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ISSUES IN MEASUREMENT AND EMPIRICAL RESEARCH

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ABSTRACT

This paper summarizes a forthcoming book that describes issues and recent innovations in the measurement of international transactions. A number of distinguished authors assess data measuring trade in merchandise, services, and foreign-direct-investment claims. Others assess international prices and data measuring comparisons of inputs and outputs internationally. (International financial data are not assessed.) The chapters in many cases tabulate the data and illustrate their application to recent research questions. U.S. international data are emphasized, but those of other countries are frequently highlighted as well.

Growing international interdependence and structural and technological change raise a number of important theoretical and measurement issues that are explored here with regard, for example, to computer prices, productivity, international convergence of income, service provision from overseas affiliates, and proper valuation of direct investment stakes.

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International Economic Transactions: Issues in  
Measurement and Empirical Research

Introduction and Summary

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The growing economic interdependence of the world economy, including the internationalization of markets for goods, services, financial assets, and factors of production, is creating increasing demands for the measurement and monitoring of economic influences across national boundaries. The international repercussions of sharp policy shifts and structural changes over the last two decades have rendered obsolete conventions of closed-economy measurement and assessment. Empirical research in open-economy economics has increased substantially in scope and magnitude over this period. In addition, fluctuating exchange rates, growing external imbalances, mounting U.S. net international indebtedness, and wide swings in financial markets across countries have stimulated international consultation and cooperation in the formulation of economic policies. These developments in research and policy analysis necessarily have depended increasingly on the monitoring and measurement of international transactions.

At the same time, concern is growing among professional economists in the research and policy communities (Juster 1988, Cole 1990, Lipsey 1990) that existing international economic data have not kept fully abreast of structural changes in the global economy and that

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they are in need of critical assessment, and in some cases significant overhaul. Federal budget support of data collection and maintenance has declined in real dollars over the past ten years. Methodological research and new ideas for measurement have borne the brunt of budget cutbacks. Lack of adequate data has inhibited empirical research of the highest quality in some areas of international economics, and ruling theoretical paradigms have not been tested sufficiently. While the same concern exists for economic measurement and research more generally (Miron and Romer 1990, Norwood 1990, Triplett 1990), the relative severity of the concern for international economics is generally acknowledged to be growing.

For these reasons, a conference was convened in November 1989, drawing together researchers, policy analysts, and statistical experts with proven commitments to measurement and empirical research in international economics. The objective of the conference, a preconference workshop, and this volume of proceedings is to publicize research that evaluates the scope and quality of existing data, explores the value of developing new or improved data, and more generally advances measurement, policy assessment, and knowledge of international transactions. In meeting this objective, the organizers tried to stimulate dialogue between the producers of the data and the users, so that each party would become better aware of the needs of and the constraints on the other party. The dialogue can be read in the words of the authors, discussants, and panelists presented in this volume.

Each author was asked to address an important research issue in international economics and to employ existing or constructed data in ways that revealed its advantages and inadequacies, with possible

suggestions for enhancing the advantages and reducing the inadequacies. Given these objectives, papers were expected to differ naturally in methodological intensity, policy relevance and familiarity with the intricacies of measurement.

The papers and discussion presented in this volume are organized into the following five topic areas: merchandise trade flows, trade prices and price competitiveness, international transactions in services, foreign direct investment, and international comparisons of outputs and inputs. The volume concludes with the remarks of three distinguished panelists who were asked to draw summary observations from both the papers and the discussion at the conference.

In the remainder of this introduction we first summarize each paper and discussant's comments, stressing measurement issues that are raised and important conclusions that are drawn from the existing data. We then size up the project as a whole and identify possible issues for the future, drawing on the commentary of the concluding panel and discussion at the conference.

#### Part I Merchandise Trade

The first paper dealing with merchandise trade is "Comparing International Trade Data and Product and National Characteristics Data for the Analysis of Trade Models," by Keith E. Maskus. Maskus illustrates the capabilities and problems of data used in estimating models of international trade and production of goods based on national factor endowments. He demonstrates the value of data improvements such as standardized concordances; mutually consistent price deflators for

inputs, outputs, and trade; and breakdowns of sectoral labor inputs by occupational groups.

