EACM countries).

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[5]Russett, op. cit., p. 3.

[6]Ibid., p. 3.

TABLE IV

INTERNATIONAL REGIONS AND THEIR COUNTRIES

No	Region Name	Included Countries and the Number
1	North America	USA, Canada, Mexico (3)
2	Far Eastern Asia	Japan, Hong Kong, S. Korea, Taiwan, China (5)
3	Europe	Germany, France, UK, Italy, Spain, Netherlands, Belgium (Luxembourg), Switzerland, Sweden, Austria, Norway, Denmark, Finland, Ireland, Portugal, Greece (16)
4	Southeastern Asia	Singapore, Malaysia, Thailand, Indonesia, Philippines (5)
5	Oceania	Australia, New Zealand (2)
6	South America	Brazil, Venezuela, Argentina, Chile, Colombia, Peru, Ecuador, Uruguay, Bolivia, Paraguay (10)
7	Southeastern Africa	S. Africa, Kenya, Tanzania, Uganda, Mozambique (5)

Though there exists a variety of international regions, large or small. In the world, these seven regions are selected on the grounds that most of them are geographically separated by long distances from one another. Therefore, each group has its own economic, political, and geographical characteristics that are distinctive from the others. Since separateness is a primary criterion, a topographic factor was also taken into consideration. All of the regions are

to represent distinct regional trade concentration at least in a broad sense. The least integrated is the Southeast African region where Kenya, Tanzania, and Uganda once formed a common market of five countries in the region. Once specific regions have been chosen, the selection of countries in the regions is made with ease.

The first three of seven regions are selected as representative trading blocs which have been frequently referred to as the tripolar regions.[7] This is especially true in the business world with respect to trade, marketing and regional integration. All of the countries in the Caribbean Sea and Central America are excluded from North America, because (1) they are geographically separated from the three major countries; (2) they are small in size; and (3) they are currently not considered to be prospective members of the North America Free Trade Area (NAFTA).[8]

In Europe, the socialist countries are excluded, because (1) economic integration between the Western European countries and the Eastern European countries had not yet been well-developed in 1988; (2) they have data deficiencies; and (3) the Eastern Bloc countries are not members of the EEC or the EFTA.

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[7]Garten states that "In the late twentieth century, there is a strong tendency for three major parts of the world to form regional economic blocs", and calls them superblocs. Refer: Garten, Jeffrey E., "Trading Blocs and the Evolving World Economy", Current History, vol. 88, January 1989, p. 15.

[8]See p. 1 of this study.

ASEAN, and the Andean Group or LAFTA countries are selected because they have formed a trading bloc and they are, as a regional group, spatially separated from other blocs and each other respectively. Since the ASEAN countries are relatively closer to the Far Eastern Asia group in some respects, they are called the East Asia group together with the Far Eastern countries by some authors, or considered part of the Pacific Rim in Asia. An adjustment of the delineation of regions with regard to geographical proximity may be needed in this study too, that is, combining the ASEAN member countries with the Far Eastern countries. It is worthwhile to note that Malaysia recently led a move to form the East Asia Economic Group including ASEAN countries, Japan, Korea, Taiwan and Hong Kong. The proposal, however, was not fruitful due to the negative position of Japan and the United States. The Andean Group is similarly combined with the LAFTA in the South American Continent.

The Oceanian countries are included, because (1) they are members of the Organization for Economic Cooperation and Development (OECD); (2) geopolitically and culturally, they are of Anglo-Saxon origin, hence different from the Asian Continent; and (3) geographically they are considerably separated from the ASEAN. Considering the fact that the economic center of Australia is located in the southeastern part of the nation, it is geographically separated from Indonesia, the closest ASEAN nation. However, an adjustment

may be required as done in the case of ASEAN, because Australia is relatively closer to ASEAN, and two Oceanian countries in the Pacific Rim region are members in the Asia Pacific Economic Cooperation (APEC).[9]

Finally, in the African Continent, the southeastern region is selected instead of the alternative western African region which includes the Economic Community of West African States (ECOWAS). In similar fashion, the Southeastern region includes the EACM[10] three countries of which once displayed a considerable regional integration. Though two regions are geographically separate from the already-chosen six regions, the selection of southeastern Africa over Western Africa is because (1) the southeastern region has a relatively clearer region delineation; (2) the southeastern region embraces a relatively smaller number of countries which are larger than most countries in the West African region in terms of size; (3) the southeastern region includes South Africa which is Africa's most industrialized country with a relatively larger trade volume; and (4) the southeastern region has a smaller variation in geographical distances compared with all other six regions. Despite the above-mentioned reasons, a somewhat subjective selection of

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[9]The third ministerial meeting held on November 12-14, 1991 in Seoul was participated by 15 countries; 5 ASEAN countries plus Brunei, 5 East Asia countries, 2 Oceanian countries, and two countries from North America (the U. S. and Canada).

[10]Refer to 'Examples of Economic Integration' in Chapter II (Footnote 11).

region was inevitable in Africa.

The 46 countries included in this study comprise all of the G-7 countries, 22 OECD countries excluding Iceland and Turkey, all 5 members of the ASEAN, all the South American Continental countries except for peripheral Guyana, Surinam and French Guiana, all the Oceanian countries, some major Southeastern African countries including South Africa, and finally 3 major North American countries. All advanced or Western countries with the exception of Iceland and four newly-industrialized countries (NICs) are included in the analysis. All of those industrial countries belong to the tripolar trading blocs.

Treatment of the Trade Flows. The trade flow variable used in this study is obtained by adding a country's import from and export to other countries included in the sample. In trade theory, conventional trade flow models deal with exports and imports separately. In other words, exports and imports are regressed in a different empirical task. A separate treatment of exports and imports is also supported by the theoretical background of the gravity model. As shown in Table III in Chapter III, the unidirectional interaction model handles exports and imports separately as its name implies, and gravity models applied in socio-economic studies usually employ this type of model. Unidirectional gravity models are similar to trade flow models that analyze export and import data separately with

respect to the employed explanatory variables; trade-governing GNP and geographical distance. In trade flow models, geographical distance is viewed as a trade impediment variable while it is regarded as a decreasing factor of gravitation in the gravity model.

On the other hand, the method of dealing with exports and imports here is to combine the unidirectional interactions in order to obtain a bidirectional gravity model as Table III indicates. A model dealing with bidirectional trade flows in the same framework of the unidirectional interactions departs fundamentally from a prototype of the trade flow model, and falls into the category of gravity models.

From the standpoint of trade theory, the sum of exports and imports is equal to the volume of trade. Paul Krugman and Elhanan Helpman[11] define the volume of trade (VT) in the deviant 2 x 2 x 2 model with two differentiated products as follows:[12]

$$(4.1)\quad VT = s(X_1^* + pX_2^*) + s^*(X_1 + pX_2)$$

where * stands for the foreign country. s (s^*)

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[11]Krugman, Paul R., and Helpman, Elhanan, Market Structure and Foreign Trade: Increasing Returns, Imperfect Competition, and the International Economy. Cambridge, Massachusetts: The MIT Press, 1985, Chapter 8; Trade Volume and Composition, pp. 159-178.

[12]Ibid., pp. 163-164. Simpler 2 x 2 x 2 models are also presented in the same chapter; a model with the home country an exporter of X_1 and the foreign country an exporter of X_2, and the other model with both the home and foreign countries exporters of X_1 and the home country an importer of X_2.

means the share of the home (foreign) country in income and spending of the two-country world. X_1, X_2 are industries I, II, and p is the price of X_2 (output of industry II). So X_1 is the numeraire. The above equation is rewritten as:

(4.2) $VT = s(GDP^*) + s^*(GDP)$

where $GDP^* = X_1^* + pX_2^*$, $GDP = X_1 + pX_2$

Furthermore, Krugman[13] empirically uses the volume of trade as a dependent variable in a crude gravity model[14] to inspect the magnitude of the strength of natural trading blocs.

Aside from the theoretical basis backed by trade theory and the gravity model, the bidirectional model has a number of advantages: (1) it indicates the overall interaction between any two countries that can not be captured by exports and imports separately; (2) it reduces a considerable amount of missing data, which is inevitable in unidirectional models, without any deterioration of the

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[13]Krugman, Paul R., "The Move Toward Free Trade Zones", Economic Review (the Federal Reserve Bank of Kansas City), vol. 76, iss. 6, (Nov/Dec) 1991, pp. 5-25. As far as we know and have investigated up to now, he is the only researcher who has ever used the volume of trade as a dependent variable in the gravity model.

[14]The sample is limited to only G-7 countries. Without key-point distance variable, two dummy variables for a regional group are employed as explanatory variables in addition to two countries's national income only. Notably, income is expressed as a product form (i.e. Y_iY_j) even after a logarithmic transformation.

theoretical essentials;[15] (3) it also reduces the computational work by applying a single equation of trade flows, unlike unidirectional models which have two equations with each for exports and imports; and (4) it has a smoothing function for the trade flow data which averaging exports and imports thus damping serious fluctuations in less-developed countries with lower trade volumes. The serious fluctuations result from imperfect data collection as well as the world market instability of primary products. For example, agricultural products are dependent on weather causing a fluctuation in its exports. Though 47 countries were originally selected, the actual number of countries used is 46. Luxembourg, the smallest country in the sample of European countries, does not have its own separate data on trade flows from the "Direction of Trade Statistics" Yearbook published by the IMF. Luxembourg is, however, included in the analysis of this study because its data are combined with those of neighboring Belgium to which Luxembourg is closely related in many ways.

The 46 nations consist of a total of 2070 potential trade flows between all pairs of two countries,[16] but the number of trade flows are reduced by half to eliminate the duplication of trade flows between each of the two

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[15]The trade flow data expressed as trade volume reduce missing data more than exports or imports data do, because one country's trade volume is the sum of its exports and imports.

[16]The number of trade flows, 2,070 is easily calculated by 46 x 45.

countries.[17] For countries in which 1988 data are unavailable, either three-year average values for 1987-1989 or, in rare cases, five-year averages from 1985-1989 were utilized. The minimum trade value reported in the Statistical Yearbook is 100,000 US dollars.[18] This means that any trade flows less than 50,000 US dollars are rounded off and dropped out of the data source, making the data "not available (NA)". However, because the three-year average is utilized, just some of the calculated trade flows less than 50,000 US dollars show up as raw data. The value of a trade flow with zero exports and imports can exceed the minimum amount if the trade value around the year 1988 is extraordinarily big enough to raise the average of the trade flow. In case one of the two trade values (exports or imports) is not zero, the smoothing method has not been applied, since the other non-zero value, no matter how small it is, guarantees a non-zero trade flow.

Out of 1035 potential trade volume observations, only 38 observations as shown in Table V, are not available due to missing data or trade embargoes. Thus 997 international trade flows are used as the observations for the dependent variable in this study.

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[17]The value of one country's exports (imports) are theoretically identical to the value of trading partner country's imports (exports). Thus double accounting leads to a drop of identical trade flows.

[18]For larger countries, the unit of trade value is greater; millions of US dollars.

If there are any missing data, or data with a zero value due to a rounding of less than 50,000 US dollars, then the number of observations decreases. The observations are first collected from larger countries' trade statistics in terms of total trade volume, in a descending order. In other words, the largest country is first utilized to collect 45 pairs of bidirectional trade flows, then the second largest country is used to collect 44 pairs excluding the pair with the largest country, and so on. This approach is taken, because the larger countries usually have more accurate, and reliable data.

It is meaningful to see the source of zero trade flows. By and large these flows occur in smaller countries whose trade statistics tend to be too small to be recorded and reported to the relevant international institution. The other source is political as no trade flows exist between China and Taiwan, or between China and S. Korea because of the decades-long ideological conflicts that deepened throughout the Korean War (1950-1953). Another political source is the zero trade value between China and S. Africa, because the Apartheid policy—S. Africa's internationally well-known racial discrimination policy—which caused a trade embargo by China.

Treatment of GNP. According to the gravity model, socioeconomic interactions between two regions are reflected by a gravitational force or attraction. Income and

TABLE V

COUNTRIES WITH ZERO TRADE VOLUME AND THEIR COUNTERPART COUNTRIES

Trade Ranking	Countries	Counterpart Countries and the Number
45	Uganda	Mexico, Venezuela, Chile, Columbia, Peru, Ecuador, Bolivia, Paraguay, Uruguay, Mozambique (10)
44	Mozambique	Venezuela, Chile, Colombia, Ecuador, Bolivia, Paraguay (6)
43	Bolivia	Greece, Philippines, Kenya, Tanzania (4)
42	Tanzania	Mexico, Venezuela, Chile, Colombia, Ecuador, Paraguay (6)
40	Kenya	Venezuela, Chile, Peru, Ecuador, Uruguay, Paraguay (6)
25	S. Africa	China, Tanzania, Mozambique, Uganda (4)
14	China	S. Korea, Taiwan (2)

population of two regions are equivalent to the two masses in the original gravity law in physics. As the proxy for international economic interactions is assumed to be trade volume between countries, the proxy for masses is assumed to be each country's GNP.

In fact, GNP is one of the main factors determining the size of a foreign sector in the simplest trade model. As a component of a country's potential trade, GNP has been frequently used in its relevant analyses, and sometimes used as a proxy for income or national income. Thus, GNP is

hypothesized to determine the size of trade flows. The second hypothesis regarding a set of GNP variables is that the GNP of a larger economy influences trade flows more than the GNP of smaller economy. To test this hypothesis, GNP data from a larger economy in each pair of countries are specified to be an origin GNP variable in comparison to other studies in the estimation. If larger GNP observations are employed as the origin GNP, its magnitude is believed to be greater than the magnitude of the destination GNP variable. This hypothesis relies on the fact that the size of a foreign sector or foreign trade is a function of GNP in the simplest trade model.

As a variable similar to GNP that represents masses in the gravity model, population is undoubtedly not the proper variable to measure the attraction force in this study. It is, however, a well-recognized principal factor used as a proxy variable for determining social interactions such as human migration, and tourist travel, etc.[19] Though national population is not conceived of as a mass, it will be discussed later, because it affects the foreign sector, or foreign trade by determining the size of the domestic country's market.[20]

In this study based on the gravity model, GDP can be

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[19]See the section, "Theoretical Framework of Gravity Model" in Chapter III.

