

JOHN F. MORRALL III

Human Capital, Technology, and the Role of the United States in International Trade

John F. Morrall III

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Preface

At the present time there are two major interpretations of the observed patterns of United States foreign trade in manufactures. Both lines of thought trace their antecedents far back in the history of economic thought, although one has always occupied the mainstream while the other has always lapped at the fringes. Indeed, the latter theory has arisen mainly as a reaction to the conventional theory and consisted, until recently, of an unorganized body of criticism rather than an integrated, self-contained theory. In this study I will examine the two theories, attempting to reconcile their differences and solidify their similarities. This course of action was chosen because I felt that the two theories were complementary on theoretical grounds. However, as an explanation for United States trade, this conciliatory approach did not prove fruitful, because one theory did prove to be superior to the other by several methods of determination.

I would like to thank Professor Dennis Appleyard for his much needed criticism of several drafts of this monograph as well as for providing most of the inspiration and direction of the project. Professors Alfred Field and George Iden also read and commented on an earlier draft of the manuscript and their help is gratefully acknowledged.

The University of North Carolina at Chapel Hill and the University of Florida both provided financial support, without which this project could not have been accomplished.

By dedicating this monograph to my wife, Anne, I thank her for typing, editing, and moral support.

Thanks must go also to the Graduate School of the University of Florida for making possible the publication of this monograph.

than yesterday's case. A student will never again confront the facts of yesterday's case in yesterday's situation. But, out of guided immersion in a succession of cases, administrative skills are nurtured and developed, and a deeper understanding of personnel policies and practices created. Case study and discussion constitutes training in problem analysis, training in communication, training in decision making, and, above all, constitutes a learning process which deepens understanding of administrative policies, processes and problems. For example, a student who studies a succession of different labor negotiations will become aware of crucial differences in the institutional and environmental variables affecting each negotiation and will note how the process operated under the influence of different actors. Similarly, study of different company approaches to the administration of safety and health will produce broadened and deepened understanding of that administrative function. Study of cases prepares students to undertake administrative assignments with considerable understanding of the problems facing them. This book, therefore, places primary emphasis on the analysis and discussion of a range of personnel and labor relations cases to build an understanding of administrative policies, processes, and problems.

As noted in the negotiation example, case situations are influenced substantially by "institutional and environmental variables." While no attempt will be made to catalog these variables, much of the subtlety of case analysis relates to them. Rather obvious economic variables are the growth or decline of the industry and company involved, the nature and degree of competition, and the profitability of the enterprise. Growth companies in expanding industries obviously have far more freedom to develop outstanding personnel policies than do organizations with severe financial, competitive, or regulatory constraints. The social environment, including community size and plant location, may be significant in particular situations. Clearly economic, social, and governmental variables play important roles in case analysis. These would include such institutions as the National Labor Relations Board, the Equal Employment Opportunity Commission, the Occupational Safety and Health Administration, and such laws as the Equal Pay Act and others.

The term "institutional variables" is intended to include such factors as the history and character of the union-management relationship, the managerial culture including the values and goals of top management, and the ongoing policies and practices of the organization. These are subtle variables providing opportunities or constraints, as the case may be, for innovative personnel management. Students at times are unrealistic in suggesting a course of action which would have a minimal chance of adoption in the managerial climate of the case. A crucial element, therefore, is the identification and incorporation into the case analysis of important "institutional and environmental variables."

As a general guide to case discussion, each section is introduced by textual material analyzing the major policy options and other administrative dimensions of the topic under discussion. Each section also includes a limited number of selected references. Obviously the greater the familiarity of the student with the relevant personnel management literature, including one or more of the standard personnel management texts, the greater will be the perspective he or she brings to the case analysis. The focus of the textual material introducing each section will be on administrative processes and problems, that is, on policy options, on important administrative considerations, and on major problems.

