Research Review

Sources of International Comparative Advantage: Theory and Evidence

Edward E Leamer Cambridge, MA· MIT Press, 1984, 353 pp , $45 00

Reviewed by Stephen W. Hiemstra*

For those willing to accept the challenge, Edward Leamer's *Sources of International Comparative Advantage Theory and Evidence* is an excellent text Leamer lays out the theoretical and statistical issues confronted in validating Ricardo's law of comparative advantage[1] and exhaustively reviews resource and trade data In pursuit of a more perfect understanding of the Heckscher-Ohlin (H-O) theorem, however, the reader is burdened in the final chapters with weighing the effect of numerous theoretical and statistical assumptions on the author's conclusions Leamer's contribution accordingly lies with the thorough theoretical and methodological discussions in the earlier chapters

Leamer begins with the Heckscher-Ohlin-Vanek (H-O-V) theorem a country with balanced trade will export services of abundant factors and import services of scarce factors The H O V theorem assumes that factors of production are immobile between countries and hypothesizes that they are used in different combinations to produce a range of goods Net exports are then defined mathematically as a linear function of an inverse matrix of factor intensities times a vector of excess factor supplies (that is, a relationship among three measurable quantities trade, factor intensities, and factor abundance) In his statistical model, Leamer postulates a linear relationship between two of these quantities trade and factor abundance [2] In estimating this model, he employs quantity, net-export data aggregated at the two-digit level (that is, 10 categories of products) and data on 11 resources for 60 countries [3]

Most of the book is devoted to Leamer's methods Chapter 1 reviews the assumptions of the H-O-V theorem

(1) The number of goods equals the number of resources,
(2) Factors are mobile within countries, but are competitive among countries,
(3) Factor and product markets are competitive,
(4) Perfect knowledge, constant returns to scale, and diminishing marginal productivity exist,
(5) Factor prices are equalized among countries, and
(6) Individuals facing identical product prices consume products in the same proportions

This inquiry specifies the mathematical model and explores deviations from its assumptions Leamer's critical deviations include the following

(1) When the number of resources and products are unequal, the outcome of trade is indeterminant,
(2) When factor prices are unequal among countries, no unique correspondence between resources and products is assured, and
(3) When returns to scale are not constant, trade need not lead to factor price equalization, markets need not be competitive, and the model may violate other assumptions of the H-O-V theorem

Of these three deviations, Leamer views economies of scale as most likely to affect the pattern of trade significantly

Leamer discusses several interesting observations in chapter 1 First, at constant output prices, an increase in the supply of a factor will increase the output of the commodity which uses that factor intensively and will reduce the output of the other commodity (the Rybczynski theorem) Second, an increase in the price of the imported good will increase the return to the scarce factor and will reduce the return to the abundant factor (the Stolper-Samuelson theorem) Third, if the number of resources and products are unequal, small transport

*The reviewer is an agricultural economist with the International Economics Division, ERS

[1]David Ricardo, *The Principle of Political Economy and Taxation* (New York Dutton, Everyman's Library, 1976), pp 77-93

[2]In leaving the inverse matrix of factor intensities (that is, shadow prices) out of his empirical model, Leamer tests for absolute rather than comparative advantage

[3]The products are classified according to the Standard International Trade Classification (SITC) code The resources include capital, three classes of labor, four classes of land, coal, minerals, and oil

costs may determine the composition of trade Fourth, tariffs must be greater than transport costs to affect the pattern of trade Fifth, nontraded goods do not materially affect the assumptions of the H-O-V theorem

Chapter 2 outlines Leamer's methodology He builds his critique on two points (1) the law of comparative advantage in the n-good case is imprecisely stated in theory and empirical tests, and (2) alternative trade theories have not yet been effectively articulated In his first point, Leamer observes that analysis of comparative advantage seldom extends beyond the two-goods case Furthermore, Leamer explains the Leontief paradox as a misspecified condition for substantiating relative factor abundance [4]

In his second point, Leamer calls for articulation of alternative trade theories Rather than evaluate comparative advantage as an abstraction, Leamer, the statistician, prefers to compare it with an alternative hypothesis such as "The H-O model serves as a more accurate guide for trade policy than the scale economy model" (p 47) In spite of his concern, Leamer likewise does not test an alternative hypothesis