[20]See the section, "Trade Flow Models", in Chapter III.

used instead of GNP.[21] However, this study utilizes GNP instead of GDP. The main reason is that the included countries have more GNP statistics than GDP statistics. However, GDP observations are alternatively used in five countries[22] where GNP statistics were not reported in 1988. Secondly, the differences are not big in most countries, and those countries showing a big difference—a so-called enclave economy—are not covered; representative nations are Saudi Arabia, Nigeria, and Liberia. Most oil-exporting countries which have an extremely high foreign sector ratio that rely largely on the revenue from oil, fall into this category. According to Linnemann's study covering 80 countries in the early 1960s, 27 out of 52 countries having both GNP and GDP statistics showed differences of less than one percent. Moreover, another 12 cases showed differences of less than two percent.[23]

There are a number of statistical sources for GNP data: some of them are the World Factbook by the Central Intelligence Agency, both the World Bank Atlas and World Development Report published yearly by the World Bank, and the International Financial Statistics Yearbook (IFS Yearbook) by the IMF. The GNP observations in this study

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[21]Krugman and Helpman, op. cit., p. 164. As stated earlier in the subsection, they theorize that the trade volume depends only on relative country size in terms of GDP.

[22]Hong Kong, Bolivia, Mexico, Finland, and Argentina.

[23]Linnemann, op. cit., p. 68.

come from the IFS Yearbook 1990. Most of the GNP observations are converted into millions of United States dollars. Technically, the GNP data are computed by the use of Line "af" which appears in the Yearbook to indicate the Market Rate/Par or Central Rate. This is calculated according to a year-average exchange rate.[24]

Treatment of Land Area. Land area expressed in square kilometer (km) is assumed to represent a proxy for the size of the market area of a country. According to location theory, a market area is the area where one firm producing a homogeneous good sells its products exclusively against other firms producing the same homogeneous good. In this context, the geographic limit for selling a good or service depends on its delivered price. Economies of scale, income, transportation costs influence the geographic limit. The greater the production required to achieve economies of scale, the greater the market area required. An increase in income implies that the geographic limit necessary for a sufficient market decreases, other things being equal. An increase in transportation costs reduce the geographic limit of a market area, and vice versa.

If two firms are producing the same good at the same

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[24]IFS yearbook states in the introduction (p. 4); "The "a" lines, Market Rate/Par or Central Rate, provide conversion factors that report market rates in preference to 'par' rates, i.e., official rates, or par value or central rates, agreed with the Fund, at all dates so far as data are available." Note: "a" line has 'ae' and 'af", and 'ae' indicates an exchange rate at the end of a year.

cost, then the market boundary would be drawn at the midpoint between the firms. Thus a firm producing the same homogeneous good cheaper than other firms has a larger market area. Assuming the same production cost, the important factor to decide the size of the market is the distance between a firm and its buyers, because the freight rate per unit of distance is the same for a homogeneous good. By the same analogy, a national territory may be regarded as an "ideal economic region" with the assumptions of an unbounded homogeneous plain, and no topographical barriers where transport costs are proportional to distance.

Furthermore, the global space is assumed to be roughly an ideal international economic region in this same way. Though overseas or foreign markets are not contiguously homogeneous due to institutional barriers (i.e. tariffs, and other trade restrictions, etc.) and topographical barriers (seas or oceans), the degree of difficulty to which an international trade flow occurs is not too high to make the flow impossible. This fact is supported by world trade in general, and the existence of international marketing in the private sector. The assumption is, therefore, extended such that the concept of a market area is applied not only within a national boundary but also outside this boundary. One difference is that at the entrance to the foreign market, non-transportation costs such as tariffs, are incurred if quantitative trade restrictions (i.e. quotas) do not exist.

This assumption implies that a larger land area may

mean a larger domestic market area. A country with a larger domestic market area tends to be more self-sufficient, hence having a lower foreign trade ratio out of GNP. This will be tested in the empirical work.

The other assumption regarding a land area is derived from its natural resources. A country which possesses certain natural resources that are not available in other countries may have an important impact on the role of its foreign sector. A country specializing in an industry in which it has abundant resources will be conductive to an increase in its products. The increased production will be channelled into either reducing imports or expanding exports. This assumes that the possession of a variety of natural resources leads to a more self-sufficient situation. This assumption is indirectly supported by Leamer and Stern[25] as the literature review in Chapter III has already pointed out.[26] They state that geographic area is one of the variables which might be able to measure the amount of resource endowment of a country. Furthermore, even weather-related variables such as average rainfall and average temperature can represent natural resource endowment. The rationale for land area as a proxy for natural resources is the usual argument, but this has been accepted in only

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[25]Leamer, Edward E., and Stern, Robert M., Quantitative International Economics, Boston: Allyn & Bacon, Inc., 1970, p. 152.

[26]See 'Trade Flow Models" in Chapter III in this study.

certain cases.

These two assumptions that the size of the country's land area may play a role as a proxy for a market area, and that a larger land area tends to be linked with a lower trade ratio of GNP[27], lead to the expectation that land area is a significant variable explaining the negative international trade flows. However, this assumption contradicts Linnemann's argument[28] that "it is concluded that the incorporation of the size of the territorial area in the analysis of a country's potential foreign supply would contribute little or nothing to a systematic explanation of this magnitude."[29]

Others argued that all countries have roughly similar natural resources except for differences in population and

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[27]This is derived by the division of one country's trade volume by its GNP, and also called an index of openness.

[28]Linnemann, op. cit., p. 24.

[29]The reasons he provided for reaching this conclusion are as follows; "The limited importance of natural resources in determining the extent of a country's participation in world trade is one of the reasons for disregarding the land area of a country as a trade-explaining variable in our analysis. A second reason is that natural resources are by no means equally distributed over the surface of the earth, so that a bigger country (in terms of national territory) has not necessarily more natural resources, or even more balanced resources, than a smaller country... Thirdly, natural resources—particularly those resources contributing to the satisfaction of primary needs—have had a great impact on the distribution of population over the world, in the course of time; the distribution of population is not independent of the distribution of (a part of the) natural resources. And population size has already been introduced as one of the explanatory variables. Linnemann, op. cit., pp. 23-24.

national income.[30] As a result, population has been often used as a proxy for natural resources in the empirical analyses.[31] This controversial assumption will be tested empirically by using both land area as a proxy for natural resources and population. It is interesting to employ land area in the empirical analysis, because land area has not been used in the gravity model as far as we know.[32]

Finally, land areas are obtained for this study from Rand McNally's "The New International Atlas".[33]

Geographic Distance. Classical trade theory customarily excludes spatial dimensions. Correspondingly, locational problems partially represented by the concept of distance have been neglected.[34] Some trade theorists tend to overlook the advantages of geographical proximity in judging the desirability of customs unions.[35] Likewise, some public sector leaders do the same in judging the

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[30]Leamer, and Stern, op. cit., p. 152.

[31]Ibid., p. 152.

[32]The fact that land area has not been utilized is partly supported by the statement by Leamer and Stern saying that "To date, this has not been the procedure followed." Leamer, and Stern, op. cit., p. 152. The above 'this' indicate that land area in addition to capital stock, expenditure on R & D, average temperature, and average rainfall. Refer to 'Trade Flow Models' in Chapter III.

[33]It is published by McNally and Company, 1983, Chicago.

[34]Refer to the section, "Trade and Location Theory" of Chapter III.

[35]Balassa, Bela, The Theory of Economic Integration. Homewood, Illinois: Richard D. Irwin, Inc., 1961, p. 39.

desirability of trading blocs.[36] Before introducing the spatial element into the framework of economic integration, the proximity of the countries involved in an economic integration scheme needs to be taken into account to see how it affects integration.

Proximity is conventionally assumed to be inversely related to transportation cost in the literature. Balassa enumerates the advantages of non-economic factors as well: "(a) the distances to be traversed are shorter in the case of neighboring countries; (b) tastes are more likely to be similar, and distribution channels can be more easily established in adjacent economies; and (c) neighboring countries may have a common history, awareness of common interests, etc., and hence be more willing to coordinate policies."[37] Hence, proximity bears upon the economic effects of the formation of trading blocs to the extent which it sets up the continuity of trade flows disturbed by national boundaries.

Despite the importance of transportation costs in international trade, reliable data on them are not available. This is the main reason why the use of distance as a proxy for transportation cost has been popularized in

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[36]U. S. ex-ambassador to Japan Mike Mansfield has publicly called for a common market between U. S. and Japan. See Thurow, Lester C., "GATT Is Dead", Journal of Accountancy, vol. 170, September 1990, p. 39. See also Schott, Jeffrey J., ed., Free Trade and U.S. Trade Policy. Washington: Institute for International Economics, 1989, p. 32.

[37]Balassa, op. cit., p. 40.

the related research.[38] Therefore it is hypothesized that distance affects trade flows adversely.

On the practical level, the measurement of the shortest navigation distances between two countries' major seaports has been obtained from the publication, "Distances Between Ports".[39] The distance between two countries is obtained by the summation of the sea distance and the overland distance from the major port to the economic center of gravity of the countries concerned. If a country has more than one major sea port, those seaports are used as well. For example, Pacific versus Atlantic ports are applied to Mexico, Columbia, Canada and the USA. The other case is in Spain and France with Atlantic and Mediterranean ports. Though the overland transportation cost is considerably higher than that of sea transportation, the overland distance is directly added to the sea distance. Linnemann[40] justifies this kind of simplification by saying that he is not considering distance exclusively, as a transportation cost factor. He also states that the transportation cost factor varies according to geographical and technical conditions. From the standpoint of empirical

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[38]For another proxy for transport costs, the difference between CIF and FOB, confer to the following time-series model.

[39]Defence Mapping Agency, Hydrographic/Topographic Center, Distances Between Ports. Washington D. C.: US Government, 1985.

[40]Linnemann, op. cit., p. 70.

analysis, log-transformed distance values do not make a considerable difference when the values are relatively large in the study.[41]

As Linnemann[42] noted in his study, a more or less subjective selection of the location of the economic center of gravity can not be denied. An ingredient of subjectivity in the selection of the locations inevitably leads to possible inaccuracies in the measurement of the overland distances. To reduce the subjectivity, this study borrows Linnemann's calculation of overland distances as much as possible. The other reason is to maintain the compatibility of both studies. For bordering countries, at least one of which has no seaport, the road distances between the economic centers are obtained from a road atlas in the case of Europe, and from approximation in the case of South America and Africa.[43] In addition, for countries which have mainly overland communications especially in Europe, the road distances between two economic centers have been estimated.

Preferential Trade Factors. A number of preferential

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[41]The natural logarithm of 250 nautical miles, the distance between Germany and Netherlands, is 5.5215 while the 11,483 nautical miles between Germany and Japan is 9.3486.

[42]Linnemann, op. cit., p. 71. He selected ports and the estimates of hinterland distances based on general geographical knowledge and encyclopedia information.

[43]This is applied to the following inland countries: Switzerland, Austria, Bolivia, Paraguay and Uganda.

groups can be delineated among the 46 selected countries to show that the preferences clearly exist in international trade flows. Tinbergen[44] used three preferential relation variables in an analysis of world trade flows: (1) a dummy variable for neighboring countries; (2) a dummy variable for Commonwealth preference; and (3) a dummy variable for Benelux preference. Linnemann,[45] inspired by the results of Tinbergen's analysis, chose similar classes of preferences: (1) British Commonwealth preference; (2) French Community preference; and (3) Belgian and Portuguese colonial preferences.

The selection of these preferential factors in this study relies on the concept of location. The spatial approach to the preference relations excludes unnecessary non-spatial factors in order to pursue an analysis of spatial interactions in terms of geographical proximity. The preference relations will be estimated in the form of qualitative dummy variables.

1. A dummy variable for bordering countries. Adjacency is expected to positively influence trade volume between countries. Neighboring countries are likely to have more intense trade activities than those closely-located countries which are separated by sea or another countries'

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[44]Tinbergen, Jan, Shaping the World economy: Suggestions for an International Economic Policy. New York: The Twentieth Century Fund, 1962, pp. 262-293.

[45]Linnemann, op. cit., pp. 71-74.

territory. Common language or cultural heritage between adjacent nations tends to serve a rationale for the trade-enhancing effect. The intensity of trading activities is also plausible partly due to the trade flows between domestic regions along the common border.

2. A dummy variable for the same region of countries (R_{ij}). The same international region is expected to enhance trade volume among countries in the region. The dummy for the same region appears to be similar to the adjacency variable. In terms of transportation costs, the results of the same region preference are expected to shed more light on the role of a region concerning the regional concentration of trade flows. Higher transportation costs are involved in the same region trade (intra-regional trade) than in the trade across the contiguous borders. This preference relation will be regarded as a quite important variable in this study. Regions defined by some standards as well as geographical proximity are expected to play a key role in explaining the formation of regional trading blocs.

3. A dummy variable for both countries' OECD or NIC membership. The total number of OECD member countries is 24, and 22 of them are included in this study. Since the OECD plays an important role in the international economic community in terms of economic cooperation and economic development programs, membership is believed to influence international trade flows. In addition, the organization includes all of the most-industrialized countries as well as

all major developed, rich countries. Four NICs are included in the same class, not only because the four countries are relatively larger trade partners in the world economy, but also because the dependence of their economies on foreign trade is larger. In addition, a third reason is that the NICs are upper middle income countries in relation to per capita income.

4. A dummy variable for either country's OECD or NIC membership. This variable is basically the same as the above except for the exclusion of either the origin country or the destination country. This is a more comprehensive hypothesis, because either country's membership is assumed to affect trade flows. But, this variable may be applied to distinguish the trade pattern between a developed country (DC) and a less-developed country (LDC) from the pattern between DCs. Whereas the above variable (both OECD membership) appears to represent the intra-trade among DCs, this variable is viewed to represent North-South trade flows. Therefore by comparing both parameters, the relationship between the two variables will be clarified.