We are in debt to many individuals and organizations for helping to make this book possible. In general, the authors of each case are listed at the beginning of each case. Most of

the cases were developed for our students in personnel and labor courses at Harvard. They are reprinted with the permission of the President and Fellows of Harvard College. In addition to being grateful to all of the cooperating companies and their executives, we are also indebted to the Committee on Industrial Relations of the American Iron and Steel Institute for their help with respect to the Vulcan Steel case and to Information Science, Inc. for assistance with the Florida Steel case. To the former students, research assistants, and faculty colleagues who helped produce these cases, we are most grateful. We are especially pleased to acknowledge the assistance of Professors Norman Berg, Clinton Bourdon, William Fulmer, M. Thomas Kennedy, and the work of former research assistants John Barrett, Mary Chatfield, Norman Fast, Donna Hale, Gordon Howie, Lesley Levy, David Peach, David Rikert, and Louis Roquet. We are also appreciative of the support and fine cooperation of Professor E. Raymond Corey, Director of Research, and Professor John McArthur, Dean, of the Harvard Business School, and Professor Henry Morgan, Dean, of the School of Management at Boston University.

We are particularly appreciative of our association with Professors James J. Healy and M. Thomas Kennedy, to whom this book is dedicated. They have been our friends and colleagues for many years. Their imaginative and creative case teaching and course development over several decades have been, and continue to be, both a landmark and an inspiration to students and faculty alike.

The Background Note on Equal Employment Law and Affirmative Action was expanded and updated from a note originally written by Deborah Wagner. The Background Note on Affirmative Action for the Handicapped was written by Carmen Vaubel.

Three of our introductory chapters benefited from careful reviews by outside experts. Betty Murphy, former member of the National Labor Relations Board, made several useful comments on an early draft of the note on equal employment and affirmative action. Thomas Brown, of the Department of Labor, Nicholas Ashford, of MIT, and Diana Chapman Walsh, of the Boston University Center for Industry and Health Care, made helpful comments on an early draft of the chapter on safety and health. Robert Paul, vice chairman of the Martin Segal Company, reviewed the section on employee benefits.

With respect to the administrative and secretarial work which completion of this book required, we benefited enormously from the fine work of Carmen Vaubel. We are also grateful to the staff of Prentice-Hall, especially Barbara Piercecchi and Sonia Meyer, for their valuable assistance.

We, of course, take responsibility for this book, including its shortcomings. It is our hope that study and discussion of the material in this volume will contribute to a better understanding of, and an improvement in, the management of human resources. Reindustrialization, a priority goal for the eighties, if it is to be meaningful, will require greater effectiveness in the management of human resources. The student should tackle this volume to ascertain how human resources management, like marketing, finance, control, and production, can be a powerful strategic weapon for realizing company objectives. Total immersion in the cases, we predict, will be an enjoyable experience as well.

Fred K. Foulkes E. Robert Livernash

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1. The Human Capital Approach to International Trade Theory

The antecedents of the traditional Heckscher-Ohlin theory can be separated into three distinct approaches: (1) classical comparative cost theory developed by Ricardo; (2) opportunity cost theory developed by Haberler; and (3) the factor proportions theory developed by Heckscher and Ohlin. Richard Caves has pointed out that Haberler's analysis and the Heckscher-Ohlin model are by no means in conflict. Indeed, he concludes that the former is "basically a condensed presentation" of the latter. Furthermore, the classical comparative costs theory is not necessarily in conflict with factor endowment theory, since the latter seeks to explore the basis for comparative advantage while the former simply assumes that a basis exists. That the two approaches have been in conflict is due to the differing results that were uncovered when empirical verification was attempted.

1. M. O. Clement, Richard L. Pfister, and Kenneth J. Rothwell, *Theoretical Issues in International Economics* (Boston: Houghton-Mifflin Company, 1967), pp. 82–85.

2. Trade and Economic Structure: Models and Methods (Cambridge:

Harvard University Press, 1960), p. 30.

3. For example, see Bela Balassa, "An Empirical Demonstration of Classical Comparative Cost Theory," Review of Economics and Statistics 45 (August 1963): 231–38; Wassily W. Leontief, "Domestic Production and Foreign Trade; The American Capital Position Re-examined," Economia Internazionale 7 (February 1954): 3–32, reprinted in Readings in International Economics, eds. Richard E. Caves and Harry G. Johnson (Homewood, Illinois: Richard D. Irwin, Inc., 1968), pp. 503–27; Leontief, "Factor Proportions and the Structure of American Trade: Further Theoretical and Empirical Analysis," Review of Economics and Statistics 38 (November 1956): 386–407; and G. D. A. MacDougall, "British and American Exports: A Study Suggested by the Theory of Comparative Costs," Economic Journal 41 (December 1951): 697–724. The Balassa and MacDougall studies strongly support the comparative cost theory while the Leontief studies show results in opposition to those predicted a priori by the Heckscher-Ohlin theory, giving rise to the famous Leontief Paradox.