Chapters 3 and 4 review the resource and trade data employed in later estimations Leamer graphs important relationships, tests resource and trade aggregates for statistical properties, and examines export commodity clusters Export clusters are product groups produced that use similar resources Export clusters pose a problem because theory suggests that countries will specialize in producing commodities, not clusters of commodities These clusters may emerge because production externalities exist, diversification reduces market risk, and few countries possess the resources needed to produce the commodities of a given cluster (pp 78-83) Leamer views the distribution of resources as the most credible and theoretically sound explanation for clustering

In chapter 5, Leamer states that, for purposes of estimation, the objective "is to 'predict' a randomly selected country's net exports or Gross National Product (GNP) given its endowments" (p 153) These four assumptions apply

(1) Errors terms are normal, randomly distributed variables with zero means and constant, unknown variance,
(2) Measurement errors are unimportant,
(3) A linear relationship between resources and products exists, and
(4) The data are adequate for prediction (p 117)

Based on his review of the data, Leamer hypothesizes that the estimation is complicated by systematic heteroskedasticity, gross measurement errors, and nonlinearities Furthermore, the estimated relationships are collinear enough so that the structural relationships are also probably collinear Perhaps for this reason, Leamer uses beta variables in place of t-statistics in selecting variables for his empirical model

In chapter 6, Leamer summarizes his econometric strategy with these words

> The approach that will be taken is first to estimate the model using ordinary least-squares methods Second, these estimates are corrected for systematic heteroskedasticity that is assumed to be a function of GNP Third, the sensitivity of the heteroskedasticity-adjusted estimates to the deletion of observations is studied to detect gross errors Fourth, the sensitivity of the ordinary-least-squares regression to chronic measurement errors is explored [5] Fifth, a Bayesian analysis of the homoskedastic model is performed, including a study of the fragility of the Bayes estimates [6] Last, nonlinear functional forms are tested

Leamer answers the following questions with his model

(1) How well do the 11 measured resources explain trade?

[4] Leontief compared the capital/labor ratios of imports with exports when he should have compared the U S share of world capital and labor supplies in determining relative resource abundance, according to Leamer (pp 52 53)

[5] In chapter 5, the omission of key observations from the data set significantly affects some variables

[6] Leamer expends considerable effort in chapter 5 analyzing restrictions on use of prior information and providing examples of their use These details may interest theoretical econometricians, but they go beyond the scope of this review (pp 136 54)

(2) Do the coefficients take on surprising values?
(3) Has the structural relation between trade and endowments changed over time?
(4) Which are the most important resources? and
(5) What effect do tariff structures have on the functional distribution of income?

Leamer, unfortunately, does not use these questions to structure the discussion of his results Instead, he provides running commentary, table by table, of his results In view of the procedure's complexity, this style of presentation makes evaluating his results difficult One is left to ponder the relative credibility of the reported observations [7]

Nevertheless, Leamer answers these questions in chapters 6 and 7 In the context of his work, resources explain trade to the extent that a linear relationship exists between resources and products Leamer tests for nonlinear relationships and concludes "this form of nonlinearity does not cause large changes in the interferences, but it does cause substantial changes in labor productivities" (p 182) This conclusion is supported by cited observations substantiating factor price equalization [8]

Several coefficients in Leamer's equations do take on surprising values and make surprising shifts The coefficient for highly skilled labor has the largest beta coefficient, followed by capital, skilled labor, and oil Highly skilled labor's importance in trade in manufactures declines relative to capital between 1958 and 1975 Another shift for manufactured goods occurred during this period as coal lost significance relative to oil as a source of comparative advantage Furthermore, capital was a source of comparative advantage and highly skilled labor was a disadvantage[9] in cereal grain exports in 1958, these observations were reversed in 1975 [10] Land resources contributed to comparative advantage in cereal exports in both years, as we might expect [11]

Leamer reports that skilled labor and capital were the most important resources in 1958 and 1975, respectively, in determining the composition of U S exports He reported that the United States was scarce in capital, skilled and semi-skilled labor, land, minerals, and oil in 1958 and abundant in highly skilled labor and coal By 1975, capital and the first three classes of land had become abundant [12]