Using improved data, he compares indicators of productivity and technology across countries. International comparisons of labor productivity can differ significantly depending on whether outputs are translated into common currencies using nominal exchange rates or relative prices (PPPs), as Kravis and Lipsey document further in their own contribution to this volume. Comparisons based on nominal exchange rates suggest that for many industries there is little similarity in labor productivities among countries at different stages of development, whereas PPP-based comparisons suggest that labor productivities are similar across different stages of development, but can vary significantly across countries at the same stage of development. On balance, the technology comparisons across countries using PPPs provide some support for the familiar view that trade is caused by factor endowment differences across countries with access to similar technologies. Yet Maskus's regressions attempting to explain net trade by industry on this basis are not notably successful. Maskus concludes, *inter alia*, that measures of relative factor shares are not cyclically sensitive, whereas measures of factor productivity are, and he closes his paper with a helpful discussion of ways to improve the measures of determinants of competitive and comparative advantage.

Edward E. Leamer, in his discussion of the paper, emphasizes the dependence of analysis on the quality of measurement. At one level, this dependence is, of course, obvious. Leamer argues at a deeper level that to correct for econometric misspecification caused by measurement error in the data, it is necessary to know the specific properties of the

measurement error. Since exact knowledge is unlikely, data collections ought to provide data analysts not only with estimated rates of measurement error, but with estimates of the sampling distribution of the estimated measurement error as well -- the "standard errors of the standard errors," as he says, citing a paper stimulated by the conference (Leamer 1989).

Ellen E. Meade, in "Computers and the Trade Deficit: The Case of the Falling Prices," considers how the measurement, modeling, and forecasting of U.S. merchandise trade flows has been affected by new measures of computer prices. Meade begins by reviewing the hedonic (or quality adjusted) price index constructed by the Bureau of Economic Analysis (BEA) for domestic shipments of computers and its application to international trade. In doing so, she compares BEA's computer price index with price indexes for U.S. exports and imports of computers reported by the Bureau of Labor Statistics (BLS). Movements in aggregate U.S. trade quantities and prices (or deflators) differ significantly depending on which measure of computer prices is used. While the hedonic index is a step forward in the measurement of computer prices, the lack of distinction between imports, exports, and domestic shipments still represents a major drawback to the BEA data.

Meade also concludes that on BEA's measure, price and quantity movements in the computer sector have been sufficiently atypical that the sector probably should be isolated from the aggregate of other sectors when attempting to model and forecast trade. In empirical tests with a conventional model of U.S. trade flows, both in-sample and post-sample prediction of aggregate trade flows are improved when computers are

treated separately. Most of this improvement stems from trade quantity equations, as key parameters in trade price equations appear to be insensitive to the inclusion of computers.

In his discussion of the paper, Richard D. Haas asks whether information gleaned from BLS data on the prices of imports and exports of computers might be used to adjust the domestic price series reported by BEA. He also suggests that in light of difficulties involved in estimating equations for trade in computers, improvements in modeling and forecasting trade in noncomputers could well be masked in the aggregate prediction results that are reported.

Bruce C. Walter, in "Quality Issues Affecting the Compilation of the U.S. Merchandise Trade Statistics," summarizes recent efforts by the Census Bureau and the Customs Service to improve the quality of U.S. trade data. The various efforts have included reducing lags (carryover) in the recording of monthly data, computerizing the editing and checking of data for consistency and measurement errors, auditing data collection operations at various ports, reconciling U.S. bilateral trade data with Canadian trade data (as well as data of other trading partners), calculating constant-dollar equivalents for monthly exports and imports, and developing the capacity to record data by business establishment, state of origin, destination, and intracorporate transactions. Some of these efforts have been funded by subscribers to the data, rather than out of general tax revenues. Among other findings, Walter reports that about 70,000 different establishments export each month, but that only 5 percent of them account for 40 percent of export value. Walter also



discusses possible further improvements in the data and data collection efforts, including the need for further automation.

David J. Klock's comments on the paper question the need for the reporting of monthly trade data in real terms when scarce resources could be more profitably devoted elsewhere, although he does recognize the potential for more timely analysis of U.S. international competitiveness made possible by monthly volume and price data for trade. Klock also doubts that data reconciliation efforts with Europe and Japan would be as useful as those with Canada have been; a reconciliation effort with Mexico might offer greater potential.