Until human capital and natural resources were added as factors of production to the Heckscher-Ohlin model, the weight of empirical evidence was overwhelmingly on the side of classical comparative advantage. Indeed, Caves thought that the classical theory would eventually win out because of its superior statistical support (p. 281). When the study is restricted to trade in manufactures so that direct trade in natural resources, which are notoriously capital intensive, is excluded,⁴ and when labor skills or human capital is explicitly taken into account, the famous Leontief Paradox seems to disappear.

Leontief himself was the first to realize this. In attempting to resolve his surprising finding that the United States, seemingly capital abundant, augmented through trade its relatively abundant factor of production rather than its scarce factor, as the Heckscher-Ohlin theory predicts. Leontief deduced that American labor was three times more productive than foreign labor.⁵ And, in his later article, he showed that United States exports, relative to import substitutes, were skill intensive when the labor component was broken down into five skill categories.6 Peter Kenen then took the concept of human capital as developed by Theodore Schultz and Gary Becker⁷ and capitalized the earnings differentials between unskilled laborers and Leontief's five skill categories; he then added the resulting human capital estimates to the tangible capital estimates that Leontief had derived for 1947 United States exports and competitive imports. His results tended to reverse factor intensities. At a 9 per cent capitalization rate, United States exports are total capital intensive, while United States competitive imports are labor intensive.8 Actually, his procedure barely reverses the factor intensities,

^{4.} See Jaroslav Vanek, The Natural Resource Content of United States Foreign Trade, 1870–1955 (Cambridge: M.I.T. Press, 1963), pp. 128–35. Vanek finds a "strong degree of complementarity between capital and natural resource requirements" and this, combined with his major finding that the United States has experienced an increasing scarcity of natural resources which it has tried to augment through foreign trade, leads him to conclude that the Leontief Paradox could be explained by the combination of these two factors.

^{5. &}quot;Domestic Production and Foreign Trade," p. 525.

^{6. &}quot;Factor Proportions and the Structure of American Trade," p. 399.

^{7.} See Schultz, "Reflections on Investment in Man," Journal of Political Economy 70 Supplement (October 1962): 1-8; and Becker, "Investment in Human Capital," ibid., pp. 9-49; and Becker, Human Capital (New York: National Bureau of Economic Research, 1964).

^{8.} Peter B. Kenen, "Nature, Capital, and Trade," Journal of Political Economy 73 (October 1965): 456-58.

and at a 12.7 per cent capitalization rate it fails to dispel the Leontief Paradox.9

Donald Keesing, in a series of important articles, proceeded more directly along the lines suggested by Leontief by refining the concept of labor skills. 10 He does not attempt to give a dollar estimate of human capital, but instead alters the Heckscher-Ohlin model by identifying four major factors of production: natural resources, physical capital, and skilled and unskilled labor. He also points out that by concentrating on manufactures we can eliminate natural resources, and that, inasmuch as capital moves internationally at a much lower cost than does labor, the general skills possessed by an economy are apt to change much more slowly than its physical capital structure. 11 This will be especially true if skilled workers are needed to train more skilled workers of the same type. 12 Keesing establishes a strong case for the prolonged influence of slowly changing relative skill endowments on trade patterns in manufactures. He has classified skill levels far more specifically than Leontief did, and, for the first time, scientists and engineers have been introduced as a separate—and the most skill intensive—category. In analyzing the skill requirements needed to produce United States exports and imports for 1962, Keesing found that the higher the skill level, the greater the difference in skill requirements. To produce United