5. A slope dummy variable representing a force in which the dummy variable for the same region (R_{ij}) affects the coefficient of the origin (larger) country's GNP (i.e. a slope dummy rather than an intercept dummy). This variable is derived from the multiplication of R_{ij} and GNP of the origin country (GNP_i). It is hypothesized to measure the effect of the larger economy's GNP on the trade flows within

a region in which the country belongs. If its coefficient, often called the differential slope coefficient, is statistically significant, R_{ij} affects the coefficient of the GNP_i variable. As to the direction of the coefficient sign, we assume that the slope dummy variable for the same region reduces the effect of the GNP_i on the intra-regional trade flows. This assumption is in line with Kemp and Wan's elementary proposition concerning the formation of customs unions.[46] Their proposition states that "an incentive to form and enlarge customs unions persists until the world becomes one big customs union, that is, until world free trade prevails."[47] If the slope dummy variable here tests the postulation that the greater the GNP_i, the smaller is country *i*'s power to augment intra-regional trade, it supports their proposition empirically.

This slope dummy variable will also shed light on the contentious debate on the effectiveness of the world trade system; that is, between multilateralism (globalism) and regionalism. Multilateralism stands for the advocacy of the existing GATT system in spite of some revealed structural problems in the global economy. Whereas regionalism is supported by the advocates of the current formation of

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[46]Kemp, Murray C., and Wan, Henry Y., "An Elementary Proposition Concerning the Formation of Customs Unions", Journal of International Economics, vol. 6, 1976, pp. 95-98.

[47]Ibid., p. 96.

trading blocs as a second best option[48] to achieve world free trade in the long run.[49]

6. A slope dummy variable representing a force in which R_{ij} affects the coefficient of GNP of the destination (smaller) economy (GNP_j). This dummy variable is analogous to the previous slope dummy variable, and is focused on GNP_j. Since this dummy variable is combined with GNP_j, all things such as hypothesis testing and implications are equivalent to those of GNP_i except for the difference in the focus of GNP on trade flows.

We are now in a position to review the structural features of the cross-section model with dummy variables. The presence of a number of qualitative variables which enables us to test a variety of hypotheses through OLS estimation. Characteristically, the model has 6 qualitative variables in addition to 5 quantitative variables. A number of qualitative variables indicate that the sample countries around the world in the model inherently possess many attributes or qualities such as OECD membership, adjacency, and the same location in a region. One way to quantify such attributes is to construct arbitrary variables which take on

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[48]Pomfret, Richard, "The Theory of Preferential Trading Arrangements", in the book of Jacquemin, Alexis and Sapir, Andre, ed., The European Internal Market: Trade and Competition, Selected Readings. Oxford, England: Oxford University Press, 1989. pp. 45, 65.

[49]Refer to the section, "Regional Trading Blocs" of Chapter II, and see Table I of the chapter.

values of 2 (alternatively e) or 1 in the log linear equation; the value 1 indicates the absence of an attribute and the value 2 indicates the other attribute (the presence of the attribute). The dummy variable method is often used to take account of the effects of the qualitative variables (also called categorical variables).

The Empirical Model

Since the equation of the gravity model takes a multiplicative form, a logarithmic transformation is necessary to utilize the ordinary least squares method (OLS). The method of OLS is known to have very attractive statistical properties, and is the most popular method of regression analysis. The nonlinear relationship is transformed by a double log form.

In the double log form some values of parameters, α_1 and α_2, for example, are exponents of GNP_i and GNP_j in an illustrative trade flow equation, $T_{ij} = \alpha_0 GNP_i^{\alpha_1} GNP_j^{\alpha_2} \ldots$ which was said above to be a multiplicative form. By the same analogy, the value of α_0 is an exponent of e (not of 10; common logarithm) in the above equation. Needless to say, a significant empirical result is important in accepting the hypothesis that a geographical factor affects economic integration, ceteris paribus.

All of the variables have been measured as follows in the year of 1988 for the cross-sectional regression. The

trade flow (T) and GNP (G) is in millions of US dollars. The land area (L) is measured in square kilometers, geographic distance (D) is in nautical miles and the dummy variables take *e* (≈2.71828)[50] if the qualitative class is applied. If not, they take 1.

The multiplicative form of the gravity hypothesis is postulated as follows:

$$T_{ij} = \alpha_0 \; G_i^{\alpha_1} \; G_j^{\alpha_2} \; L_i^{\gamma_1} \; L_j^{\gamma_2} \; D_{ij}^{\delta} \; B_{ij}^{\zeta} \; R_{ij}^{\omega} \; C1_{ij}^{\theta_1} \; C2_{ij}^{\theta_2} \; R_{ij}*G_i^{\phi_1} \; R_{ij}*G_j^{\phi_2} \; e_{ij}^{u}$$

The transformed log-linear model is:

$$(4.3)\quad \log T_{ij} = \alpha_0 + \alpha_1 \log G_i + \alpha_2 \log G_j + \gamma_1 \log L_i + \gamma_2 \log L_j + \delta \log D_{ij} + \zeta \log B_{ij} + \omega \log R_{ij} + \theta_1 \log C1_{ij} + \theta_2 \log C2_{ij} + \phi_1 \log R_{ij}*G_i + \phi_2 \log R_{ij}*G_j + u_{ij}$$

where

T_{ij} = trade flow between countries *i* and *j*

α_0 = constant

G_i = gross national product of country *i*

G_j = gross national product of country *j*

L_i = land area of country *i*

L_j = land area of country *j*

D_{ij} = distance between countries *i* and *j*

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[50]The other frequently-used value in log-linear models is 2, and the natural logarithm of the number is 0.69315. The natural logarithmic value of *e* is 1, so slightly different from the above value, 0.69315. However, the other number which represents a different attribute (or class) is the same in both models, making the logarithmic value zero.

B_{ij} = dummy variable for adjacency
if trading partners are neighboring countries, then e (≈2.718)
if not, 1

R_{ij} = dummy variable for same region
if trading partners are located in the same region, then e
if not, 1

$C1_{ij}$ = dummy variable for OECD or NIC
whether both trading partners are member countries of OECD or one of NICs

$C2_{ij}$ = dummy variable for OECD or NIC
whether one of partners is a member of OECD, or one of NICs

$R_{ij}*G_i$ = slope dummy variable
whether the same region preference affects the coefficient of GNP_i
(= R_{ij} x GNP_i)

$R_{ij}*G_j$ = slope dummy variable
whether the same region
affects the coefficient of GNP_j
(= R_{ij} x GNP_j)

u_{ij} = the error term

α_1, ..., ϕ_2 = the coefficients of the explanatory variables

The Time-series Gravity Model

The second gravity model used in this study is a modified gravity model using the same framework and scope of regions as the first model, but it is a time-series model. Unlike the cross-sectional gravity model, this model excludes a distance variable, which is a key factor in spatial analyses. The exclusion is inherent in the nature of time-series modelling, since geographical distance is by nature a static variable. The time-series gravity model is presented to examine the hypotheses that decreasing trade impediments leads to an increase in trade volume. The GNP variables have the same properties as in the preceding model.

The Model and its Setup

The time-series gravity model is based on the general gravity model previously discussed. As a bidirectional single-link model as is indicated in Table III of Chapter III, it examines an international flow of trade between the largest country in one region (a possible trading bloc) in terms of GNP, and the largest country in another region. The largest country from each of the three regions with a dominant economy is chosen. This is because the other four regions do not have a dominant economy in terms of the world economy.

These countries are the USA, Japan and Germany. The

three countries are the three dominant economies in terms of both GNP and trade ranking (Appendix A) in the global economy. Moreover the three countries are termed as the "tripolar" countries,[51] and some authors confine their interests and studies to the three countries only.[52] As a result, 3 sets of estimations are implemented in an empirical analysis.

The dependent variable of the model is as in the cross-sectional gravity model, the trade volume (Appendix F and G). However, it is a time-series for the years 1960 to 1989. Two independent variables are the same GNPs of each pair of countries (Appendix E). Instead of the geographic distance variable, the FOB factor (Appendix D) contained in IMF's International Financial Statistics Yearbook is used as a proxy for transportation cost.[53] A time trend variable is also used. The FOB factor is mathematically expressed as

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[51]See 'Regional Trading Blocs' in Chapter II.

[52]One of the papers dealing with the 3 countries in the framework including an element of geographical aspects is as follows: Hanink, Dean M., "A Comparative Analysis of the Competitive Geographical Trade Performances of the USA, FRG, and Japan: The Markets ana Marketers Hypothesis", Economic Geography, vol. 63, no. 4, (October) 1987, pp. 293-305.

[53]Beckerman (1956) utilized FOB/CIF data to calculate economic distance. He suggested the difference between FOB and CIF as an appropriate indicator of economic distance. Later, Ingo Walter (1967, 91-92) used the same concept of economic distance based on Beckerman. Use of the same difference as an indicator was also suggested by Balassa (1961, 42).

CIF/FOB.[54] An institutional barrier to international trade usually indicates a tariff, quota, and other indirect governmental measures impeding imports. Although the FOB factor does not reflect an institutional barrier, neither does it a pure natural barrier in the sense that it comprises some costs arising from the contracting process. It will decrease due to an improvement in the transportation system and managerial skill.

For simplicity, *F* signifying the FOB factor is substituted for the mathematical expression, CIF/FOB. The dummy variables used in the first model are not relevant in this model. Thus the time-series gravity model is expressed multiplicatively as follows:

$$T_{ijt} = \alpha_0 \, GNP_{it}^{\alpha_1} \, GNP_{jt}^{\alpha_2} \, \{(F_{it} + F_{jt})/2\}^{\alpha_3} \, TIME_t^{\alpha_4} \, ERATE_t^{\alpha_5}$$

The exchange rate, ERATE, is expressed as the Deutsche mark price of Japanese yen, and it is obtainable through cross-calculation based on two exchange rates (between Japan and USA, and between Germany and USA) which use the United States dollar as a numeraire. In fact, the same variable (exchange rate) was also employed in the estimation of the USA-Japan and USA-Germany equations, but it proved insignificant, hence omitted. For the estimation of the trade flow between Japan and Germany, the variable is, however, added in order to get a better statistical result.

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[54]Refer to 'Trade Flow Models' (Footnotes 14 and 15 in Chapter III.

Hence, the two kinds of estimations are equivalent except for the exchange rate variable.

The transformed equation of the model is:

$$(4.4)\quad \log T_{ijt} = \alpha_0 + \alpha_1 \log GNP_{it} + \alpha_2 \log GNP_{jt} + \alpha_3 \log(F_{it} + F_{jt})/2 + \alpha_4 TIME_t + \alpha_5 ERATE_t + u_{ijt}$$

where

T_{it} = trade volume between country i and j at the time period t

GNP_{it} = country i's GNP at t

GNP_{jt} = country j's GNP at t

i = ith country

j = jth country

F_{it} = (CIF_{it}/FOB_{it}) at t period

F_{jt} = (CIF_{jt}/FOB_{jt}) at t period

$TIME_t$ = time trend variable

$ERATE_t$ = exchange rate between Germany and Japan

u_{ijt} = the error term

CHAPTER V

EMPIRICAL RESULTS AND INTERPRETATION

Introduction

The empirical results obtained from the models specified in the last chapter suggest conclusions for regional economic integration. Since the theme of the study is the formation of trading blocs around the world, the empirical results provide fundamental explanations for the current trend of regional economic integration. The explanations are based on the geographical factor revealed in the process of economic integration.

Using the gravity model, this study reaches the conclusions that spatial factors such as geographic distance, land area and location of regions are not only preponderant in determining the general delineation of trading blocs and trade patterns in the global economy, but are also important in predicting the success of present-day individual integration schemes.

The interpretation here is largely based on the cross-sectional analysis, because the estimation of the time-series model does not possess strong statistical significance.

Empirical Results

The Cross-sectional Gravity Model

The estimates of the trade flow model are made by using the gravity equation (4.3) in the previous chapter. The results of the OLS estimation of the relationship between trade flows and the relevant sets of explanatory variables are summarized in Table VI. Table VI shows the overall outcome of the estimation. The regression coefficients are presented along with significance levels including t-statistics. The values of the t-statistics determine whether the coefficients are significantly different from zero. The coefficient of determination (adjusted R^2) shows the goodness of fit. The F-value or amount of the overall significance of the model is reported in the bottom row. All of the explanatory variables are highly significant.

The parameters on GNPs (G_i, G_j), 1.140 (α_1) and 0.814 (α_2) fall within the range of previous estimations by other researchers. The elasticities on GNP are empirically tested to center around 1.[1] Tinbergen's results range from 0.74

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[1]The 99.1 percent confidence interval for the t test statistic is:
$Pr(1.140 - t_{\alpha/2}\ se(\alpha_1) \leq \alpha_1 \leq 1.140 + t_{\alpha/2}\ se(\alpha_1)$
$= Pr(1.140 - 3.090 \times 0.042 \leq \alpha_1 \leq 1.140 + 3.090 \times 0.042)$
$= Pr(1.010 \leq \alpha_1 \leq 1.270) = 1 - 0.001$ percent
Thus if we let $H_0 : \alpha_1 = \alpha_1^*$(estimated α_1) = 1 and $H_1 : \alpha_1 \neq \alpha_1^*$, the confidence interval becomes $Pr(0.870 \leq \alpha_1 \leq 1.130)$. Since the t test statistic is $(1.140 - 1) / 0.042 = 3.333 (>3.090)$, it lies in the critical region and the conclusion remains the same; H_0 is rejected, that is, α_1 is significantly different

(continued...)

to 1.16 for origin country's GNP, and from 0.62 to 0.97 for destination country's GNP.[2] In addition, Linnemann compared his results with Pulliainen. The estimates of Linnemann's range from 0.96 to 1.11 for origin GNP, and from 0.82 to 0.96 for destination GNP, while those of Pulliainen's show 0.83-0.84 for origin GNP, and 0.73-0.77 for destination GNP.[3] Geraci and Prewo (1977, 71), Brada and Méndez (1985, 552), Bergstrand (1985, 479) and Bikker (1987, 326) also showed typical magnitudes which are significantly different from zero.