## Part II Trade Prices and Price Competitiveness

The first of two papers dealing primarily with trade prices and price competitiveness is "Price Trends in U.S. Trade: New Data, New Insights," by William Alterman. Alterman documents the ongoing development of true export and import price indexes at BLS. The coverage of merchandise trade prices has been virtually complete for imports since late 1982 and for exports since late 1983. Price indexes for selected categories of trade in services are being developed currently, with some country-of-origin indexes planned for 1992. Alterman illustrates how much the BLS price indexes for merchandise trade differ from the unit value indexes that they recently replaced in the National Income Accounts. For example, the BLS series is much more stable than the volatile unit value series. And its implications for trade volumes are quite different. Alterman calculates that the U.S. trade deficit in real terms (measured at 1985 prices) was running at an annual rate of just

about \$100 billion in mid-1989 when deflated by the BLS price indexes, compared with nearly \$130 billion when deflated by unit value indexes.

Alterman uses the BLS price data to analyze the rate at which U.S. and foreign exporters "pass through" changes in exchange rates into the prices of U.S. exports and imports. He finds that rates of exchange rate pass-through vary significantly across different commodity categories and that firms are more likely to raise the prices they charge (in terms of the currency of the country they are selling to) following a depreciation of their own currency than they are to lower their prices following an appreciation. He also finds that U.S. firms tend to pass through more of exchange rate changes to their prices in foreign markets than foreign firms do to their prices in the U.S. market (consistent with the findings of Lipsey, Molinari, and Kravis, at least for the post-1985 period). Alterman also uses some data that became available as a byproduct of the BLS price collection effort to assess the currency invoicing of various categories of U.S. imports. He finds that an increasing proportion of U.S. imports is now priced in foreign currency - as much as half of imports of certain finished goods, particularly from Western Europe.

In his discussion of the paper, Richard C. Marston notes that Alterman's analysis serves not only to establish the superiority of the BLS price indexes, but also to indicate how misleading it may be to use historical unit values which were the only trade "prices" available until the early 1980s. With respect to Alterman's calculation of pass-through estimates, Marston questions the use of consumer prices as a proxy for costs in foreign countries. The insensitivity of consumer prices to movements in costs may have imparted a significant downward bias to the

pass-through estimates. While data are limited for many countries, Marston would have preferred to see wholesale prices used in place of consumer prices wherever possible.

Robert E. Lipsey, Linda Molinari, and Irving B. Kravis in "Measures of Prices and Price Competitiveness in International Trade in Manufactured Goods," use disaggregated national price indexes for traded manufactures to construct indexes of export and domestic prices and indexes of price competitiveness for the United States, Germany, and Japan. Indexes of price competitiveness are constructed for each country with its own export weights vis-a-vis similarly weighted indexes for its major competitors, aggregated by their importance in world export markets. Price indexes are also constructed for total exports of developed countries and for the exports of developed countries to developing countries. These last indexes are adjusted for differential quality change, and domestic wholesale prices and hedonic price indexes are used to fill gaps where appropriate export price data are missing. To estimate prices that are missing entirely, the authors fit a regression equation with country-specific and commodity-specific dummy variables to a block of countries and commodities. In doing so, they use all available data to establish coefficients that can be used to form a "best-bet" prediction of the missing prices. This procedure eliminates a potentially important source of bias that arises in more conventional procedures, which use national prices indexes alone as proxies for the missing prices and disregard the availability of more closely related product prices in other countries.

The authors' painstaking construction of reliable price indexes pays off in some surprising observations. For example, over several periods during the past four decades, movements in both German and Japanese export prices relative to those of their major competitors tended to be more in line with those of the United States than had been thought previously. At the same time, the authors find very limited evidence for "pricing to market" (adjusting the margin between export prices and domestic prices to offset the effects of fluctuations in exchange rates). Except for the period after 1985 when German and Japanese export prices fell significantly relative to their domestic prices as their currencies were appreciating, only mild traces of such behavior have occurred since the 1950s.

Among other contributions, Lipsey, Molinari, and Kravis summarize correlations suggesting the frequency of supply shifts along relatively stable demand curves for major categories of trade in most manufactures (except semimanufactures, SITC 6), and they include tabular presentations of their raw export prices for other researchers to use.