Leamer assesses the effect of changes in resource endowments and tariffs on trade in chapter 7, but his discussion is hard to follow for lack of clear summary statements [13] Leamer reminds us that his model is a longrun model of trade, the shortrun motivation of participants and outcomes could be quite different Beyond this observation, however, the overall implications of Leamer's counterfactual tests are neglected in favor of a continued discussion of model specifications and mechanics The concluding pages do not summarize the final chapter, and the few observations cited and discussed provide an almost anecdotal image of his work Chapter 6 does a better job of summarizing Leamer's results, albeit incompletely

In spite of a weak ending, Leamer's book adequately covers the theoretical and statistical problems inherent in testing the H-O-V theorem and provides a lengthy bibliography of pertinent literature Although technically complex, the first five chapters of the book are more readible than most texts of this genre In view of its complexity and expensive price, however, its appeal is limited to analysts interested in international trade theory and econometrics

[7]The author recognizes this problem In the text he provides disclaimers, such as "Because of the seriousness of chronic measurement errors, the estimates in this table need not be treated too seriously" (p 162)

[8]Anne O Krueger, "Factor Endowments and Per Capita Differences Among Countries," *Economic Journal* Sept 1968, pp 641 59

[9]Although this result appears credulous at the outset, it is consistent with the Stolper Samuelson theorem cited earlier

[10]One has to wonder whether 1975 data might not pose special problems when the H O V theorem is tested because of the disequilibrium created in world markets by the oil embargo and world grain shortages of 1973

[11]In this analysis, the ranking of resources as sources of comparative advantage seems more credible than the magnitude of their contribution in such trade projections (p 200)

[12]These shifts in resource scarcities add credence to the analysis In a market economy undergoing technological and institutional change, changes in the relative value of resources are expected—in spite of perfect resource immobility—as an inevitable consequence of economic development For example, see Albert O Hirschman's *The Strategy of Economic Development* (New York W W Norton & Company 1958, The Norton Library, 1978)

[13]This comment applies both to organization and content At one point in the discussion (p 191), Leamer presents a table of values for discussion generated from an "optimally selected reallocation of resources" Both the selection process and the precise allocation of resources are unexplained This lack of explanation seems unusual in a text which earlier provided lengthy discussions of theoretical and statistical techniques

Made in Washington: Food Policy and the Political Expedient

Clarence D. Palmby. Danville, IL: The Interstate Printers & Publishers, Inc , 1985, 226 pp., $14.95

Reviewed by Martin E. Abel*

Clarence Palmby observed first hand over nearly 50 years the evolution of U S agriculture and agricultural policy in various capacities—as farmer, Government official, market developer, and business executive Those concerned with U S agriculture will benefit from Palmby's insights and experience

The tone of his book is set in the first sentence "Prices are made in Washington " Palmby clearly believes that the Government has interfered in U S agriculture too much through restricting output and supporting commodity prices These interventions compounded the surplus problems of the fifties, sixties, and early eighties by encouraging production and discouraging exports and domestic use They restricted the market place from bringing about necessary adjustments in supply and consumption

The author, however, is not against any and all interventions in agriculture He favors

- Low levels of price supports that do not interfere with the market most of the time but that do provide protection against precipitous price declines,
- International trade liberalization, and
- Market development activities that increase total demand for U S agricultural exports longer term

In short, Palmby is for demand expansion and against controlling supplies

Some of Palmby's reflections also deal with the political and administrative processes that make U S farm policy He worked in these arenas for several years and thus can speak knowledgeably about what it takes to be effective He is a realist, recognizing that honest men and women can hold different views and that these differences should be respected One needs to be patient, yet persistent, in changing policies, sooner or later the power of events will force Government to adjust to reality

Made in Washington is timely in view of the recent efforts to forge a new farm bill which moves in a direction advocated by Palmby—more reliance on the market and more emphasis on increasing demand Yet, one senses that policy changes are being driven largely by the current depressed situation in agriculture rather than by long-term considerations The danger in this situation is that people develop unrealistic short-term expectations and ignore the long-term problem of how once again to achieve demand growth worldwide Those involved in the policy process could benefit from Palmby's reflections, for they would realize that policy changes do not necessarily yield instant success It may instead take years before correct policies bear significant fruit

The book has a number of shortcomings First, the author assumes the reader knows a lot Those unfamiliar with the history and technical details of agricultural policies and programs will have a hard time following some sections of the book Second, Palmby's material is not always well organized, which unnecessarily interrupts the flow of his arguments Finally, some of the history is incomplete For example, Palmby extensively discusses the bad features of the 1983 payment-in-kind program which sharply reduced output and raised prices at a time when the United States was losing its competitive position in world markets He makes no mention, however, of the 1982 farmer-owned reserve program that encouraged farmers to produce and store grain and that artificially supported prices when production should have actually been discouraged and prices been allowed to fall

