wastes in this study, the cost difference probably represents a lower bound on the true cost difference due to the relatively higher costs of industrial waste treatment. Further, our careful modeling of the inventory and constraint sets for each reach of the river lends credence to our resulting cost differences.

The picture emerging from the literature dealing with this matter, then, strongly suggests very high social costs associated with the uniform treatment requirements of the 1972 Water Pollution Control Act Amendments. From an efficiency and cost perspective, the characterization of the Amendments as "silly" and "ridiculous" certainly strikes one as reasonably accurate.

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The International Allocation of Economic Activity: A Review Article

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In June, 1976, a Nobel Symposium was held in Stockholm. The theme and title of the Symposium were The International Allocation of Economic Activity.1 The Symposium owes its existence to Professor Bertil Ohlin and is devoted to a modern assessment of the state of the art in international trade theory. Prior to the award of the Nobel Prize in 1977, this Symposium may be said to be the apogee of Ohlin's professional career since modern trade theory still rests to a remarkable degree on his 1933 classic, Interregional and International Trade.2 This Symposium shifts the emphasis by explicitly recognizing the close interrelationship between trade theory and location theory. This shift in emphasis explains the presence of eight well-known location theorists and economic geographers in addition to what was virtually an all-star cast of international trade theorists. The emphasis given to location theory was deliberate. It was foreordained in Ohlin's excellent review of the state of international trade theory in the mid-'sixties'3 and constitutes a stroke of great enlightenment since the subject matter of trade theory has tended to become excessively narrow and ingrown in recent years and a broadening of scope could restore some lost realism and vitality.

Fifteen major papers were presented together with a substantial voluminous. Each of the papers was the beneficiary of at least one comment and a general discussion. In order to keep the analysis well-defined, the subject matter was limited to positive problems in trade and location theory in the absence of imbalanced trade and under assumed conditions of satisfactory rates of capacity utilizations. The effects of imperfections in competition were also excluded. These restrictions meant that the discussion among forty-one scholars (of whom thirty-one came from Sweden or the United States and only two from outside the developed world) was conducted in a full-equilibrium framework that was usually static or comparative static.

The papers were not uniformly insightful but the Symposium must be judged very successful. The book will amply repay the time spent reading it.

This review article will attempt to provide a working guide to the almost six hundred pages so that the potential reader may have the benefit of one signpost in the selection of passages that will be of particular relevance to the reader's own research interests. Section I
summarizes the main thread of the Symposium. Section II draws more detailed attention to papers of particular interest, quality, or originality. The third section attempts to put the subject of international trade theory into some perspective in the light of the papers given and vice versa.

I. The Main Thread of the Symposium

The single most important thread of the Symposium is the interaction of the patterns of trade and the location of production. Walter Isard refers to trade theory and location theory as "the two sides of the same coin" (159). There is therefore a tendency to emphasize activities which are internationally mobile in preference to problems relating to immobile natural resources—although these problems are touched on from time to time as the presence of economic geographers might be expected to ensure.

The Symposium began with two background paper reviews by Gottfried Haberler and Ohlin. From these papers and subsequent discussion, it is apparent that the factor proportions theory must be seen as a complex, multi-dimensional theory if it is usefully to portray the real world. With the exception of Ronald W. Jones, this was an apparently spontaneous consensus. But the role of the formal model (the core or basic theory of the field) must be seen as something other than a general equilibrium analysis in a static or comparative static framework. Ohlin sees the formal theory as an introduction into an analysis of the process of transition from one stage to another in a framework to which other variables can (and must) be added as the complexity of the problem increases (30-52).

Even so, many participants seemed to emphasize the attributes of the formal model and to regard the formal theory as an end in itself. Occasionally a hankering after the comfortable manipulability of the 2 x 2 x 2 model can be observed. What is surprising is the degree to which Ohlin's forty-year-old insights were able still to point the way to many of the more modern elaborations of trade theory. Ronald E. Findlay refers to the "majestic trajectory" of Ohlin's thought (57).

Papers 4, 5, and 12 and their attendant comments and discussion provide economists with the essence of the interweaving of local and trade theory. These papers deserve wide attention.