Catherine L. Mann's discussion points out first how occasionally the "full-information" country/commodity dummy approach to correcting for missing values may cause measurement errors in recorded data to infect the proxies. Yet she also thinks that omission of typically low-cost Asian developing countries from the approach may impart systematic upward bias to the indexes that are constructed. Finally, she reminds the reader of the important potential divergences between indexes of international price competitiveness, which are the focus of this paper, and indexes of international cost competitiveness. Measures of relative international costs are of course rare and incomplete. However, the

growing analytical literature on price-cost margins and how they respond optimally to exchange rates and other shocks, can be used to impute rough cost indexes from price indexes, and in any case can provide several alternative interpretations of any given price movement, each with a distinct policy implication.

### Part III Service Transactions

The first paper on international transactions in services is "Developing a Data System for International Sales of Services: Progress, Problems, and Prospects," by Bernard Ascher and Obie G. Whichard. Ascher and Whichard document the substantial improvements in statistics on international transactions in services that have been achieved over the past decade through the improvement of existing surveys, the introduction of new surveys, the increased use of gross recording methods, and the adoption of indirect estimation methods in areas where survey data are still not available. Such areas as financial, legal, medical, educational, and other professional and technical services, which a decade ago were largely uncovered, as well as services transactions with foreign affiliates, which were obscured by net recording, are now included and accounted for more than one fourth of the measured total of U.S. trade in services of \$175 billion in 1988.

Ascher and Whichard also stress the importance of improvements in measuring within-country or "establishment" transactions, between firms owned by residents of different countries and local purchasers. Measured establishment transactions by U.S. firms abroad and by foreign firms in the United States actually exceeded total U.S. cross-border transactions or trade in services in 1988. While the establishment transactions are

not technically "international," they are closely related to issues in cross-border trade such as market access, reciprocity, and national treatment. They are also potentially a close substitute for cross-border trade, as discussed in the paper by Stekler and Stevens. Ascher and Wichard conclude with a review of the significant problems that remain in the measurement of international sales of services and the prospects for resolving some of these difficulties.

Samuel Pizer cautions against confusing statistics on international transactions in services, which are used in the balance of payments and national income accounts, with data on the transactions of affiliates established in foreign countries, which are an aspect of direct investment activities. Both types of data are important in their own contexts. He notes that the United States is ahead of most other countries in its coverage of trade in services and that it is the only country to date that has begun to collect data on the service sector establishments of multinational corporations.

Bernard M. Hoekman and Robert M. Stern, in "Evolving Patterns of Trade and Investment in Services," evaluate both international trade and direct investment in various services with data covering the past 25 years for a large number of countries. They find that developing countries are gaining world export shares in shipping, travel, passenger services, and other private services. Moreover, the services exports of the developing countries have been growing faster than merchandise exports for most of the past 25 years. Trade in financial and business services, however, remains a fairly stable and exclusive turf for developed countries. Similarly, until very recently most foreign direct

investment (FDI) in services was between developed countries. Furthermore, FDI in services has been growing faster than FDI in manufacturing; because of higher trade barriers, it is larger relative to trade flows than FDI in manufacturing.

The tables in the Hoekman and Stern paper contain a wealth of country detail over five-year intervals, although the categories presented are rather aggregated, based on what is available in balance of payments accounts. The authors also make several recommendations for improvements in the data, relating to nomenclature, coverage, and presentation of detail on origin/destination, value/volume, and intrafirm versus arms-length transactions. With respect to coverage, Hoekman and Stern document important but unsampled categories such as transborder data flows, health provision, and education.

Samuel Pizer commends the authors wryly for their heroic compilations and their attempt to test an important hypothesis. He believes that there is ample scope for more disaggregated and focused measurement of selected services but warns against using the very broad content of "services" to evaluate the role of service in developments citing cases in which the developing country was merely the locus for offshore finance. He also notes that studies of trade in services might be more reliably tied to data on domestic developments, with the foreign sector measured separately, or on surveys of direct foreign investors, rather than on the balance of payments data used by Hoekman and Stern.

Part IV Foreign Direct Investment

The first of two papers on foreign direct investment is "Financial Flows Versus Capital Spending: Alternative Measures of U.S.-Canadian Investment and Trade in the Analysis of Taxes," by Harry Grubert and John Mutti. They examine how much U.S. affiliate investment activity in Canada, as measured either by balance of payments financial flows or by plant and equipment expenditures, is influenced by U.S. and Canadian tax policy. They also consider the extent to which real capital formation in the Canadian manufacturing sector is financed by U.S. direct investors. In addition to comparing real and financial investment data, their paper makes one of the few attempts in this volume to attempt to construct alternative measures of policy. One of their contributions is to show cases in which average effective tax rates, in addition to marginal effective tax rates, have empirical explanatory power. Another is to show the superior explanatory power of marginal tax rates when investors are assumed to require a real rate of return as much as double the normally assumed rate of 4 percent.