The estimated coefficients and their signs for land areas of country *i* (L_i) and country *j* (L_j) are -0.195 (γ_1) and -0.204 (γ_2). These conform to expectations and their *t*-ratios are highly significant at well below the one percent level. Though most studies that have estimated the gravity equation have typically used population as a factor affecting a bilateral trade flow, the land area variable,

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[1](...continued)
from 1.

If we let $H_0 : \alpha_2 = \alpha_2^*$(estimated α_2) = 1 and $H_1 : \alpha_2 \neq \alpha_2^*$, the confidence interval becomes $Pr(0.895 \leq \alpha_1 \leq 1.105)$. Since the *t* test statistic is (0.814 - 1) / 0.034 = 5.471(>3.090), it lies in the critical region and H_0 is rejected. This means that α_2 is significantly different from 1.

As to the *F* test, $H_0 : \alpha_1, \ldots, \phi_2$ (all true parameters) = 0 Since the computed *F* ratio, 350.72 is greater than the critical *F* value for 11 and 985 degrees of freedom at the 1 percent, 2.25, the null hypothesis that the explanatory variables have no influence on the trade flows is rejected.

[2]Tinbergen, op. cit., pp. 270, 273, 286.

[3]Linnemann, op. cit., p. 84.

TABLE VI

ORDINARY LEAST SQUARES (OLS) ESTIMATES
OF INTERNATIONAL TRADE FLOWS
IN A CROSS-SECTIONAL STUDY

Name of Variable	Coefficient Value	Standard Error	t Statistic	Significance Level
Constant	α_0 -1.682	0.900	-1.871	0.061
G_i, GNP_i	α_1 1.140	0.041	27.211	0.000
G_j, GNP_j	α_2 0.814	0.034	24.135	0.000
L_i, $Land_i$	γ_1 -0.195	0.025	-7.644	0.000
L_j, $Land_j$	γ_2 -0.204	0.025	-8.122	0.000
D_{ij}, $Distance_{ij}$	δ -0.518	0.083	-6.275	0.000
B_{ij}, Adjacency	ζ 1.140	0.225	5.074	0.000
R_{ij}, Same Region	ω 6.960	0.939	7.409	0.000
$C1_{ij}$, Both OECD	θ_1 0.119	0.132	0.906	0.365
$C2_{ij}$, One OECD	θ_2 0.432	0.145	2.973	0.003
$R_{ij}*G_i$, Same Region*GNP_i	ϕ_1 -0.366	0.087	-4.220	0.000
$R_{ij}*G_j$, Same Region*GNP_j	ϕ_2 -0.180	0.099	-1.828	0.068

Adjusted R^2 = 0.794, N = 997, $F_{11, 985}$ = 350.724

Note: R^2 = 0.796

which is unique in this study, shows very high statistical significance at the 1 percent level. The population variable employed in a different estimation using the same

framework resulted in a significance problem.[4] Therefore the population variable was not considered further. The result for the land area is partly in contradiction with Linnemann's statement as mentioned in the subsection, 'Treatment of Land Area'.[5] He concluded that the inclusion of a land area in the analysis of a country's potential foreign supply will contribute little or nothing to a systematic explanation of trade flows. But, if it is noted that his analysis of land area was confined to the supply side of national income, the refusal of his results is rational.

The land area variable used in the gravity equation is criticized for the lack of theoretic foundation. These results, however are highly robust and significant as verified by the estimation. The results are also logically supported both by the concept of market areas, and by the assumption that land area reflects resource endowment as suggested in the subsection, 'Treatment of Land Area' in Chapter IV.

The coefficient for the distance variable (D_{ij}), -0.517 (δ) has the expected negative sign as a trade-suppressing factor, and displays a very high confidence level. It is

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[4]The regression of the same trade flows on GNP_i, GNP_j, $population_i$, $population_j$ and $distance_{ij}$ has following coefficients and their significance levels: constant; -1.19 (0.66), GNP_i; 1.00 (0.04), GNP_j; 0.86 (0.03), $population_i$; -0.17 (0.04), $population_j$; -0.03 (0.04)—totally insignificant and $distance_{ij}$; -0.88 (0.05).

[5]See also Linnemann, op. cit., p. 24.

statistically significant at well below the 1 percent significance level. The size of δ falls within the range of previous estimates. Specifically, it is located around the medium of those estimates.

The estimates on the adjacency dummy variable (B_{ij}) and the same region dummy variable (R_{ij}), 1.140 (ζ) and 6.960 (ω) respectively, have the expected signs, and their *t*-values are relatively large. Though both the dummy variables are significant at the 1 percent level, the value of the coefficient of R_{ij}, 6.690 (ω) is extraordinarily larger than the other value, 1.140 (ζ). This is not surprising as Linnemann has indicated that the adjacency effect is of minor importance.[6]

As to the OECD membership or NIC status dummy variables ($C1_{ij}$, $C2_{ij}$), the coefficients on both variables are relatively smaller than the previous two dummy variables, and have the expected signs. However, only either country's membership variable ($C2_{ij}$) is significant at the 1 percent level. Thus $C2_{ij}$ clearly supports the hypothesis that the either country's membership influences the trade flow pattern between the DCs and the LDCs. Notably, the coefficient value of $C1_{ij}$ is much less than the variable ($C2_{ij}$). This indicates that the force to affect intra-DCs trade flows is not as strong as the one to affect trade flows between DCs and LDCs. The issue for the minor role of

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[6]Geraci and Prewo, op. cit., p. 71.

Cl_{ij} will be will be refereed to again later in 'Role of Further Stepwise Regression'.

The coefficients measuring the effects of G_i and G_j on the trade augmenting power of a geographical cluster (same region), ϕ_1 (-0.366) and ϕ_2 (-0.180), have the expected signs, and are significant at the 1 and almost 5 percent level respectively.

The Time-series Gravity Model

The estimates of the inter-country trade flows among the three major countries are obtained by equation (4.4). The results of the OLS estimation of the time-series models are presented in Table VII.

All of the three time-series regressions had serious autocorrelation problems. Thus the Cochrane-Orcutt first-order autoregressive correction technique was applied to remedy the problem. Though the serial correlation problem has been corrected, the Japan-Germany regression shows that half of its coefficients do not have an statistical significance. But, it is still important to compare the results of the time-series models with the ones of the former cross-sectional model and derive practical implications. In contrast, the other two time-series regressions possess many significant coefficients.

Let us now turn to the explanation of each estimate. All of the negative intercepts show statistical significance at the one percent level. In addition, the coefficients of

GNP variables of larger country (α_1) are also all highly significant at well below the one percent level. The values fall within the range of previous estimations obtained by other analysts. In contrast to the significant GNP_j estimates of the USA-Japan and the USA-Germany estimations, the GNP_j coefficient of the Japan-Germany estimation is not acceptable even at the 10 percent significance level. The size of the coefficient is, however, still in the bottom of the typical range of previous estimations with an expected positive sign. The sizes of GNP_j coefficient, α_2, from all three estimations are much lower than those of coefficient GNP_i, α_1. This consistent statistical result will be utilized to draw a theoretical implication concerning the role of the GNP variable later.

As a factor of concern in this model, the overall statistical significance of the FOB factor (α_3) is not acceptable in terms of both the signs and significance levels. Only one case, that is, the USA-Germany estimation, is significant at the 10 percent level, but the sign is not in conformity with theoretical expectations and previous estimations.[7] The estimation between the USA and Japan also has a positive sign contrary to the expectations and the significance level is not acceptable either. In the case of the Japan-Germany estimation, the sign of FOB factor

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[7]Geraci and Prewo, op. cit. See the 'Review of Gravity Models' section in Chapter III.

TABLE VII

ORDINARY LEAST SQUARES (OLS) ESTIMATES
OF INTER-COUNTRY TRADE FLOWS
IN A TIME-SERIES STUDY

Name of Variable		USA-Japan	USA-Germany	Japan-Germany
constant α_0	value	-8.516	-13.728	-7.166
	s. d.	1.753	4.351	1.749
	t-stat.	-4.858	-5.156	-4.098
	s. level	0.000	0.004	0.000
GNP_i α_1	value	0.939	0.779	0.827
	s. d.	0.188	0.119	0.302
	t-stat.	4.991	6.440	2.736
	s. level	0.000	0.000	0.012
GNP_J α_2	value	0.314	0.414	0.481
	s. d.	0.129	0.087	0.316
	t-stat.	2.441	4.779	1.521
	s. level	0.023	0.000	0.143
FOB Factor α_3	value	0.096	7.807	-1.398
	s. d.	1.550	4.177	1.299
	t-stat.	0.062	1.869	-1.075
	s. level	0.951	0.074	0.294
Time α_4	value	0.356	0.316	-0.109
	s. d	0.206	0.125	0.163
	t-stat.	1.728	2.515	-0.667
	s. level	0.097	0.019	0.512
Exchange Rate α_5	value			-0.005
	s. d.			0.003
	t-stat.			-1.941
	s. level			0.065
Adjusted R^2		0.998	0.996	0.998
DW d statistics		2.287	2.020	1.701
F(4,24) statistics		2236	1563	2417*

Note: s. d. = standard deviation
s. level = significance level
* indicates F(5,23).

is consistent with the theoretical prediction, but the *t*-ratio is too low.

The limited time-series model here generally fails to test the hypothesis that decreasing trade impediments, using the FOB factor as a proxy, results in an increase in trade volume. As for the inaccuracy of FOB factor, Geraci and Prewo[8] say that "In principle, the difference between c.i.f. and f.o.b. trade values represents the costs of freight and insurance. However, due to notorious measurement errors, these figures cannot be used in traditional econometric procedures. Consequently, most trade studies dealing with this subject have not utilized the differences between c.i.f. and f.o.b. values." Despite the inaccurate nature of the f.o.b. factor, a general interpretation of the time-series results in Table VII combined with the results of the cross-sectional analysis in Table VI will provide important insights into the subject of regional economic integration.

Interpretation

It seems proper to place an emphasis more on the quantitative GNP variable and deal with it first. As one of the major trade-governing factors, GNP should be more extensively evaluated in terms of the power to explain trade flows. Both elasticities on GNP_i ($\alpha_1 = 1.140$) and GNP_j ($\alpha_2 =$

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[8]Geraci and Prewo, op. cit., p. 67.

0.814) fall within the range of previous estimations. Thus the reliability of the elasticities of trade flows with respect to GNPs gives full support to the first hypothesis that GNP determines critically trade flows. In other words, GNP has a very strong power in explaining trade flows.

However, the two magnitudes have a sizable difference from each other in this estimation. The discernable difference between the coefficient of the origin country's GNP (GNP_i), $\alpha_1 = 1.140$, and the coefficient of the destination country's GNP (GNP_j), $\alpha_2 = 0.814$, is economically justified.

Recall from Chapter IV ('Treatment of the Trade Flows'), all of the observations were arranged in a descending order of GNP size. For example, since the ranking of the USA's GNP is 1, the GNP data of the USA was used as the origin GNP (the GNP of a larger economy). For Japan (ranking; 2), its GNP data was used once as the destination GNP (smaller economy's GNP) when being paired with the data of the USA. This procedure leads to a result which differs the coefficients of GNP_i and GNP_j. In other words, the larger economy's GNP_i reflects a stronger effect on the trade flows than the smaller economy's GNP_j. Therefore, the second hypothesis that GNP_i influences the overall trade flows more than GNP_j does is empirically tested. The time-series results also show that all three pairs of GNP estimates have a large difference from each

other between the larger economy and the smaller economy. Interestingly, all of the larger economies in a pair of countries in the time-series have quadruple or twice as large GNP as the smaller economies (Appendix E).

The sizable difference between the two coefficients on GNP is believed rational, since the origin GNP representing the larger economies generates more trade volume due to a larger income. The increase in GNP causes the openness index (trade as a percentage of GNP) to rise, ceteris paribus. For this reason, higher GNP has a positive impact on the effect of trade volume. It confirms a priori theory that higher output in the manufacturing sector of the capital-rich countries increases their trade volume.[9] Another reason is that richer countries have a structural bias toward trade. The production of more advanced countries is more concentrated in high-technology industry and capital-intensive industry. Therefore they generally produce manufactures, whereas the production of developing countries is more concentrated in primary goods which have more difficulty entering into international trade.

Let us now turn to the GNP slope dummy variables connected with the dummy variable for same region (R_{ij}). A direct influence of GNP on trade flows is well-established and also supported by the empirical results of this study (the first hypothesis testing regarding GNP variables).

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[9]Krugman and Helpman (1985), op. cit., p. 163.

Therefore the slope dummy variable combined with GNP variable (R_{ij}*G) should receive special attention. The fact that R_{ij}*G has a negative sign may lead to possible confusion in connection with the idea of trade regionalization. This probable confusion is, however, easily resolved by noting that the inclusion of the slope dummy changes the GNP slope of the original regression, since the GNP variable is multiplied by R_{ij} to form a slope dummy variable. With the appearance of ϕ_1 (-0.366), the new elasticity on GNP_i changes from 1.140 to 0.774. This shows that the mean trade flow function for same region, which is expressed by a new adjusted equation, has a different value for the intercept and the coefficient of GNP_i.[10] Compared with the original elasticity, 1.140, the new reduced elasticity has an important implication. While R_{ij} contributes to the formation of trading blocs as will be explained below, the reduced elasticity (0.774) indicates that the effect of the larger economy's GNP variable on intra-regional trade flows is less than its effect on interregional trade flows. In other words, larger countries are looking beyond their regions (or natural blocs) with

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[10]Before adjusting the dummy variable for same region (R_{ij}), mean trade flow function for same or different regions;

$$E(T_{ij} \mid R = \log 1, G_i, G_j) = \alpha_0 + \alpha_1 G_i + \alpha_2 G_j + \ldots\ldots$$

After the adjustment, mean trade flow function for same region;

$$E(T_{ij} \mid R = \log e, G_i, G_j) = (\alpha_0 + \omega) + (\alpha_1 - \phi_1) G_i + (\alpha_2 - \phi_2) G_j + \ldots\ldots$$

which they closely trade. The smaller economies are doing the same as is illustrated by the following equation, 0.634 = 0.814 (α_2) - 0.180(ϕ_2). But, this effect is much smaller(|-0.366| > |-0.180|). Therefore, the inequality displays that smaller economies, including all LDCs when compared with DCs, do not look to foreign markets beyond their region to the same extent to which larger economies do.