Paper 4 by Alan R. Pred (127-147) describes the evolution of city-systems. The argument is made that cities (regional centers) spread to develop increasing trading economic, information, communication, and transportation linkages. The development of these ties promotes further reciprocal involvement which, in turn, further strengthens the linkages. Cities come ever more interdependent. By extension the international system will become international and these linkages will become increasingly important in establishing the pattern of international and investment. If the intent of the Symposium is to expose economists to the role of international economic relationships of a broader and usually-neglected set of spatial-informational variables, then Gunmar Törnqvist's Comment (148-158) on Pred's paper may be the single most valuable contribution. Taking off from Pred's essentially intradimensional development of the dynamics of city-systems, Törnqvist develops a model showing both why national frontiers will continue to be an important demarcation line in the interregional exchange of goods and in the allocation of economic activity. He then goes on to show how multinational enterprises (MNE's) might create their own international sets of city-systems by creating internal channels of international flows and quite specific transportation linkages. What neither Pred nor Törnqvist does is to examine the limits of the development among cities and what forces will work against or retard the development of these systems. Equally, Isard sums consideration of forces that weaken the tendency for agglomerations to produce economies to enterprises located within them.

According to Törnqvist, international transactions are the more likely to take place the better is the awareness of decision-makers of the detailed characteristics of the potential foreign trading-partner nation. In general both public- and private-sector decision-makers have "mental maps" which decrease in accuracy quite quickly once national boundaries or certain prespecified geographical limits are exceeded. This whole question of earlier trade patterns and linkages would help to explain the importance of national-again the analysis of the historical-colonial ties in trade and investment relationships. They also explain why many ex-colonies still find themselves continuing to follow traditional trade patterns. These relationships may now be consummated by MNE's instead of political constraints but it is easier, in this context, to see how even a relatively benevolent MNE could be considered an agent of neo-colonialism. When anything which reinforces traditional patterns of trade is seen working against the aspiration of the newly-independent nation, MNE's are inevitably suspect. This comment lends naturally into Isard's paper on agglomeration (159-177). This paper is devoted to the role of economies of agglomeration in the determination of the location of different activities. Three types of economies derive from having a nucleus of production set in a limited geographic space: large-scale economies within a firm; localization economies which derive from having the focus of an industry present in a single location; and urbanization economies which derive from the enlargement of the interindustry total economic size at a single location (161). These gains are set against the costs of "diffusion". These costs include the lack of plant economies in peripheral areas and the costs of transportation to those areas. The concept of economies of agglomeration makes the widening income gap between poor and rich nations more easily understood. What Isard does not do, presumably because of the ubiquitous constraints of time and space, is to examine the implications of MNE's for agglomeration economies. This task is, in part, undertaken by Torsten Hägerstrand who relates agglomeration to innovation. Innovation is seen to derive from agglomeration, from the interaction of ostensibly isolated endeavors in the face of increases in demand and of technological advance. What MNE's can do is to convey the gains from agglomeration (scale economies represented by the agglomeration economies) and can combine them there with factors with different relative costs. In this way, the periphery and the center are integrated. This phenomenon underlies "production sharing" whereby MNC's ship cheap parts to the periphery for assembly and ultimate reexportation. For production sharing to occur requires that MNE's generate the better geographical perspective and communications network that were considered in Törnqvist's paper. But however much an MNE may convey agglomeration benefits to the periphery, the periphery is unlikely to achieve anything more than a dependency status unless it can achieve some critical minimal size and indigenous innovativeness.

The final important contribution to this thread is Dunning's paper (number 12) on the effect of multinational enterprise on trade and location (395-418). Given the current importance of MNE's as producers in the world, Dunning's paper is almost inevitably the focus of much attention and discussion at the Symposium. It is no longer realistic to consider theories of international...
trade (or location) without taking into account the implications of this organizational form. Multinational enterprise most directly confronts the decision of whether to ship goods across national boundaries or to create a new source of economic activity in a different nation. The Symposium was fortunate that such an important topic received a paper of such high quality and extreme breadth.