Grubert and Mutti find that taxes significantly influence real business fixed investment by U.S. affiliates, but not necessarily the financial measures of FDI. They also find that U.S. multinational firms account for a large share of the responsiveness of aggregate Canadian real manufacturing investment to tax rates. Capital formation by U.S. multinationals is estimated to be twice as sensitive to taxes as capital formation by other firms in Canada. U.S. merchandise exports to Canada also appear to be sensitive to tax incentives such as the U.S. provision for Foreign Sales Corporations.

Edward M. Graham reinterprets Grubert's and Mutti's distinction between a multinational's real capital formation and its FDI in a



constructive, yet empirically undocumented, way. He hypothesizes that the two alternative investment measures are highly correlated for new investors in greenfield projects, but not otherwise, either for established investors or for takeovers or expansions of preexisting projects. Thus Graham is unsurprised that Grubert and Mutti find real capital formation in Canada more responsive to taxes than balance-of-payments FDI. Direct investors in Canada are established veterans. He hypothesizes that balance-of-payments FDI would be much more responsive to taxes (and other real fundamentals) in the case of impending first investments in new host countries - Eastern Europe perhaps - or formerly insular debtor countries.

Lois Stekler and Guy V.G. Stevens, in "The Adequacy of U.S. Direct Investment Data," review the history and current status of BEA's system for collecting direct investment data and assess various questions that have been raised in the profession about the coverage and accuracy of these data. They conclude that there seems little reason to doubt that BEA's surveys capture most direct investment transactions and that the basic data on direct investment income and capital flows are reasonably accurate, to the extent that they reflect the reporters' books. However, the accuracy of answers to survey questions pertaining to information that is not normally kept on the books of the reporters is likely to be much more variable. Moreover, late reporting, particularly by foreign-owned U.S. firms, periodically has resulted in large data revisions in the direct investment accounts.

Stekler and Stevens also review the problems associated with data on the U.S. net direct investment asset position and various efforts

to estimate that position more accurately, as well as reasons for wide differences in apparent rates of return on direct investment holdings in the United States and abroad. They argue that surveys would be ineffective in trying to establish market values of direct investment holdings at home and abroad, and that scarce resources available for improvements in data in this area should be devoted to other efforts. One alternative they propose is to determine why the reported rate of return on foreign investments in the United States is so low.

The paper also assesses the adequacy of direct investment data for analyzing such questions as the implications of direct investment for merchandise trade, the welfare implications of direct investment, and the modeling and forecasting of direct investment transactions. The authors conclude that study of such empirical research issues would benefit significantly from a greater availability of data at the establishment level.

Betty L. Barker comments on the feasibility of implementing the recommendations for data enhancements that are made in the paper, and she discusses some of the improvements that are either planned or under way at BEA. Data on foreign investment in the United States at the establishment level will be published by BEA in mid-1992, as a result of legislation that has been passed giving BEA access to Census establishment data for foreign-owned U.S. companies. Obtaining accurate data on U.S. investment abroad at the establishment level will be more difficult, however. BEA is constructing market-value estimates of the U.S. direct investment position abroad and the foreign direct investment position in the United States, using indirect estimation methods rather than surveys; these estimates are scheduled to be published in the June

1991 Survey of Current Business. BEA has also obtained funding for 1991 and beyond to improve compliance with its surveys and to increase its research capabilities.

#### Part V International Comparisons of Output and Inputs

The first of three papers dealing with international comparisons of outputs and inputs is Robert Z. Lawrence's "Issues in Measurement and International Comparison of Output Growth in Manufacturing." Lawrence addresses questions that have been raised by Lawrence Mishel and others about whether the relative international performance of U.S. output in manufacturing has been overstated in U.S. data as a result of improper weighting of computers and the use of domestic prices to deflate imported inputs, among other factors. Lawrence finds that while U.S. manufacturing and productivity growth was overstated during the early 1980s, this bias was largely reversed after 1985 when the downtrend in the relative price of imported inputs was reversed. He concludes that although BEA's data may somewhat overstate manufacturing output growth over the 1980s, manufacturing did not decline appreciably as a share of GNP.