Despite these shortcomings, Palmby has written an interesting memoir that is worth reading One should not ignore hard-earned experience

*The reviewer is president of Abel, Daft & Earley in Washington, DC

The Handbook of Econometrics

Volume 2. Zvi Griliches and Michael D. Intrilligator (eds.) Amsterdam: Elsevier Science Publishers, 1984, 585 pp., $65 00.

Reviewed by David Freshwater*

Reviewing a book written by a number of authors is an onerous task, reviewing one volume of a series by numerous authors is even more difficult However, when the series is entitled *The Handbook of Econometrics,* the task is nearly insurmountable Volume 2 of the handbook contains three parts of unequal length "Testing," "Time Series Topics," and "Special Topics In Econometrics " The section on "Time Series" comprises the bulk of the volume, having six chapters, while the section on "Testing" has four and the "Topics" section two

The detailed nature and diversity of the various chapters prohibits comprehensive review of the subject matter in each chapter Instead, I have decided to evaluate the book from the perspective of what I would call a sophisticated regression runner—that is, an individual with an empirical orientation, but one who has been exposed to a good course in graduate econometrics and has a working knowledge of linear algebra and mathematical statistics The vast bulk of agricultural economists who might consider consulting a series of volumes with the portentous title, *The Handbook of Econometrics,* would presumably fall into this class

The editors set themselves the task of creating three volumes which are " to serve as a source, reference, and teaching supplement for the field of econometrics, the branch of economics concerned with empirical estimation of economic relationships " The focus of the handbook is clearly on the theory of econometrics and not on empirical estimation This volume presents recent advances in the development of tests of hypotheses, the use of time series models, and the appropriate use of latent and qualitative variables The material should provide "comprehensive and accessible surveys" to professionals and advanced graduate students The editors' intent is surely not to create a cookbook of recipes for the neophyte

Have they met their goal for my sophisticated regression runner? Unfortunately, they have not Unlike several other handbooks in this series, this volume is not a self-contained book of instructions that would meet the needs of the audience I have defined The book fails on several grounds The level of mathematical sophistication generally exceeds that of most applications-oriented agricultural economists The presentation neither motivates the reader in the sense of setting out critical points nor follows a well structured path linking individual issues in the various chapters The three sections could have been improved by a brief introductory comment identifying the objectives and showing how they relate As currently constituted, the book reads more like a collection of journal articles than a guide or source of information for individuals with limited knowledge of specific topics Conversely, the advanced econometrician with a strong background and familiarity with econometric and statistics journals is likely to find the handbook a redundant source as it provides little new material

Of the individual papers, those by Granger and Watson on "Time Series and Spectral Methods in Econometrics," Chamberlain on "Panel Data," Aigner, Hsiao, Kapteyn, and Wansbeck on "Latent Variable Models," and McFadden on "Econometric Analysis of Qualitative Response Models" are the most clearly written, providing the reader with a clear outline of the topic at a level within the grasp of the target audience These chapters mix verbal and mathematical exposition, enabling the reader to get over the harder spots

Other chapters emphasize proofs almost to the exclusion of applications, examples, and verbal description Individuals unfamiliar with the topics would likely need to consult other material prior to reading these chapters Such problems certainly weaken the value of the volume as a handbook

Volume 2 of *The Handbook of Econometrics* provides a highly referenced source of frontier topics in econometrics Each chapter is well referenced for those seeking to explore topics in greater detail However, all but the most technically sophisticated economists will find the book tough sledding, thereby reducing its value as a handbook It will rarely be the first source one would consult, but it might prove a most important source if the reader is willing to work slowly through a particular chapter

*The reviewer is a visiting economist with the Agriculture and Rural Economics Division, ERS

Farm Equipment Innovations in Eastern and Central Southern Africa

Iftikhar Ahmed and Bill H. Kinsey (eds.). Brookfield, VT: Gower Publishing Co., 1984, 333 pp., $31.50.