Dunning begins by pointing out that none of the existing theories of international trade can satisfactorily explain the whole potential range of activities of MNEs (397). Emphasizing the need for a theory of the MNE to identify both location-specific endowments within nations and ownership-specific endowments (within firms) Dunning attributes the main reason for the growth of MNEs to the economies available from the internalization within the corporation of many transactions and activities. The relatively succinct description of these internalization economies (402-4) is as complete as this reviewer has found. From this, Dunning develops his own "systemic theory of ownership advantages" which combines the advantages of internalization to corporations with technological factors and the effects of imperfect competition and barriers to entry. This theory is offered as an eclectic theory of the MNE and is in many ways a companion to the neotechnological theory of international trade. It applies, therefore, more importantly to manufacturing activities. The main problem with the neotechnological theory is that it can be reduced to a simple argument that bigness reduces costs and it can tend to underestimate the negative aspects of sheer size. It also may be so all-embracing that it does not aid in focusing on crucial determinants of different investment and production decisions. Despite its breadth, the theory does ignore some factors to which many would attribute positive roles: the great ability of MNEs to concentrate groups of complementary factors quickly at a point in geographic space to co-operate with local, immobile resources; the importance of political boundaries in influencing the terms at which goods and factors may flow; the importance of the factor-price set in different nations; strains arising from potential alienation of host governments as a result of a clash between MNE and host interests; and the role of "city-system-type linkages". When the possibility of the establishment of an MNE subsidiary in a developing nation is considered, the compatibility of the MNE's system of working and the socio-economic climate of the host nation may be important. This may usefully be considered in the framework that Staffan Burestamn Lindner introduced to international trade theory. Lindner argued that trade in manufactured goods was more likely to take place between nations of approximately the same level of economic sophistication (per-capita income) simply because the goods produced in one country would be suited to the trading-partner tastes. For direct investment to take place, the host economy must be able (and willing) to adapt to the practices of the MNE and vice versa. In addition, the local market must need goods of the degree of sophistication which the MNE is capable of producing. This factor suggests a limit (other than internalization economies) on the degree to which MNEs from rich nations will be able to invest in poor nations. Quite possibly, semi-developed nations will soon launch their own MNEs in poor countries. Of course, in cases such as extractive industries in which the MNE can "paritise itself off" from the host economy in an enclave, this restriction will not be applicable. But, Dunning tends to stress the role of the MNE in internationally-mobile activities. This is inherent in the close relationship between the systemic and neotechnological theories since the latter are concerned pre-eminently with foothose manufacturing industries.

The main thread of the Symposium is the development of interaction between location and trade variables. In this the MNE is probably fundamental since it has tremendous quantitative importance and because the organizational form itself is multi-faceted. In practice, MNE decisions include virtually all of the variables that location theory provides as a supplement to the more traditional variables in international trade theory. A full, eclectic theory of the MNE may be an almost sufficient addition to standard trade theory to identify both sets of theoretical forces quite fully.

A first, working step toward the introduction of locational variables in the theory of international trade may be to recognize them (together with what may be termed second-order economic forces) as qualifications to the factor-proportions theory. The factor-proportions theory can be seen as a theory of the relative costs of goods in different nations given the prices of factor inputs generated in domestic factor markets. If the cost differentials between production in two countries, when determined on the basis of factor prices and least-cost technical coefficients are small, then locational factors and other relatively minor economic factors can determine the direction and mix of international trade. They achieve this by dominating the effects of small differences in factor endowments (and therefore prices). If, however, the difference in factor-endowments is substantial, locational variables will probably have little to add to traditional international trade theory.


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about the transitional stage to a trade theorist is the rapid change in comparative advantage that is likely to accompany the growth of per-capita GDP from $150 to $1500 (in 1973 dollars) (480). The three categories of economy all experience this change and adapt to it with varying degrees of success. One derivative point (among many) that warrants further research by international economists is the need to anticipate the change in comparative advantage. Chenery compares (482) the success of large nations which have anticipated this change by having emphasized export industries in the course of development with those that have not. The nations which remained inward-looking could not escape "the loss in growth that is caused by periodic import shortages".12

Myint's task was to incorporate institutional changes as endogenous variables in the analysis of the international allocation of economic activity. No small task! The paper (367-368) emphasizes the implications of domestic institutional factors which shape the ability of the nation to confront the international economic scene. At the beginning, Myint identifies a useful triorthic of institutions (367): international institutions such as International Monetary Fund or UNC-TAD, international linkage institutions such as those considered by Fred and Torney, and the domestic institutions. Analysis of the second set would also have made an interesting paper. Myint is concerned with the elimination of institutional defects within developing nations and how this elimination could lead to a substantial change in the volume and pattern of international trade. In so doing, Myint confronts some of the great weaknesses of orthodox international trade theory as it relates to developing nations—the assumption that there is an efficient resource-allocating mechanism at work in the developing nation so that its economy responds rationally and efficiently to the conditions in the international market place. (Two examples of this failure are reported by Brookfield, 70-79.) The institutional changes which concern Myint are those of inefficient capital markets, dual economies with the traditional sector being the labor-intensive and long-run comparative-advantage sector, the diseconomies of small-scale marketing, and inappropriate governmental policies. Myint shows that a breaking down of these elements could easily generate advantages in primary products. To be sure, this comparative advantage might be stronger under existing conditions than if some of the internal institutional problems could be eliminated. The LDC may well be in a vicious circle in that its need for essential imports is so great that it cannot afford to reduce its dependence on the traditional exports. Under such circumstances, its only hope is for an improvement in the terms of trade. However, the inequality of bargaining strength between some LDCs and some MNES does suggest that many LDCs do not enjoy the nationhood or economic independence which is built in to the orthodox theory and that this may be the fundamental cause of the gap between theory and reality in so far as it pertains to the problems of LDCs.