Lawrence also documents a dramatic cross-industry dispersion of measured growth rates in both the United States and Japan, in which computers are an outlier on the high side. Since the rise in U.S. aggregate manufacturing output has been concentrated in only a few sectors Lawrence notes that inference should be made with caution. A preferable approach might be to make comparisons at the industry level. However, two alternative sources of data on industry growth rates (GNP and industrial production) show very different patterns of cross-industry

dispersion in both the United States and Japan. Lawrence argues that anomalies like this one and the mismeasurement of input prices would be greatly alleviated by more timely publication of input-output tables and by calculation of imported input price indexes with the same levels of disaggregation as in the input-output tables.

Lawrence Mishel notes that in response to criticism of its manufacturing output data, BEA suspended publication of the data until it could be thoroughly revised. His estimates suggest that U.S. manufacturing output did decline significantly as a share of GNP during the 1980s, partly because, by his calculations, the shift in the relative prices of imported inputs after 1985 was not enough to reverse the bias that had accumulated earlier. Mishel also notes that little comfort can be taken in the fact that the Federal Reserve Board's industrial production series happens to have moved about in line with BEA's series on total manufacturing output, because the two series show such wide divergences at the industry level.

Barry Eichengreen presents a lucid review of the debate between Lawrence and Mishel, and he concludes that the data are still too fragile to pick a winner. It does seem clear that when computers are excluded, U.S. manufacturing output has weakened relative to activity elsewhere. However, Eichengreen argues that from the point of view of the international competitiveness of U.S. manufacturing as a whole, we probably should not be concerned about a decline in one sector (noncomputers) if it is offset by a rise in another (computers).

[Editors note. In January 1991, BEA published revised estimates of U.S. manufacturing output after addressing some of the criticisms raised by Mishel and others. The revision resulted in a slightly slower

rate of growth in manufacturing output during the 1980s. However, the revised estimates still show a moderate increase in the share of manufacturing in total output between the late 1970s and 1988. See De Leeuw, Mohr, and Parker, 1991.]

John F. Helliwell and Alan Chung, in "Macroeconomic Convergence: International Transmission of Growth and Technical Progress," consider, among other issues, whether international transactions have influenced the convergence of technical progress among industrial countries. Using real GDP per worker as a primary proxy for technology in a sample of 19 industrial countries, they find evidence of convergence in rates of growth of technology since 1960. Moreover, they attribute a portion of the explanatory power in their regressions to rapid growth in the ratio of trade to GDP, consistent with recent theoretical research that describes the potential for openness to enhance variety, productivity, and competitive performance in input markets. The authors also find evidence in some countries to suggest that technical progress is capital-embodied. Based on this finding and on the importance of openness effects, they conclude that the rates of generation and diffusion of technical progress are endogenous rather than exogenous variables, and hence can be influenced by policy.

On measurement issues, in the spirit of work by Maskus and Kravis and Lipsey presented elsewhere in this volume, Helliwell and Chung test the use of both PPPs and nominal exchange rates to translate real outputs or productivities into common currency units. They find that the convergence results are strengthened when theoretically preferred PPPs are used. They also find that a narrow measure of capital the private

fixed stock of business capital gives better results in explaining output than broader measures that include residential capital, public capital, or inventories.

Irving Kravis and Robert E. Lipsey, in "The International Comparison Program: Current Status and Problems," report on the history, purpose, and present status of the International Comparison Program (ICP), which is aimed at correcting for relative price differences across countries in the measurement of comparative levels of national output. They summarize the now-familiar finding that real incomes per person are much higher in low-income countries when sectoral outputs are valued at a set of "world prices" common to all countries (PPPs) than when simpler exchange-rate conversions are employed. Less familiar is their finding that the Gerschenkron effect accounts for only about one-sixth of the 60 percent average difference between PPP and nominal exchange-rate conversions.