- 9. Evidence from another country, however, supports Kenen's emphasis on human capital. Karl W. Roskamp, in "Factor Proportions and Foreign Trade: The Case of West Germany," Weltwirtschaftliches Archiv 2 (1963): 319–26, found (consistent with the Leontief Paradox) that German exports in 1954 were capital intensive relative to the United States. However, Roskamp and Gordon C. McMeekin, in "Factor Proportions, Human Capital and Foreign Trade: The Case of West Germany Reconsidered," Quarterly Journal of Economics 82 (February 1968): 152–60, again using a 55-sector input-output table for 1954 West Germany, but this time introducing human capital as a third factor of production, found, as one would expect a priori, that human capital was the relatively most abundant factor and physical capital the relatively least abundant, with unskilled labor occupying the intermediate position. The second article reverses the Leontief Paradox.
- 10. "Labor Skills and International Trade: Evaluating Many Trade Flows with a Single Measuring Device," Review of Economics and Statistics 47 (August 1965): 287–94; "Labor Skills and Comparative Advantage," American Economic Review Proceedings 56 (May 1966): 249–54; and "Labor Skills and the Structure of Trade in Manufactures," in The Open Economy: Essays on International Trade and Finance, eds. P. B. Kenen and R. Lawrence, Columbia Studies in Economics, vol. 1 (New York: Columbia University Press, 1968), pp. 3–18.
 - 11. "Labor Skills and the Structure of Trade in Manufactures." p. 6.
 - 12. "Labor Skills and Comparative Advantage," p. 252.

States exports, it was necessary that 5.02 per cent (34,430) of the labor force consist of scientists and engineers, while for the United States to produce its imports, only 2.77 per cent (9.762 scientists and engineers) would have been required. In correlating skill requirements with a measure of export performance, the percentage of United States exports to fourteen industrial nations' total exports. Keesing found that scientists and engineers as a percentage of the labor force in thirty-five manufacturing industries explained 50 per cent of the variation. This was by far the highest R2 for any skill class with unskilled labor following with a negative correlation coefficient of -64. Thus, Keesing concluded "that United States comparative advantage centers in industries involving a high percentage of professional labor and a low percentage of unskilled labor."18

David Ball also found that United States 1960 exports were skill intensive for twenty manufacturing industries, this pattern being consistent along Heckscher-Ohlin lines with the assumption that the United States was both tangible capital and human capital abundant compared with the rest of the world.14 He also found that the United States' scarce factor, unskilled labor, is protected by higher effective tariff rates than our abundant factor, skilled labor. 15 This is as the Heckscher-Ohlin theory predicts. The scarce factor of production is apt to suffer from free trade because the scarce factor is augmented through imports, while demand for the abundant factor, embodied in exports, is increased. 16

Helen Waehrer has investigated Irving Kravis' findings17 that United States export industries are characterized by higher average

- 13. Ibid., pp. 255-58.14. "Studies in the Basis of International Trade" (Ph.D. diss., University of North Carolina, 1967), chap. 6.
- 15. Ibid., chap. 5. Also see Ball, "U.S. Effective Tariffs and Labor's Share," Journal of Political Economy 75 (April 1967): 183-87. William Travis has also provided extensive support for the contention that the scarce factor seeks to limit the volume of trade through protection. However, his model is the traditional capital and labor model without human capital. His study is further weakened by his use of nominal tariffs rather than effective tariffs (see The Theory of Trade and Protection [Cambridge: Harvard University Press,
- 16. See Wolfgang F. Stolper and Paul A. Samuelson, "Protection and Real Wages," Review of Economic Studies 9 (November 1941): 58-73, reprinted in Readings in the Theory of International Trade, eds. Howard S. Ellis and Lloyd A. Metzler (Homewood, Illinois: Richard D. Irwin, Inc., 1950), pp. 333-57.
- 17. "Wages and Foreign Trade," Review of Economics and Statistics 34 (February 1956): 14-30.

wages than United States import-competing industries, a finding that is not predicted by, although neither is it necessarily inconsistent with, either classical comparative advantage or unmodified Heckscher-Ohlin theory. Both theories predict that the structure of trade should be determined by inter-industry differences in factor productivities (the former theory simply assuming them and the latter explaining them by factor proportions). Waehrer's explanation, and one also mentioned by Ball, is that high wages are associated with human capital or labor skills as predicted by Schultz and Becker and that the United States' comparative advantage is associated with a relatively abundant factor of production, skilled labor, a claim made by Leontief and Keesing. 18 Indeed, Waehrer's statistical results confirm her hypothesis. Using thirty-five industries, the correlation coefficient between an index of trade performance and a skill index was greater than the correlation coefficient between trade performance and the average wage rate.18 The high wages and high productivity of net export industries found in many studies can be explained by their relative human capital intensity.20