The main achievement of this group of papers is to show the need for the creation of a basic model of international trade adapted especially for the developing world. This conclusion would not have been universally accepted by the participants some of whom stressed the relevance of orthodox theory to LDCs and to the questions of policy-formation in general (496-8, 547, 554-6). In the opinion of this reviewer, the orthodox theory in its present form does not carry over successfully to this particular but important subset of nations. However, the core of trade theory for developing nations will undoubtedly be a direct outgrowth of one of the more complex versions of the H-O orthodoxy. Once this basic model has been constructed, it will serve as a springboard for many adaptations and more-specialized analyses since studies of individual developing nations and groups of nations will undoubtedly require special elaborations of the core theory. Probably such adaptations for LDCs will be much more numerous than the need for adaptations so the orthodox core theory for the study of developed nations. If the prosperity of the developed world hinges on the stability of the developing nations as political entities, as markets for goods and as suppliers of goods, then attention to the development of this adaptation must be considered an urgent matter.13

Of the other papers presented, Wassily Leontief's (507-530) is the most impressive and ambitious. This is a trade-oriented summary of the global I-O model completed for the U.N. study, The Future of the World Economy. People may differ over its relevance but not over the quality and magnitude of the undertaking. Findlay's comment on Haberler and Ohlin (57-60) is an elegant reconciliation of the Ricardian and factor-proportions theories. By tying the argument into the question of the ultimate validity of factor-price equalization, Findlay shows how the existence of industry-specific factors can be used to identify the two theories. If the industry-specific factor is fixed through all time, then the Ricardian model is relevant and factor-price equalization will never be achieved; if the industry-specific factor become malleable with the passage of time, then the H-O theory applies and factor-price equalization will occur. The third general

12This concept may help to resolve Keynes' debate in Irving B. Kravis, "Trade as a Handmaiden to Growth: Simulations between the Nineteenth and Twentieth Centuries," Economic Journal 30. (December, 1970), pp. 850-872.

13This process reflects Ohlin's own views on the use and pattern of evolution of international trade theory.
I also recognize that there are very well-defined limits at which the general model must be curtailed and developed in a specialized way if it is to be made relevant to a particular problem. For example, adding capital accumulation, population growth and technological advance to a pure factor-proportions theory does not, for me, make the theory applicable to LDCs. By the same token, we cannot expect a general theory of international trade (and location) to explain every minute particular or even every historical fact.

The Concluding Remarks provide a useful basis for amplifying the various facets of this problem of method. While our respective models are not perfect, does show that commercial policies affect the pattern of trade (241) and the degree of industrial diversification (242).
Patterns of Income Concentration Over Time in Puerto Rico: A Curvilinear Regression Model

ARTHUR J. MANN* AND WILLIAM C. OCASIO**

Introduction

The relationship between economic growth and the size distribution of income in developing areas has been the focus of debate ever since the original Kuznets presentation. Taking its cue from this seminal contribution, the conventional wisdom appears to posit an inverted U-shaped relation between economic growth (and development) and a given measure of income inequality, with the latter variable increasing in the initial stages of the growth process.

Numerous cross-sectional studies of this relationship have been carried out, employing as a data base both developed and developing countries. Yet, interpretation of the results of such studies is too often clouded by the highly varying quality of the data, especially those of the developing countries. Moreover, quantitative international comparisons that are cross-sectional in nature may give rise to policy inferences or interpretations which are

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directed at specific countries. Kuznets himself has critically questioned such exercises that draw inferences about changes from data on differences.1 Time-series analysis for developing countries has proved even more treacherous, again in part due to data limitations.

It is the purpose of this paper to use a readily available and consistent data base to analyze the growth-income concentration question over time for one developing area. Both cross-section and time-series analysis will be carried out on data pertinent to the Puerto Rican experience over the 1949-1969 time period. A quadratic relationship between the logarithms of eight socioeconomic independent variables and the Gini coefficient as the dependent variable will be postulated. Thus, since the Kuznets thesis in essence specifies a polynomial function, this paper represents a test of the Kuznets hypothesis with reference to the Puerto Rican case. Such a specification will make it possible to test the inverted U-shaped hypothesis for a specific developing area, a hypothesis that at present appears to be based almost solely upon cross-sectional data covering numerous regions. No attempt is made in this paper to prove or disprove the overall Kuznets thesis. Indeed, it is highly questionable whether or not this can be done with respect to Puerto Rico, given its