Reviewed by Richard D. Sigwalt and Darryl S. Wills*

The problems facing agriculture in African nations today are not new Low productivity, low incomes, and poor weather head the list of familiar problems confronting African farmers, the majority of whom are poor smallholders One promising avenue for addressing these difficulties lies in the design of improved farm equipment The editors of this volume set out to discover the current state of farm equipment use in smallholder agriculture and to assess the potential benefits of equipment innovations

Bill Kinsey is considerably more than the editor of what is, in fact, a loosely structured argument for a systematic, multidisciplinary, and farm-centered approach to transforming peasant agriculture through appropriate technology He has written four of the six case studies (those on Zambia, Tanzania, Uganda, and Malawi) and has coauthored three introductory and concluding chapters with Iftikhar Ahmed Case studies on Kenya (by Gichuki Muchiri) and the southern Sudan (by J D de Coninck, A Duncan, and P E Winter) and a substantial policy essay by Bruce R Johnston round out the book

The case studies are so disparate in theme and quality as to compromise the value of the book as a whole Certainly the southern Sudan essay, which focuses heavily on how hand tools are supplied and which is based on no actual fieldwork in rural areas, belongs elsewhere Kinsey's own essays are quite different from one another The ones on Malawi, where he has worked extensively, and Zambia, where agriculture is already relatively highly mechanized, are particularly good, however, the one on Tanzania is based only on others' work and is far from thorough Muchiri's piece differs considerably from the area surveys Rather than surveying Kenya as a whole, Muchiri reports on an experimentation project with available technology with a view to later propagation, however the subject is germane because it exactly reflects the approach Kinsey, Ahmed, and Johnston favor

From the case studies, the editors conclude that there has been no significant diffusion of new items of equipment for small farmers in East Africa in over two decades One reason for this situation, they argue, is that past research and development (R&D) activity was both inadequate and inappropriate, operating without regard to what farmers really needed. The editors demonstrate conclusively that gasoline-driven equipment displaces laborers (presumably for urban unemployment), devours scarce capital, and falls into disuse in environments lacking an infrastructure to maintain such equipment In every respect, they find animal-powered equipment preferable and believe that R&D should aim at inserting such equipment into local economies An effective R&D program would have researchers study farms as social and economic systems and would identify what parts of those systems suffer constraints, especially seasonal labor constraints, that could be alleviated with improved farm equipment Existing technology could then be applied to eliminate those particular bottlenecks

The decision of the editors to include a chapter on policy considerations is wise because government actions not only detemine what types of R&D will be supported (and the extent of that support) but also foster the economic environment in which farmers must choose whether to adopt the results of that research Even appropriate equipment innovations will not necessarily be adopted by farmers Widespread acceptance depends on several factors, not the least of which is the price of the equipment relative to expected returns Other factors include effective demonstration and training and a good transport and storage system to facilitate distribution Overall government policies directly bear on these factors Furthermore, Johnston emphasizes the desirability of designing equipment innovations that lend themselves to the creation and expansion of small-scale manufacturing in the countryside Such a strategy would provide additional sources of employment and income and would expand the productive base of the economy, while conserving essential foreign reserves for other development needs

One could easily fault the book for not addressing Africa's contemporary food crisis or for not placing it in its overall political and economic context The case for appropriate technology is ably made (if it

*Sigwalt is a professor of history at Howard University, and Wills is an economist with the Agriculture and Rural Economics Division, ERS

still has to be made), programmed innovation works only if it responds to needs and opportunities peasants themselves encounter in their workaday lives Surely innovation would occur almost spontaneously, as it did in southern Africa a century ago, if peasants were offered attractive markets If, as is clearly the case, peasants still need to be prodded into adopting improved equipment, why is that so?

Kinsey provides the beginning of an answer in his case study of Malawi There, a simple winch-type gadget (the "Snail") costing about $700 was found to demand an amount for yearly operation about five times the average peasant's household income [1] Kinsey finds that the only equipment a peasant has the income to purchase are hand tools such as the traditional hoe and machete However valuable a farm-systems approach to development is (and it is valuable), it will lead nowhere until exploitation (through artificially low food prices) of the peasant to feed the city ends and until peasants are induced to invest by the simple promise of attractive gain Until then, the farm-systems approach merely represents an attempt to reconcile technology and poverty

[1]The Snail is a fuel-powered cultivating device designed to permit early planting and increase yields by facilitating the cultivation of dry, hard soils before the seasonal rains