The empirical conflict between the Heckscher-Ohlin model and classical comparative advantage, one that Cayes and others²¹

- 18. Helen Waehrer, "Wage Rates, Labor Skills, and United States Foreign Trade," in Kenen and Lawrence, *The Open Economy*, p. 25; Ball, "Studies in the Basis of International Trade," p. 142.
- 19. Waehrer, p. 37. The correlation coefficient was +.50 between the skill index and the net trade balance vs. +.43 for annual wages and the trade index.
- 20. In addition to the Kravis and Waehrer studies, MacDougall and Balassa also found higher relative productivities in export industries.
- 21. Note the views of the leading textbook writers in the field. Charles P. Kindleberger, in Foreign Trade and the National Economy (New Haven: Yale University Press, 1962), p. 75, states that "What he [Leontief] proves is not that the United States is capital-scarce and labor-abundant, but that the Heckscher-Ohlin theorem is wrong." And Ingo Walter, in International Economics: Theory and Policy (New York: Ronald Press Company, 1968), p. 136, concludes: "The classical theory of comparative costs based on differences in productivity levels emerges as an important determinant of trade patterns, judging from the empirical studies surveyed. Experience with the factorendowments model seems to show a somewhat more limited predictive value, although numerous and complex considerations are involved which, if taken into account, might change the picture quite materially." As pointed out above, these two theories are not necessarily in conflict, since the classical comparative advantage theory stops short of explaining why factor productivities differ. The Heckscher-Ohlin theory goes on to attribute the differing factor productivities to differing factor proportions. Therefore, a rejection of the Heckscher-Ohlin theory actually weakens the more general classical comparative advantage theory in the sense that the differing factor productivities must now be explained by influences other than factor proportions.

thought was being resolved in favor of classical comparative advantage, seems to disappear when the Heckscher-Ohlin model is extended to more than two factors of production, as indeed Heckscher and Ohlin had originally intended.²² If there is any validity to the assumption that unskilled labor is a relatively scarce factor in the United States, then the prediction of the factor proportions theory, that United States exports will be skill intensive and imports unskilled intensive, is borne out for United States trade data for the years 1947, 1957, 1960, and 1962. The Leontief Paradox disappears.

The empirical studies by MacDougall, Balassa, and Kravis in support of the classical comparative advantage theory are thus no longer in conflict with the modified Heckscher-Ohlin approach, since relatively greater skill intensities may explain the relatively greater labor productivity observed in United States export industries, compared with import-competing industries.23 When it was found that a higher ratio of physical capital to labor was not the cause of the greater productivity of labor in United States export industries, attention was diverted from a factor proportions explanation of productivity differences to one of differing technologies. This, of course, violates the Heckscher-Ohlin assumption of similar production functions for identical goods produced in different countries. However, the labor-skills approach reduces the need to turn to theories that violate the assumptions of the Heckscher-Ohlin theory, although it does not vitiate the fact that explanations such as differing technologies can explain a large portion of trade in manufactures.

The introduction of labor skills or human capital as well as natural resources as explicit factors of production also blunts the force of another kind of attack on the Heckscher-Ohlin model. The model has been criticized because of the possibility that factor intensity reversals could occur which would destroy its operational significance since it would no longer be possible to identify different industries as to their factor intensities. A factor intensity reversal occurs when a factor of production changes to the unintensive

^{22.} See Eli Heckscher, "The Effect of Foreign Trade on the Distribution of Income," *Ekonomisk Tidskrift* 21 (1919): 497-512, reprinted in Ellis and Metzler, *Readings*, p. 279.