This leads to a significant implication that the presence of the negative differential slope coefficients will cause the eventual breakdown of trading blocs even as they are being formed. Interestingly, this long-run prediction is in conformity with views of the leaders of the principal economies—say G-7 countries—that "free trade is a powerful, important goal, and that lapsing back into a protectionist era would have tremendous dangers for us."[11] Strong,[12] as one of the GATT system supporters, observes that "the history of international negotiations shows that crisis always precedes resolution and provides some of the motivation for it"[13], though he acknowledges that the GATT is at a crunch point. Jacques Drèze's post scriptum (July

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[11]Rappleye Jr., Willard C., interview, "Maurice F. Strong: Adaptations of the Blocs", Financier, vol. 13, iss. 4, April 4, 1989, p. 17.

[12]Former Under Secretary General of the United States, and Chairman of the World Council of the World Economic Forum in 1989.

[13]Ibid., p. 18.

1988) to his address[14] announces that "A fresh look at these issues (*customs unions*) is timely, as we ponder today the extent to which the process of market integration will accelerate after 1992. Judging from past experiences the acceleration will be gradual, except in specific areas where geographical mobility entails little costs, like capital markets or air transportation."[15]

As mentioned in previous chapters, world trade indicates that each country has a variety of sizes of market areas for different commodities, and an increase in a certain country's GNP causes a increase in world trade through an expansion of the country's market area beyond the international region as well as over the national boundary. The rise in world trade is divided into intra-regional trade and world trade (trade outside the region). The $R_{ij}*G_i$ coefficient (ϕ_1; -0.366) indicates that as GNP gets greater, the dummy variables for the same region loses the power to augment intra-regional trade. This direction is consistent with Kemp and Wan's proposition regarding the formation of customs unions.[16] Therefore, the existence of an incentive

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[14]The Belgian economist made his address at the Royal Society of Political Economy of Belgium in November 1960. Drèze, Jacques H., "The Standard Goods Hypothesis", in the book of Jacquemin, Alexis and Sapir, Andre, ed., op. cit., p. 13.

[15]Ibid., p. 32. Italics added by the author.

[16]Kemp, Murray C., and Wan, Henry Y., "An Elementary Proposition Concerning the Formation of Customs Unions", Journal of International Economics, vol. 6, 1976, pp. 95-98.

to pursue world free trade is confirmed empirically.[17]

There are several possible reasons for the validity of the above proposition. First, as intra-regional trade approaches a saturation point, an increase in GNP will affect outer-regional trade as an outlet for the increased output created by an improved scale economy. Second, as production costs fall, an economic market area is expanded, thus causing outer-regional trade to increase. Third, as GNP increases, more goods become necessary goods, thus leading to an increase in world trade via an increase in consumption. Fourth, an increase in production efficiency obtained through trade creation along with a rise in production will result in the specialization of production on the basis of comparative advantage. This causes the goods concerned to flow beyond the perimeter of an international region.

The other GNP-associated variable, $R_{ij}*G_j$, also fits our expectations with respect to the sign and the size. Even the smaller size of the coefficient ϕ_2(= -0.180) is plausible compared with the coefficient of $R_{ij}*G_i$. The size difference indicates that the smaller countries do not have the same power to augment world trade as the larger

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[17]It is interesting to point out the similar position contended by a historian from the standpoint of current history. "The superblocs need to stimulate a new way of thinking about the purposes of foreign policy beyond the givens of promoting peace, prosperity and human rights. In the world of superblocs, the objective should be to promote outward-looking blocs in a framework of cooperative allied relations." Garten, op. cit., p. 55.

economies. Correspondingly, our generalization is that the smaller magnitude of ϕ_2 implies that the effect of smaller economies' trade augmentation outside an individual region is smaller.

Thus, the two slope dummy variables lead to a conclusion that the current formation of regional trading blocs around the world involves the possible breakdown of the trading blocs as GNP increases. This is due to the mechanism inherent in international trade, production and space. The results are consistent with the views of some economists such as Thurow and Krugman who perceive the emergence of trading blocs. On the other hand, the results refute Krugman's U-shape idea which says that the 'second global economy' at this period is about to crash as the first global economy disintegrated in the period between the World Wars.[18] Though the results do not indicate an accelerated globalization of the world economy, nor suggest the results a sharp disintegration of the world economy. The right side of the U-curve will not rise any more for the next few decades, but it will be upper-sloping again from the sluggish point. This prediction is quite different from the cyclical U-shape curve, because it does exclude a possible process downturning to the deepest trough of the U-shape curve.

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[18]Krugman, Paul R., "A Global Economy Is Not the Wave of the Future", Financial Executive, vol. 8, iss. 2, (Mar/Apr) 1992, p. 10.

This conclusion interests us most with respect to the controversial second best choice of trading blocs in reaching free world trade. The best option to free world trade is multilateralism represented by the GATT system. If the GATT system worked flawlessly, which it does not, there would be no need for regional economic arrangements. Critics[19] of the regionalism believe that prospective trading blocs would not reinforce the GATT negotiations and might block free world trade. Therefore this could undermine the ongoing Uruguay Round Multilateral Trade Negotiations[20] of the GATT. For example, they believe that the compelling interest of industrial countries in achieving a strengthened GATT will provide them with a major incentive to bridge some of principal Uruguay Round gaps. Agricultural subsidies between the EC and the U.S is one example, the opening of services is another.

On the other hand, advocates[21] of regionalism contend that bilateralism is clearly suboptimal or second best. The

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[19]For instance, Schott views that "GATT negotiations hold a better prospect for trade liberalization than bilateral FTAs (Free Trade Areas). Moreover, prospective FTAs would not reinforce the GATT negotiations; indeed, a continuation of FTA negotiations could undermine the Uruguay Round and contribute to the further erosion of the GATT system. op. cit., p. 54.

Barlas also sees that regionalism may block world trade. Barlas, Stephen, "Trading blocs may block world trade", Marketing News, vol. 22, Oct. 10, 1988, pp. 23-25.

[20]Refer to the section, 'Regional Trading Blocs' in Chapter II.

[21]Belous and Hartley, op. cit., Chapter 3; Blocs: Making the Best of a "Second-Best" solution, pp. 30-36.

Uruguay Round negotiations have bogged down, because the GATT system has the inability to keep liberalizing multilateral world trade and to adapt to the changing international economic environment. Specifically, the advocates of regionalism argue that an essential strengthening of regional trading arrangements is a necessary step towards the development of a free-trading global system.[22] As the vehement debate goes on, whether the goal of global free trade can be better achieved by regionalism or via multilateral GATT talks is not self-evident. The controversy is not readily analyzed by economists' tools.[23] However, the empirical results support the second best option to world free trade implying that regional trading blocs will continue to grow at least in this decade or so.

The hypothesis about the 'same region' dummy variable (R_{ij}) is that it plays a major role in explaining the current formation of trading blocs in a regional context. In other words, R_{ij} is postulated to have a strong impact on intra-regional trade flows. The estimated regression gives an excellent fit with respect to the estimate of the variable ($\omega = 6.960$). As the negative intercept term implies ($\alpha_0 = -1.682$), a pair of countries would have no trade if there were not the sizable GNPs of both countries.

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[22]Refer to Table I in Chapter II, especially No. 7 of principles.

[23]Pomfret, op. cit., p. 63.

But, by virtue of countries being located in the same region, there would be trade between two countries, even if it were not associated with GNP. This analysis of the intercept can be also applied to the three negative intercepts of the time-series regression.

The coefficient, ω, sometimes called a differential intercept coefficient, tells how much the value of intra-regional trade flows differs from the value of outer-regional trade flows. This relation is illustrated by the sum of the negative intercept and the positive ω (i.e. $6.960(\omega) - 1.682(\alpha_0) = 5.278$).[24] Thus, the 'same region' variable reflecting cultural similarities, common interests and common language, etc.[25] contributes to an increase in trade flows, even after GNP and other variables are adjusted for. In other words intra-regional trade flows exist, even though all trade-promoting variables are held constant. This is the main reason why trading blocs have been forming based on the concept of region that implies geographical propinquity.

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[24]Refer to the derivation in Footnote 10 of the chapter.

[25]Specifically, cultural analysis of international marketing also includes more factors such as religion, education, esthetics regarding design, brand name, and color of goods, consumer behavior, values and attitudes, etc. In detail, attitudes comprise a variety of elements; attitude toward change, wealth, material gain or acquisition, and so on.

Beckerman (1956, 38) refers to "psychic" distance apart from economic distance which is calculated from the difference from CIF and FOB prices. He says that foreign purchases are made depending partly "on the extent to which foreign sources have been personally contacted and cultivated."

The adjacency dummy variable (B_{ij}) that is closely related with the 'same region' variable (R_{ij}) can be interpreted the same way. Since its coefficient (ζ = 1.140) has a positive value, it functions as a same spatial force to reinforce the effect of R_{ij}. The increased intercept, 6.418 (-1.682 + 6.960 + 1.140) from 5.278 indicates that neighboring countries have larger trade flows than when only R_{ij} is taken into account, even if other variables were accounted for in the estimation. In the 1950s Beckerman[26] pointed out that the trade concentration of Europe was closely linked to neighboring nations.

The estimate of R_{ij} (ω = 6.960) has the highest value among the four qualitative variables (Table VI). No other variables possess coefficients in excess of 2. The influence of R_{ij} on the formation of regional trading blocs is explained as follows: first, the extraordinarily large parameter indicates that a region fundamentally affects the trade pattern of commodity flows; second, since R_{ij} shows a good statistical performance, its importance as one of spatial factors is reliable. Thus, the result gives full support to the hypothesis that R_{ij} reflects a distinctive spatial interaction within the same region with respect to international trade flows. In other words, R_{ij} is of great use to explain the pattern of trade flows of a pair of countries.

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[26]Beckerman, op. cit., p. 37.

As for the geographic distance (D_{ij}), the coefficient (δ = -0.518) has a negative value and falls into the typical range. From the statistical point of view, the value is derived after adjusting for other included variables. Therefore, distance functions as general resistance to trade, even after all other variables are adjusted. The negative sizable magnitude, indicating that trade flows decline as the distance increases, shows a preponderant effect on trade flows. As stated earlier, distance is assumed as a proxy for transportation cost involved in international trade. Thus trade is smaller the farther apart two countries are, and vice versa. This relationship makes a contribution to the explanation for the formation of regional trading blocs. Another justification for a trading blocs' promotion of internal trade is that distance may represent an index of information on foreign markets.

Both partners' OECD or NIC membership status ($C1_{ij}$), which reflects high income or industrialized countries, provides some implications as compared with either country's OECD variable ($C2_{ij}$). The parameter of $C1_{ij}$ (θ_1 = 0.119) is much smaller than that of $C2_{ij}$ (θ_2 = 0.432). This leads to an implication that LDCs tend to have larger trade flows with DCs than among them. Intra-DC trade becomes smaller relative to trade between DCs and LDCs, after all other variables are taken account of. The finding that trade between DCs and LDCs is inclined to increase sheds light on

North-South trade by implying that the existing North-South problem may improve gradually for some time to come.

Another implication is that a partial structural explanation not only for the dissolution of existing economic integration of LDCs but also for their failure to establish a form of regional economic integration. The result suggests that the economic forces causing and aggravating the North-South problem, may weaken via an increased in international trade. At least the trade flows between DCs and LDCs will not decline for the time being, aside from the worsening terms of trade. If export-promotion strategy (export substitution or outward-looking strategy) for economic development is still persuasive, the finding provides an implication of what policy makers of LDCs should take into account while setting up trade strategy as a part of the development programs. The size difference between the coefficients consequently leads to a prediction that there is still room for LDCs to export to the industrial markets, ceteris paribus, thanks to comparative advantage which exists between them.

Land area variables should be treated as the GNP variables, distinguishing the larger economy's land area (L_i) from the smaller economy's land area (L_j). Both land area estimates have reliable parameters, and the two values of the parameter are precisely the same. The coefficient equality implies that a country with a larger territory has an inclination to depend less on foreign trade regardless of

the size of the economy, because of its larger internal market and resource availability.

One of the population variables was not empirically significant in the estimation of this study as mentioned in the subsection, 'Treatment of Land Area' in Chapter IV. This result conforms to the criticism that population variables do not affect an international trade flow significantly. Thus, when estimating a trade flow model, some authors even assume that the size of the population does not have a discernable effect.[27] By dropping out the population variable, the remaining GNP and distance variables, etc. render more resemblance to the law of gravity.

In the time-series analysis, none of the FOB factor variables were significant. Furthermore, the signs were not in line with the 'a priori' expectations. Though absolute trade volume among three major economies (USA, Japan and Germany) has increased prominently for the last three decades, decreasing FOB factors which were assumed as a proxy for transport cost turned out to be improper variables. Thus, the FOB factor cannot match with the distance variable with respect to empirical usefulness due to its inherent serious measurement error. The insignificance of FOB factor may be explained by the fact that a slight decrease in the transport cost could not

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[27]Bikker, op. cit., p. 315.

induce an increase in the trade flows between far distant countries. A slight decrease in the transportation cost is not believed to be a strong enough incentive to encourage long-distance trade flows rather than adjacent trade flows. Thus, the unimportance of FOB factor leads to an implication that the three countries constituting the tripolar blocs may have already experienced a considerable trade concentration in their own regions.

Role of *Beta Coefficients*

Up to this point, the estimated parameters have been dealt with in terms of the interpretation of the empirical results. The three factors encompassing the intercept, GNP, and the same region not only have provided a reasonable basis for the interpretation, but also possess much larger magnitudes as a whole. The values of the intercept, GNPs, and the same region variable raise a question as to their relative contribution to the model. In order to decide on the size of the relative contribution of each variable, so-called *beta coefficients* are introduced. According to Maddala, the regression coefficients obtained in the preceding chapter depend on the units of measurement of the variables, and "they can be made more comparable by expressing each variable in terms of its own standard

deviation."[28] As to the usefulness of them, Maddala also adds "Ezekiel says that for comparison between problems where the standard deviations are much different, the *beta coefficients* may have value."[29] They are derived from the estimated coefficients through a couple of calculations. To obtain the *beta coefficient*,[30] a division of the standard deviation of an explanatory variable by the standard deviation of the dependent variable is first necessary. Next, the obtained value should be multiplied by the coefficient of the explanatory variable itself. For example, one of the *beta coefficients*, β_1 of the earlier cross-section analysis is expressed as follows:

$$\beta_1 = \alpha_1 \ (\sigma_{\log GNPi} \ / \ \sigma_{\log T})$$

where T = the dependent variable (trade flows)

σ = standard deviation

All the *beta coefficients* of the cross-section regression are given in Table VIII.