^{23.} For an in-depth investigation of this proposition see Ball, "Studies in the Basis of International Trade," chap. 7.

rather than the intensive factor in the production of one good relative to another good. With a given production function, this can occur among countries when relative factor prices differ to a sufficient degree, or, with given prices, it can occur if production functions for a given industry differ to a sufficient degree from country to country (i.e., they use different technologies, which, of course, is a violation of the Heckscher-Ohlin assumptions). The importance of this phenomenon to international trade theory is essentially an empirical question and probably would not have arisen if it had not been for the soul-searching brought about by the Leontief Paradox and its aftermath.²⁴

Empirical investigation was instigated by one group along two lines. Arrow, Chenery, Minhas, and Solow, and later Minhas alone. in developing their "constant elasticity of substitution" production function, estimated the elasticities for physical capital/labor substitution for various industries by using international data.25 Using a ces production function, rather than the Cobb-Douglas production function, allows elasticities to vary among industries; if they do vary, then as relative factor prices change, some industries will undergo factor intensity reversals faster than others. Minhas then identifies possible factor intensity reversals within the actual Asian-United States relative factor price range (p. 38). He also uses a more general test, one that does not depend on the artificial assumption of constant elasticities. He simply ranks twenty industries by capital intensity for the United States and Japan, using both value added and total capital estimates (p. 40). The dissimilarity in the rankings leads him to reject the strong factor intensity hypothesis (i.e., no reversals) and the empirical relevance of the Heckscher-Ohlin theory in predicting the direction of trade (p. 50).

But here also the explicit addition of natural resources and human capital to the Heckscher-Ohlin model serves to dispel doubts about the strong factor intensity hypothesis. It also provides indirect

^{24.} Before Leontief's result had been made known, Paul A. Samuelson, in "A Comment on Factor Price Equalization," Review of Economic Studies 29 (1951-52): 121-22, observed that "the phenomenon of goods that interchange their roles of being labor intensive is much less important empirically than it is interesting theoretically."

^{25.} See K. Arrow, H. B. Chenery, B. S. Minhas, and R. M. Solow, "Capital-labor Substitution and Economic Efficiency," Review of Economics and Statistics 43 (August 1961): 225-50; and B. S. Minhas, An International Comparison of Factor Costs and Factor Use (Amsterdam: North Holland, 1963).

evidence that technologies are the same among nations because factor intensity reversals would be expected to occur if they differed. Ball and Hufbauer, at about the same time, criticized Minhas for the inclusion of certain industries in his analysis of United States and Japanese capital intensities.26 Ball argued that the natural resource based industries of agriculture, and, to a lesser extent, grain mill products and processed foods should not be included due to the dissimilarity in composition of output, the influence of natural resources, the differing diffusion rates of technology, and the less reliable statistics in the agricultural sectors of the two countries. Removing agriculture from the rankings of direct capital intensity raises the Spearman rank correlation from +.733 to +.833. and removing the three food-related industries from the total physical capital intensity rankings raises the Spearman coefficient from +.339 to +.765; in both cases the probability is less than 1 per cent that these rankings could have occurred by chance.27

These results were attained before recognition was made of the fourth factor of production. When allowance is made for different endowments in labor skills, the case against factor reversals is even stronger. Specifically, with regard to Minhas' estimates of the elasticities of substitution for different industries, Kenen has shown, theoretically, and Merle Yahr, empirically,28 that the inclusion of human capital systematically biases the elasticity estimates. Yahr has estimated ces production functions for nineteen industries and twenty countries with human capital held constant and concluded that "there are no statistically significant differences among elasticities of substitution," and, therefore, "these empirical results substantiate the strong factor-intensity assumption" (p. 90). She finds that the systematic bias that occurs when human capital is not recognized is one of labor substitution by the countries that are more human capital abundant (p. 98). This is empirical evidence for Ball's tentative suggestion that a higher relative use of skilled labor in devel-

^{26.} See Ball, "Studies in the Basis of International Trade," chap. 2, and his "Factor Intensity Reversals in International Comparison of Factor Costs and Factor Use," Journal of Political Economy (February 1966): 77-80, based on this chapter; and Gary Hufbauer, Synthetic Materials and the Theory of International Trade (Cambridge: Harvard University Press, 1966), Appendix B, pp. 113-20.

^{27. &}quot;Studies in the Basis of International Trade," pp. 30-33.
28. Kenen, "Nature, Capital, and Trade," p. 456; Yahr, "Human Capital and Factor Substitution in the CES Production Function," in *The Open Econ*omy, pp. 70-99.