Among the *beta coefficients*, the value of the same

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[28]Maddala, G. S., Econometrics. New York: McGraw-Hill Book Company, 1977, p. 119.

[29]Ibid., p. 119.

[30]Ibid., p. 119. *Beta coefficients* are not used very often in empirical estimation because of no relation between the *beta coefficients* and corresponding partial correlation coefficients in multiple regression. In two-variable regression, the slope *beta coefficient* is identical to the correlation coefficient between the dependent variable (y) and independent variable (x), because $\beta_1 = \alpha_1(\sigma_{x_2} / \sigma_y) =$ correlation coefficient r_{xy}. Note: $r^2 = \alpha_1^2(\sigma^2_x / \sigma^2_y)$.

region variable (R_{ij}) is the highest, although the original value is deeply reduced through the transformation procedure. Thus, the greatest contribution to the explanation of the variation in trade flows is made by the two GNP variables, R_{ij} and $R_{ij}*G_i$. According to the original estimates, the parameter of either country's OECD membership dummy variable ($\theta_2 = 0.432$) was larger than that of both countries' OECD membership dummy variable ($\theta_1 = 0.119$). Moreover, as a relative contribution index, the *beta coefficient* of $C2_{ij}$ (0.127) is now larger than $C1_{ij}$ (0.019). This explains the strong tendency of trading between DCs and LDCs.

TABLE VIII

BETA COEFFICIENTS FOR THE ESTIMATES OF INTERNATIONAL TRADE FLOWS IN A CROSS-SECTIONAL STUDY

Name of Variable	Beta Coefficient		Name of Variable	Beta Coefficient	
Constant	β_0	-0.598	G_i, GNP_i	β_1	0.566
G_j, GNP_j	β_2	0.448	L_i, $Land_i$	β_3	-0.143
L_j, $Land_j$	β_4	-0.142	D_{ij}, $Distance_{ij}$	β_5	-0.169
B_{ij}, Adjacency	β_6	0.089	R_{ij}, Same Region	β_7	0.986
$C1_{ij}$, Both OECD	β_8	0.019	$C2_{ij}$, One OECD	β_9	0.127
$R_{ij}*G_i$, Same Region*GNP_i	β_{10}	-0.635	$R_{ij}*G_i$ Same Region*GNP_j	β_{11}	-0.279

The value of R_{ij} provides an important insight into the issue of current trading bloc formation. Its magnitude supports the importance of 'natural' trading blocs. In practice the seven regional sets of countries indicate natural trading partners, who would have done much of their trade with one another even in the absence of special trade arrangements. Based on this reasoning, members of North America and the western Pacific Rim, which had not established any trading arrangements prior to 1988, will show the strong tendency to focus their trade on nearby trading partners for the next few decades. The similar, but minor, adjacency variable will also show the same, though smaller effect.

Another important implication comes from the slope dummy variable, especially the one associated with the larger economies ($R_{ij}*G_i$). As mentioned earlier, these variables exhibit the greatest contributions to the explanation of the trade pattern. These variables imply that in spite of the current formation of trading blocs, the possible concomitant breakdown of these blocs will follow the current major change in the world trading system. More precisely, the prospective breakdown is proceeding gradually at the same time. This prediction leads to a confirmation that most economists favor the proposition that a world with free trade is better off than with regional trading arrangements. In light of the world trading system, the implication supports most economists' agreement with the

GATT approach. In other words, the idea of free trade will keep prevailing as it has been supported by the mainstream trade theorists, in spite of the major rethinking of trade theory that has taken place over the last decade or so.[31]

Role of Further Stepwise Regression

To examine the issue of trading blocs further and confirm the results in a different context, a stepwise regression is employed. Three regional preference variables and a set of OECD slope dummy variables associated with GNP are added. The overall estimation gives a similar significant result[32] with respect to the earlier-mentioned variables.

First, the OECD slope dummy variable ($OECD_{ij}*G_i$) is consistent with the implication of the 'same region' slope variable ($R_{ij}*G_i$). This leads to a decrease in the coefficient of the larger economies' GNP (G_i). Thus the

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[31]Krugman (1991), op. cit., pp. 6-7.

[32]$Pr(1.039 \leq \alpha_1 \leq 1.317) = 1 - 0.001$ percent = 99.9 % Thus if we let $H_0 : \alpha_1 = \alpha_1^*$(estimate of α_1) = 1 and $H_1 : \alpha_1 \neq \alpha_1^*$, the confidence interval becomes $Pr(0.861 \leq \alpha_1 \leq 1.139)$. Since the *t* test statistic is (1.178 - 1)/ 0.045 = 3.956 (>3.090), it lies in the critical region and the conclusion remains the same; H_0 is rejected.

If we let $H_0 : \alpha_2 = \alpha_2^* = 1$ and $H_1 : \alpha_2 \neq \alpha_2^*$, the confidence interval becomes $Pr(0.654 \leq \alpha_1 \leq 0.864)$. Since the *t* test statistic is (0.759 - 1)/ 0.034 = 7.088(>3.090), it lies in the critical region and H_0 is rejected.

As to the *F* test, since the computed *F* ratio is 273 and the critical *F* value for 16 and 980 df at the 1 percent is 2.04, the null hypothesis that the explanatory variables do not influence the trade flows is rejected.

growing GNP loses the power to augment intra-regional trade more than only $R_{ij}*G_i$ is considered. In the same context, inter-regional trade becomes larger as GNP grows.

Second, it provides significant insights into the prospective role of Japan as a centric country constituting one of the tripolar blocs whether or not it forms a successful trading bloc in its region. A trading bloc dominated by Japan is delineated either narrowly (East Asia only) or broadly (the western Pacific Rim).

In the stepwise regression, only three estimates out of the regional preference variables are statistically significant. In fact, the seven regions can make up numerous combinations of regions. Notably, the three estimates are all related to the Far East Asian region which includes Japan. Though variable A_{ij} (East Asia only) has a negative coefficient ($\psi_1 = -1.532$), it was logically expected because of a couple of zero trade flows among countries within the region.[33] In contrast, two other variables which stand for combined regions in relation to East Asia have a positive coefficient. The sign and significance of the East Asia and North American variables (AN_{ij}) were expected on the basis that East Asian countries are heavily reliant on the U. S. and Canadian markets. The sign and significance of APO_{ij} (East Asia, ASEAN and Oceania) were also anticipated in the sense that the Asia

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[33]Refer to Table IV in Chapter IV.

TABLE IX

STEPWISE ORDINARY LEAST SQUARES ESTIMATES OF INTERNATIONAL TRADE FLOWS IN A CROSS-SECTIONAL STUDY

Name of Variable	Coefficient Value	Standard Error	t Statistic	Significance Level
Constant	α_0 -3.809	0.908	-4.194	0.000
G_i, GNP_i	α_1 1.178	0.045	26.319	0.000
G_j, GNP_j	α_2 0.759	0.034	22.507	0.000
L_i, $Land_i$	γ_1 -0.198	0.025	-8.091	0.000
L_j, $Land_j$	γ_2 -0.155	0.026	-5.989	0.000
D_{ij}, $Distance_{ij}$	δ -0.350	0.082	-4.276	0.000
B_{ij}, Adjacency	ζ 1.384	0.217	6.386	0.000
R_{ij}, Same Region	ω 6.598	0.917	7.194	0.000
$C1_{ij}$, Both OECD	θ_1 2.132	1.123	1.898	0.058
$C2_{ij}$, One OECD	θ_2 0.423	0.140	3.012	0.003
$R_{ij}*G_i$, Same Region*GNP_i	ϕ_1 -0.266	0.085	-3.119	0.002
$R_{ij}*G_j$, Same Region*GNP_j	ϕ_2 -0.245	0.102	-2.403	0.016
$C1_{ij}*G_i$, Both OECD*GNP_i	ψ_1 -0.193	0.076	-2.536	0.011
$C1_{ij}*G_j$, Both OECD*GNP_j	ψ_2 0.059	0.102	-0.579	0.563
A_{ij}, East Asia	κ_1 -1.526	0.558	-2.735	0.006
APO_{ij}, Asia, ASEAN, Oceania	κ_2 1.721	0.179	9.607	0.000
AN_{ij}, E. Asia, N. America	κ_3 0.875	0.298	2.941	0.003

Adjusted R^2 = 0.814, N = 997, $F_{16, 980}$ = 273.738

Note: R^2 = 0.817

Pacific Economic Cooperation (APEC) encompasses all Oceanian countries (Australia and New Zealand), and also Japanese overseas investment in Asia has grown substantially in the 1980s.

For these reasons, the western Pacific region with Japan's economic dominance highlights the prospects of an evolving trading bloc. Unlike two other tripolar trading blocs, a trading bloc centered on Japan has attracted much skepticism by many authors and leaders both in the public and private sector, because the region does not have homogenous characteristics. For an illustration, Asia does not possess the natural, socio-economic and political affinities that lend itself to the formation of a true regional trading bloc. The absence of a strengthened trading bloc in Asia is also attributable to the lack of comparative advantage in the region.[34] From the standpoint of geopolitics the so-called 'Co-Prosperity Sphere,' which was the historical precedent of a regional trading bloc, has long deterred neighboring countries' will to form a new trading bloc. Put it another way, Asian countries fear Japanese hegemony over their region remembering the experience of World War II.

More specifically, Schott points to a combination of economic and political factors[35] against a potential

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[34]Brand, op. cit., p. 157.

[35]Schott, 1991, op. cit., p. 14.

trading bloc initiated by APEC: (1) widely dispersed geography and diverse levels of economic development; (2) the ASEAN is not "interested in the development of a regional trading bloc, as long as multilateralism remains a viable alternative"; and (3) "the dependence of East Asian economies on the US market argues against the evolution of an East Asian bloc."[36] Despite all these negative arguments, a regional trading bloc is likely to evolve on a de facto basis in the region, as Asian neighbors intensify economic interactions with Japan in terms of trade, investment and other economic cooperations. These growing ties with Japan will provide a power incentive to form a regional bloc. Moreover, Japan is currently in a better economic position to wield more influence in the region. In broad strategic terms, the Asian bloc across the Pacific in East Asia from Seoul to Melbourne as one of the Big Three or superblocs will together dominate the world economy in the next few decades in the direction of regionalization. As the empirical results (Table VI) shows, there is much evidence of globalization of international trade, but trade within regions will grow faster in the 1990s and beyond.

With the second largest GNP next to USA and a per capita income exceeding that of USA,[37] Japan is able to utilize its capital exports, foreign aid, direct overseas

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[36]Ibid., p. 14.

[37]GNP and per capita income are decisive factors as a mass or an attraction in the gravity model.

investments and trading activities in a manner that improves its power and influence.[38] The other factor supporting the evolution of a trading bloc in the region is clearly that Japan and the Asian Pacific countries are deeply concerned with the growing trading blocs in Europe and North America.

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[38]Nanto, Dick K., "Asian Responses to the Growth of Trading Blocs" in the book of Belous, Richard S., Hartley, Rebecca S., ed, The Growth of Regional Trading Blocs in the Global Economy. Washington, D.C.: National Planning Association, 1990. pp. 100-101.

CHAPTER VI

POLICY IMPLICATIONS

The cross-section model does not include any direct policy variables, but from the results of the study reported in Tables VI, VII and VIII, several policy implications can be drawn for both national and international organization decision makers.

International commodity flows are most affected by the four major factors in the study; GNP, land area, same region and geographic distance. Since other variables represent a set of attributes or characteristics of countries, some of them do not change at all and the others do not change easily at least in a short period of time. Moreover, geographical locations of nations are by no means changeable. Thus the qualitative variables as exogenous elements may not be a big concern to policy makers due to the unresponsiveness of the variables to policy targets.

As a spatial approach to the formation of trading blocs, this study leaves the explanation for the effects of GNP, and other pure trade-related variables on trade flows to the hands of trade theorists. Since the topic of spatial interactions pertains to the realm of location theory which incorporates the 'gravity law', the gravity model in the

study gives particular attention to the treatment of distance variable, and two dummy variables which are conceptually similar to distance variable, but qualitative in nature. The two dummy variables represent the effect of adjacency, and the effect of countries located in the same geographical region respectively.

As a proxy for transportation cost, the distance variable shows a trade-resisting effect clearly. The other two qualitative variables, however, possess a significantly trade-enhancing effect. Whatever direction the proxies have, one conclusion regarding structure should be made. Although only merchandise trade flows are empirically analyzed, like other typical gravity models dealing with trade flows, only data on commodity trade flows are readily available for an analysis of multiple countries.[1] This implies that trade flows may be regarded as a rough proxy representing the whole flow of economic goods, and possibly even all economic activities over a geographical space. Thus, the results of the analysis can be utilized to provide a broader interpretation with respect to policy implications by taking into consideration factor movement as well as service trade.

Since factor mobility is also a concern of the theory of international economic integration, economic integration

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[1]Data sources of international organizations do not often have overall data on service trade from developing countries. If any, the precision of the data seems dubious.

should take note of international factor movements, and should also embrace the issue of policy-making toward the factor movements. As stated in Chapter II,[2] a higher mobility of production factors forms a larger international economy out of small-scaled national economies, and it is difficult for individual countries to implement national economic policies independently at the higher stage of integration where a harmonization of national macroeconomic policies as well as free movements of factors are pursued among member countries. The two other trade-affecting major variables (GNP, and land area), whether restricting or enhancing, are also believed to play a great part with respect to factor movements. Labor movement seems more associated with GNP, because as a more dominant variable in trade flow models, a larger GNP usually indicates more flows of all sorts of services. The extent to which factor movements are affected by the two trade-governing variables is, however, not directly comparable with the case of commodity trade flows.

Considering both unaccounted indirect effects such as lower costs of management and communications with propinquity and the direct effects (transport costs) arising from the distance variable and distance-related variables, the study leads to a clear conclusion that these variables

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[2]Refer to 'Theory of Economic Integration' section of the chapter.

seen as somewhat secondary ones, should be given the same amount of priority, when a trade arrangement meeting or negotiations on the establishment of a trading bloc is being processed. The reasoning is that in spite of an improvement in modern transportation and communications, trade is still regionally concentrated. As the empirical results suggest, the qualitative dummy variable for same region indicates that preferential treatment, such as MFN status, is more effective for countries in the same region. Higher stages of international economic integration necessitates greater consideration of geographical proximity. For instance, a supranational state which excludes closer countries is less likely to be formed over separate geographical distances.[3]

For a specific example, weight-gaining commodities lose their merits in international trade. This implies that those commodities are preponderantly affected by geographical distance. The same is generally true for bulky or highly perishable products, because geographical distance acts as resistance to trade. The opposite case is found in the areas of communication, service, intellectual property rights such as patents, copyrights, trademarks, etc., which incur the least transport costs, and have advantage of the

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[3]Beckerman, W., "Distance and the Pattern of Intra-European Trade" Review of Economics and Statistics, vol. 28, Feb 1956, pp. 31-40, and Walter, Ingo, The European Common Market: Growth and Pattern of Trade and Production. New York: Frederick A. Praeger, Inc., Publisher, 1967, pp. 89-93.

highest degree of mobility. The tertiary industries have a much larger market area than the manufacturing industries producing bulky tangible commodities and primary industries.

From a macro-perspective, the objectives of international economic integration, viewed as a process, is to more efficiently achieve a number of common goals within the group. These goals extend beyond the single consideration of allocative efficiency in the analysis of trade creation vs trade diversion, and reach further to full employment, persistent economic growth, and international income distribution within the integrated areas. However, the achievement of such goals in the framework of economic integration should be viewed from a long run basis. It is clear that more fundamental factors determining a country's economic performance does not derive from the membership of a country to an economic grouping in the short run. Though the EEC displays the most successful integration, forming an economic grouping does not necessarily lead to a better economic performance for a member country or the group as a whole. This is well-displayed in the several failures of LDCs' economic integration attempts. This means that participating in a trading bloc does not guarantee the economic success of a country. Examples of negative economic results of integration and failure are the West Indian Federation and the East African Common Market constituting Uganda, Tanzania

and Kenya.[4]

A variety of dissimilarities between member countries are less likely to lead to an economic success. Achieving economic development and benefitting scale economies is difficult as shown in the many attempted integrations on LDCs. Political disagreement between the governments of would-be partners is one example of dissimilarity. A variety of similarities may be regarded as propinquity representing the closeness between countries. As the geographical proximity displays a clear implication in the study, the other kinds of proximity will play a role as well in helping countries form a trading bloc, and in associating countries together in the process of regional integration. Thus, in the light of policy implication, propinquity or homogeneity including geographical proximity seems to be most important in considering the possibility of forming a successful trading bloc. This is also important in delineating the prospective geographical range of a bloc, and finally in deciding a feasible level of integration.

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[4]Ethier, Wilfred J., Modern International Economics. New York: W. W. Norton & Company, 1983, p. 489.

CHAPTER VII

CONCLUSIONS, AND SUGGESTIONS FOR FURTHER RESEARCH

Conclusions

> If you look around the world at the moment, you see all kinds of places where we are essentially breaking up into trading blocs... Everybody in the world knows that this is happening, but nobody wants to face reality.[1]

This dissertation has pursued the discovery of existing relationships with respect to regional trade concentration in the global economy, and to uncover spatial forces that play a great part in determining the formation of trading blocs all around the world. The trend towards forming trading blocs is an important issue that many scholars have pursued trying to find the fundamental explanation for this phenomenon. This study regards the phenomenon as one of spatial interactions. It employs the gravity model which is frequently used in the analyses of social interactions. The first equation in Chapter IV is designed to show which qualitative factors affect international trade flows. The

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[1]Thurow, Lester, World Link, June 1989, p. 9. Note: The same paragraph is quoted in the section of 'Regional Trading Blocs' in Chapter II.

gravity equation displays a good performance of the estimation. The results possess a significant degree of power in explaining the current formation of trading blocs. Furthermore, the gravity equation includes more qualitative semi-spatial factors. The help of these factors reinforce the power to explain the issue from the standpoint of location theory.

An international region composed of multiple nations, the delineation of which heavily relies on geographical aspects, is a key factor in explaining the ongoing formation of trading blocs in an international region. A close proximity of two countries in a region is likely to lead to a much greater possibility of combining the two countries, ceteris paribus. GNP or national income is known to be a crucial factor determining international trade. It is also a major variable in the gravity equation. The GNP variable combined with a dummy variable for the same geographical location of nations is revealed as the most important qualitative variable which affects the direction of an international trade flow. This is true, after adjusting for distance and other variables that explain trade patterns. Thus the attribute of same region as a qualitative variable helps to provide an overall explanation for regional economic integration which is viewed as a state of affairs. The economic rationale behind the factor of the same region is that within the same region a shorter distances reflects a lower transport cost, an easier flow of information on

external markets within the international region, and cultural or social similarities.[2] The factor of the same international region, or relatively closer geographical locations outside the region imply that trade flow distortions arising mainly from political conflicts such as ideological confrontation and disagreements of governments will be adjusted in the way that economic forces dominate. This prediction is based on the important contribution of geographical proximity to the attainment of post-war regional economic integration.

In concluding this study, two major findings concerning the issue of a trading bloc are stressed: first, countries not in the same region will have no trade except due to the sizes of GNPs. By virtue of location of the same region and adjacency, there will be trade, even if they were not producing any GNP. Thus the spatial factors contribute to trade, even after taking GNP and other factors into account. This is why trading blocs have been forming on the basis of geographic proximity. As the empirical results are intended to show, the formation of trading blocs is one type of spatial interactions over national borders. Geographical proximity, which is the basic factor in spatial interactions, is important to evaluate the issue of trading bloc formation. This factor plays a further role in the process of forming trading blocs than it has been recognized

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[2]See Footnote 24 in Chapter V.

up to now. The degree of the role of propinquity varies considerably from region to region. Other factors affect the process of integration within a region, however, the role of geographical proximity is widely believed to be important in the long run in spite of modern technological innovations in transportation and communications.

Second, this study discovers that the same region slope dummy variable associated with GNP moves in the opposite direction to geographical proximity, and proves its validity empirically. This variable is seen to indicate that there still exists a strong power towards global free trade. However, since the effect of this variable is lower than the one of the same region dummy variable—representing relative geographical proximity—the trend of forming trading blocs will continue for the time being. The counteracting effect of the variables expressed ($R_{ij}*G_i$ and $R_{ij}*G_j$) as a multiplicative form of the dummy variable for same region and GNP indicates that larger economies have a smaller effect on trade within the same region than on trade outside of that region. This leaves a possibility that worldwide free trade will be induced in the long run. This is likely to cause the breakup of trading blocs, even though they are currently being formed. This prediction is consistent with the advocates of regionalism in the context that trading blocs are a way of promoting world free trade through easier negotiations between the blocs in the long run.

Concluding Thoughts

This study of regional economic integration based on the gravity model comes up with a methodology and striking findings particular to this study.

First, a model is developed that is based on a geographical delineation of international regions rather than on existing forms of economic integration. The model further illuminates geographical factors which are fundamentally dominant in determining the scope of economic integration.

Second, the model did not divide trade flows into exports and imports to investigate the underlying forces which govern their pattern and size. Though the "gross" (or combined) method has not been extensively applied insofaras a trade flow is concerned, the theoretical background is found in the implications of a gravity model[3] and in trade theory.

Third, the model captures a plausible proxy for the second-best issue of economic integration. The model further utilizes it to display that there exists an offsetting force which reduces intra-regional trade as the GNPs of member countries grow.

Fourth, the model tests the justification of the land area variable for the explanation of trade flows. We proved that land area is also an important factor which adversely

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[3]Refer to Chapter III and Table III in that chapter.

influences an international trade flow. Though land area is not generally viewed as a reliable variable which properly represents market size or market structure and resource endowment, this study empirically finds a significant negative relation.

Suggestions for Further Research

Although the results of this study indicate that the cross-sectional regression of the gravity model yields highly useful insights into international trade flows, the addition of exchange rate volatility, and the wholesale price index,[4] etc, to the model may improve its explanatory power. Moreover, the addition of the two variables makes the model represent a trade-determining model, hence making the model more familiar to trade theorists.

The introduction of industrial productivity, and a level of technological advance to the cross-sectional model may shed further light on the factors that affect trade flows between countries. Finally political factors, whether quantitative or qualitative, may be appropriately formulated in the gravity model to measure the effect arising from the socio-political factors.

The cross-sectional gravity model can be separately applied to different individual industries. Considering the fact that the output of each industry has a different degree

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[4]See Bergstrand (1989), op. cit., pp. 146-147.

of mobility, or characteristics, and the fact that the transportation costs vary greatly according to the nature of industry's products, it is highly plausible that separate estimation would yield meaningful results showing that the transportation cost factor is more important for some industries than others.

For that purpose, the single-digit Standard Industrial Trade Classification (SITC) code may be a good choice. Further, if the trade volume of a single commodity is relatively large and scattered over expansive areas around the world, the cross-sectional model can be applied for a single item. As a broader classification than the single commodity, a double-digit number would mean more specified SITC codes than the single-digit codes. But the disaggregation models must be carefully interpreted, by paying close attention to the nature of the disaggregation. The estimates derived from the disaggregated model should show a much larger variation, depending upon the individual industry and the commodity than the aggregated trade flow model.

Computation of the rate of regionalization of exports (imports)[5] within a region or a trading bloc is one way to

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[5]Walter, Ingo, The European Common Market: Growth and Pattern of Trade and Production. New York: Frederick A. Praeger, Inc., Publisher, 1967, pp. 78-79.

The rate of regionalization uses the following relation.

(continued...)

measure the degree to which regional economic integration has undergone. Though the rate of regionalization of trade is viewed partially as a function of time, even prior to a formal establishment of any form of economic integration, it provides a comprehensive picture in which economic integration is explored and a change in trade pattern is exploited.

The indexes of the Gini Coefficient[6] of geographical trade concentration (or concentration by trading blocs) both over time and over regions may provide an insight into

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[5](...continued)

$$\frac{X^J_{(t+i)}}{X^W_{(t+i)}} - \frac{X^J_t}{X^W_t}(1+r)^i$$

where
X^J = total exports(imports) of bloc j to the bloc of j
X^W = total exports(imports) of bloc j to the world
t = base year
t+i = terminal year(i years after t year)
r = average annual rate of movement toward regionalization of exports(imports)

[6]For an analysis of the Gini Ratio, the following relations are used:

$$\sum_{t=1}^{T} \sqrt{\sum_{i=1}^{n} \left(\frac{x_{it}}{X_{jt}}\right)^2}$$ Gini ratios over time

$$\sum_{j=1}^{n} \sqrt{\sum_{i=1}^{n} \left(\frac{x_i}{X_j}\right)^2}$$ Gini ratios over regions

where x_i = exports(imports) going to region i
X_j = total exports of region j
T = Tth year
n = nth region

regional economic integration.[7] By comparing the indexes over regions, it seems likely to discover a relative degree of regional economic integration of a specific region. Equivalently, by comparing the indexes over time, a temporal shift in the regionalization of a bloc might be captured.

There have been also attempts to apply the concept of information theory to economic matters. For example, international trade flows is only one of the matters in which Theil (1967) utilized information theory.[8] The expected information of a distribution is called the entropy of that distribution. Theil used the concept of entropy to investigate the degree of trade concentration over time. Hence, examining the concentration of exports and imports respectively over time in the framework of information theory will shed light on the trend of trade concentration. Though obtained units of entropy are not directly comparable to the results of cross-section analysis, it will provide a

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[7]The Gini coefficient was also used by Hirschman and Michaely. But, Hirschman measured geographic concentration of trade (exports and imports respectively) of countries whereas Michaely measured both commodity concentration of exports and imports of countries and geographic concentration of exports and imports of countries.

Hirschman, Albert O., National Power and the Structure of Foreign Trade. Berkeley and Los Angeles: University of California Press, 1945, Chapter VI.

Michaely, Michael, "Concentration of Exports and Imports: An International Comparison", The Economic Journal, vol. 68, 1958, pp. 722-736.

[8]Theil also utilizes information theory in the fields of the measurement of income inequality, consumer allocation problem, industrial concentration and the allocation of the firm, and input-output analysis.

useful yardstick to measure the extent to which a set of regional integration in different regions has proceeded over time.

Finally, an expansion of the sample size might be more persuasive, though the 47 countries included cover a large portion of world trade and world GNP. The expansion will encounter a great number of zero trade flows among smaller countries many of which are not included in the study. In addition, the proposed estimation with a larger sample is likely to have some bias because of the omission of a number of zero trade flows. However, the estimation with a larger number of countries can be properly interpreted by adopting a careful approach to the obtained results, and may have a possibility that the regression results would be reinforced. Hence, the estimation of the trade flows of countries from all over the world provides a research agenda for the future.

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APPENDIXES

APPENDIX A

GNP, TRADE VOLUME, TRADE RANKING, POPULATION, AND GEOGRAPHIC AREA FOR 46 COUNTRIES, YEAR 1988

COUNTRY	GNP mil. US$	TRADE VOLUME mil. US$	TRADE RANKING	POPULATION mil.	GEOGRAPHIC AREA square km
USA	4,873,700	781,796	1	246.33	9,528,318
Germany	1,208,974	573,891	2	61.45	248,650
Japan	2,866,867	452,234	3	122.61	372,313
France	960,978	346,638	4	55.87	547,026
UK	840,500	334,505	5	57.08	244,102
Italy	833,075	266,450	6	57.44	301,262
Canada	474,275	232,977	7	25.95	9,922,330
Netherlands	226,348	202,740	8	14.76	41,160
Belgium(Lux)	159,151	184,421	9	10.29	30,513
Hong Kong	46,200	127,059	10	5.65	1,061
S. Korea	171,705	112,508	11	41.97	98,484
Taiwan	91,700	110,265	12	20.01	35,989
Switzerland	193,193	107,170	13	6.59	41,290
China	376,535	102,818	14	1,096.1	9,560,939
Spain	341,222	100,872	15	38.81	504,741
Sweden	178,546	95,265	16	8.44	449,960
Singapore	25,024	83,176	17	2.65	581
Austria	126,077	66,533	18	7.60	83,850
Australia	239,361	66,085	19	16.53	7,686,850
Denmark	105,006	53,570	20	5.13	43,080
Brazil	337,424	48,799	21	144.43	8,511,965
Norway	87,367	45,407	22	4.20	324,220
Finland	105,286	42,899	23	4.95	337,030
Mexico	174,160	40,356	24	82.73	1,972,547
S. Africa	85,293	38,902	25	33.75	1,221,040
Malaysia	32,762	37,661	26	16.92	332,632
Thailand	58,599	35,369	27	54.54	513,113
Ireland	28,266	34,289	28	3.54	70,283
Indonesia	80,144	32,957	29	170.18	1,919,270
Portugal	39,899	27,781	30	10.41	88,940
Venezuela	60,404	22,775	31	18.75	912,050
Greece	52,271	18,597	32	10.00	131,944

APPENDIX A (Continued)

COUNTRY	GNP mil. US$	TRADE VOLUME mil. US$	TRADE RANKING	POPULATION mil.	GEOGRAPHIC AREA square km
New Zealand	40,065	16,210	33	3.29	268,680
Philippines	37,720	15,753	34	58.72	300,000
Argentina	74,300	14,456	35	31.53	2,766,890
Chile	20,162	11,777	36	12.75	756,656
Colombia	38,559	10,039	37	30.24	1,138,914
Peru	13,918	5,775	38	21.26	1,285,216
Ecuador	9,326	3,906	39	10.20	283,561
Kenya	8,254	3,046	40	23.88	582,650
Uruguay	7,638	2,565	41	3.06	176,220
Tanzania	4,960	1,210	42	24.00	945,090
Bolivia	5,192	1,205	43	6.99	1,098,581
Mozambique	500	1,081	44	14.23	801,590
Uganda	1,653	780	45	17.19	236,040
Paraguay	6,073	698	46	4.04	406,750

APPENDIX B

SEA PORTS AND HINTERLAND DISTANCES FOR 46 COUNTRIES

Country	Sea Ports	Distances to the Economic Center in Nautical Miles
North America		
USA	New York	800
	San Francisco	2,300
	New Orleans	800
Canada	Montreal	500
	Vancouver	2,000
Mexico	Acapulco	400
	Vera Cruz	200
Europe		
Germany	Hamburg	250
	Rotterdam	250
France	Le Havre	100
	Marseille	350
UK	London	150
	Liverpool	150
Italy	Naples	0
	Genoa	0
	Venice	0
Netherlands	Rotterdam	0
Belgium (Lux)	Antwerp	0
Switzerland	Rotterdam	500
	Genoa	200
Spain	Bilbao	200
	Barcelona	300
	Gibraltar	300
Sweden	Stockholm	200 (when coming from the East)
		0 (when coming from the West)
Austria	Rotterdam	650
	Venice	300
Denmark	Copenhagen	0
Norway	Oslo	300
Finland	Helsinki	100
Ireland	Dublin	0
	Cobh	100

APPENDIX B (Continued)

Country	Sea Ports	Distances to the Economic Center in Nautical Miles
Portugal	Lisbon	0
Greece	Piraievs	150
Eastern Asia		
Japan	Yokohama	200
Hong Kong	Hong Kong	0
S. Korea	Inchon	0
	Pusan	150
Taiwan	Kaohsiung	0
China	Shanghai	1,000
	Hong Kong	1,500
Southeastern Asia		
Singapore	Singapore	0
Malaysia	Singapore	150
Thailand	Bangkok	200
Indonesia	Djakarta	400
Philippines	Manila	200
Oceania		
Australia	Sydney	500 (when coming from the East)
		0 (when coming from the West)
New Zealand	Wellington	0
South America		
Brazil	Rio de Janeiro	400
Venezuela	Maracaibo	0
	Barcelona	0
Argentina	Buenos Aires	400
Chile	Valparaiso	0
Colombia	Buenaventura	200
	Barranquilla	300
Peru	Callao	0
Ecuador	Guayaquil	100
Uruguay	Montevideo	0
Bolivia	Arica	400
	Iquique	500
Paraguay	Rio de Janeiro	1,000
	Buenos Aires	700
Southeastern Africa		
S. Africa	Durban	300 (when coming from the North)
		0 (when coming from the South)

APPENDIX B (Continued)

Country	Sea Ports	Distances to the Economic Center in Nautical Miles
Kenya	Mombasa	200
Tanzania	Dar-es-salaam	300
Mozambique	Maputo	300 (when coming from the South)
		0 (when coming from the North)
Uganda	Mombasa	700

Note: Most hinter distances quoted from Linnemann. Less than 100 nautical miles ignored. See Chapter IV.

APPENDIX C

NEIGHBORING COUNTRIES

Country	Neighboring Countries
North America	
USA	Canada, Mexico
Canada	USA
Mexico	USA
Europe	
Germany	France, Italy, Netherlands, Belgium (Lux), Denmark, Switzerland, Austria
France	Germany, Italy, Netherlands, Belgium (Lux), Spain, Switzerland
UK	Ireland
Italy	Germany, France, Switzerland, Austria
Netherlands	Germany, France, Belgium (Lux)
Belgium (Lux)	Germany, France, Netherlands
Switzerland	Germany, France, Austria
Spain	France, Portugal
Sweden	Norway, Finland
Austria	Germany, Italy, Switzerland
Denmark	Germany
Norway	Sweden, Finland
Finland	Norway, Finland
Ireland	UK
Portugal	Spain
Greece	None
Far Eastern Asia	
Japan	None
Hong Kong	China
S. Korea	None
Taiwan	"
China	Hong Kong
Southeastern Asia	
Singapore	Malaysia
Malaysia	Singapore, Thailand, Indonesia
Thailand	Malaysia
Indonesia	Malaysia
Philippines	None

APPENDIX C (Continued)

Country	Neighboring Countries
Oceania	
Australia	None
New Zealand	"
South America	
Brazil	Venezuela, Colombia, Peru, Bolivia, Uruguay, Argentina, Paraguay
Venezuela	Brazil, Colombia
Argentina	Brazil, Chile, Bolivia, Uruguay, Paraguay
Chile	Argentina, Peru, Bolivia
Colombia	Brazil, Venezuela, Peru, Ecuador
Peru	Brazil, Colombia, Chile, Ecuador, Bolivia
Ecuador	Colombia, Peru
Uruguay	Brazil, Argentina
Bolivia	Brazil, Argentina, Chile, Peru, Paraguay
Paraguay	Brazil, Argentina, Bolivia
Southeastern Africa	
S. Africa	Mozambique (no trade)
Kenya	Tanzania, Uganda
Tanzania	Mozambique, Uganda
Mozambique	S. Africa, Tanzania
Uganda	Kenya, Tanzania

APPENDIX D

FOB FACTORS FOR 3 MAJOR COUNTRIES

Year	World	USA	Germany	Japan
1960	1.096	1.091	1.07	1.2
1961	1.093	1.084	1.07	1.2
1962	1.09	1.086	1.07	1.2
1963	1.09	1.088	1.077	1.183
1964	1.089	1.088	1.082	1.186
1965	1.087	1.087	1.068	1.214
1966	1.87	1.088	1.068	1.222
1967	1.086	1.075	1.071	1.221
1968	1.085	1.074	1.067	1.217
1969	1.082	1.065	1.062	1.203
1970	1.081	1.065	1.065	1.2
1971	1.082	1.067	1.071	1.187
1972	1.081	1.067	1.062	1.177
1973	1.08	1.067	1.058	1.159
1974	1.078	1.073	1.047	1.136
1975	1.076	1.066	1.042	1.132
1976	1.072	1.063	1.034	1.119
1977	1.069	1.059	1.035	1.106
1978	1.068	1.057	1.034	1.108
1979	1.066	1.057	1.035	1.105
1980	1.063	1.048	1.03	1.088
1981	1.065	1.047	1.033	1.08
1982	1.068	1.045	1.031	1.078
1983	1.065	1.046	1.031	1.074
1984	1.063	1.047	1.03	1.079
1985	1.06	1.047	1.028	1.082
1986	1.058	1.046	1.027	1.09
1987	1.053	1.045	1.025	1.025
1988	1.054	1.042	1.026	1.09
1989	1.054	1.042	1.027	1.09

Source: IMF Statistical Yearbook XLIII, 1990.

APPENDIX E

GNP FOR 3 MAJOR COUNTRIES

Year	USA	Germany		Japan	
	B$	B$	B DM	B$	B¥
1960	515.3	72.65	303	44.04	15852
1961	533.8	82.47	331.4	54.2	19575
1962	574.7	90.17	360.5	60.15	21702
1963	606.9	95.83	382	69.31	25053
1964	649.8	105.57	419.6	81.77	29598
1965	705.1	114.75	458.3	90.48	32707
1966	772	121.9	487.4	104.84	37988
1967	816.4	123.82	493.6	122.95	44525
1968	892.7	133.69	533.7	146.37	52772
1969	964	152.27	597.7	173.28	62097
1970	1015.5	185.3	675.7	204.4	73188
1971	1102.7	215.91	751.8	231.68	80592
1972	1212.8	258.77	825.1	304.78	92401
1973	1359.3	343.82	918.9	414.13	112520
1974	1472.8	380.9	985.7	458.77	133997
1975	1598.4	418.4	1029.4	499.24	148170
1976	1782.8	447.26	1126.2	561.18	166417
1977	1990.5	516.45	1199.3	690.96	185530
1978	2249.7	643.03	1291.6	971.65	204475
1979	2508.2	761.91	1396.5	1012.25	221825
1980	2732	817.08	1485.2	1058.91	240098
1981	3052.6	683.67	1545.1	1164.49	256817
1982	3166	658.2	1597.2	1082.77	269697
1983	3405.7	658.16	1680.5	1181.29	280568
1984	3774.5	621.91	1769.9	1256.54	298453
1986	4240.3	895.79	1945.2	1965.67	331254
1987	4526.7	1122.62	2017.8	2388.52	345476
1988	4880.6	1208.18	2121.8	2866.87	367389
1989	5234	1202.34	2260.4	2833.73	390942

Source: IMF Statistical Yearbook XLIII, 1990.

APPENDIX F

TRADE FLOWS BETWEEN USA AND GERMANY, AND BETWEEN USA AND JAPAN

Year	USA↔ Germany			USA↔ Japan		
	Exports	Imports	Trade	Exports	Imports	Trade
1960	1076.4	897.1	1973.5	1345.2	1148.5	2493.7
1961	1085.7	855.6	1941.3	1742.1	1054.8	2796.9
1962	1082.1	963.3	2045.4	1415.5	1358	2773.5
1963	1585.1	1003.6	2588.7	1846.4	1498.1	3344.5
1964	1620.4	1171.1	2791.5	2018	1768	3786
1965	1650.5	1341.6	2992.1	2083.5	2414.2	4497.7
1966	1679.9	1796.8	3476.7	2371.4	2964.5	5335.9
1967	1714.9	1955.5	3670.4	2699.9	2998.7	5698.6
1968	1708.9	2721.2	4430.1	2954.3	4054.3	7008.6
1969	2117.9	2603.3	4721.2	3489.7	4888.2	8377.9
1970	2740.2	3129.6	5869.8	4652	5875.2	10527.2
1971	2831	3874	6705	4055	7702	11757
1972	2808	4501	7309	4963	9599	14562
1973	3756	5660	9416	8313	10247	18560
1974	4986	6881	11867	10679	13325	24004
1975	5194	5750	10944	9563	12336	21899
1976	5730	5965	11695	10144	16922	27066
1977	5989	7701	13690	10532	20203	30735
1978	6957	10575	17532	12885	26471	39356
1979	8482	11624	20106	17597	28173	45770
1980	10960	12257	23217	20790	32973	53763
1981	10277	11918	22195	21823	39904	61727
1982	9291	12503	21794	20966	39931	60897
1983	8737	13229	21966	21894	43559	65453
1984	9084	17810	26894	23575	60371	83946
1985	9049	21232	30281	22631	72380	95011
1986	10561	26128	36689	26882	85457	112339
1987	11748	28028	39776	28249	88074	116323
1988	14269	27380	41649	37620	93128	130748
1989	16883	25672	42555	44584	97110	141694

Source: IMF Direction of Trade Statistics.
Unit: Million US dollars.

APPENDIX G

TRADE FLOWS BETWEEN GERMANY AND JAPAN

Year	Germany ↔ Japan		
	Exports	Imports	Trade
1960	119.9	68	187.9
1961	187.8	93.6	281.4
1962	192.9	113.5	306.4
1963	198.9	130.7	329.6
1964	218.8	159	377.8
1965	187.8	239.6	427.4
1966	217.8	257.2	475
1967	318.3	231.9	550.2
1968	349.3	290.7	640
1969	396.9	412.5	809.4
1970	534.9	560.4	1,095.3
1971	520	725	1,245
1972	617	996	1,613
1973	1,049	1,358	2,047
1974	1,252	1,349	2,601
1975	956	1,744	2,700
1976	1,115	2,167	3,282
1977	1,304	2,802	4,106
1978	1,737	3,593	5,330
1979	2,265	4,326	6,591
1980	2,186	5,731	7,917
1981	2,110	5,741	7,851
1982	2,130	5,220	7,350
1983	2,189	5,782	7,971
1984	2,432	6,440	8,872
1985	2,707	7,120	9,827
1986	4,056	11,112	15,168
1987	5,903	14,100	20,003
1988	7,461	16,150	23,611
1989	8,129	17,143	25,272

Source: IMF Direction of Trade Statistics.
Unit: Million US dollars.

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