A significant innovation in this paper is the calculation of margins of error for the estimates of per capita income levels at world prices. Uncertainty in the estimates results from such factors as sampling error in the collection of price data, problems of quality comparison, and the presence of "comparison-resistant" expenditure categories, particularly among such services as health, education, and government. Uncertainty ranges are calculated by considering a plausible set of alternative methodologies for estimating comparative benchmark income levels. The results show margins of uncertainty on the order of 20 25 percent for lower-income countries and less than 10 percent for high income countries. These margins of uncertainty are considerably

smaller than the deviations from benchmark estimates obtained by exchange-rate based conversions. The authors challenge the widespread assumption that the conversions via the exchange rate are robust because, unlike the PPP-based conversions, they are not subject to variation depending on the methodological choices adopted for their calculation. The authors show that the results of exchange rate conversions are, if anything, more sensitive to methodology than the PPP conversions. The authors end their paper with a number of suggestions for improving the methods of estimating comparative national performance and for extrapolating estimates to cover non benchmark countries.

Alan V. Deardorff emphasizes in his commentary the wide usefulness of the price and other measurements generated in the ICP. He also echoes Edward Leamer's plea for better integration of measurement with theory, pointing out the relevance to ICP calculations of the economic theory of index numbers and the econometric theory of missing data.

Deardorff closes his commentary with a speculation that the familiar ICP conclusion that developing-country prices are lower at prevailing exchange rates than comparable developed-country prices is incorrect. Since the lower developing country prices apply to both tradable and nontradable goods, Deardorff hypothesizes that the apparent price differences might actually reflect real product differentiation by nations, with developing-country goods being typically lesser-quality varieties. If that were the case, the equally familiar ICP conclusion that real GDPs of developing countries are understated would be suspect - a product of neglecting generalized quality differences. This speculation assumes that the major effort of the ICP field work -- to

compare prices for goods of equal quality -- ultimately failed to capture all quality differences. However, explanations for lower price levels in low income countries on other grounds have been offered.

#### Concluding Observations

The concluding panelists, Robert E. Baldwin, Jack Bame, and Ralph C. Bryant, generally commended the timeliness of the efforts to blend perspectives on data and research in trade, services, and direct investment. They also underscored the overall thrust of the project, endorsing the desire to address both analytical and measurement needs and opportunities, with its concomitant interchange between data producers and users, between government, academic, and business professionals, and between specialists in international and in domestic data.

Bryant observed that data on international transactions are international public goods, and that international collaboration on the content of the conference would be highly desirable. Over time, Bryant remarked, both governments and analysts may want to support coordinated compilations of data by representative international organizations such as the World Bank. Bame documented some of the more successful of these efforts: the harmonized merchandise trade system, the drafting of the 5th edition of the IMF's Balance of Payments Manual, the UN's revision of the System of National Accounts (SNA), and the work of the OECD and EUROSTAT on international services transactions.

Baldwin observed similarly that comparable trade, production, and input data are a national public good, and argued for better coordination across data-collection agencies to that end (see also Triplett 1990). Baldwin also observed that changing technologies and



types of goods traded may make the idea of measuring at the "border" less relevant, and the idea of sampling firms in some randomly representative way the wave of the future. On this theme Baldwin and Bame caution that events may overtake principle, if and as border measurement is abolished within the European Community and possibly between Canada and the United States.

Bame observed, and Bryant seconded, the need for future consideration of data on international financial transactions. In principle, an entire volume could be devoted to this need. As Bryant details, the ideal might include

"a breakdown of the balance sheets of financial institutions in all the important national jurisdictions, cross-classified by currency of denomination, residence of customer, and type of customer, ... data on cross-border security transactions and the corresponding stock asset and liability positions, ... substantial information about [off-balance-sheet items] as well, ... [and] systematic international compilations of these data."

A number of points arose in general discussion. One was the value on researchers having confidential access to confidential data, recognizing the trade-off between such access and the willingness of private-sector actors to provide such data. Another was the need for monitoring agencies, such as corporate controllers' offices and the Office of Management and Budget, to be more sensitive to the benefits as well as burdens of data provision. Still another was the agenda's under representation of some potentially important international transactions, such as financial capital movements (discussed above), migration and remittances, and the meaning of large and volatile statistical discrepancies.

REFERENCES

- Cole, Rosanne. 1990. Reviving the Federal Statistical System: A View from Industry. American Economic Review 80 (May): 333-36.
- DeLeeuw, Frank, Michael Mohr, and Robert P. Parker. 1991. Gross Product by Industry, 1977-88: A Progress Report on Improving the Estimates. Survey of Current Business, U.S. Department of Commerce, Bureau of Economic Analysis, 71 (January): 23-37.
- Juster, F. Thomas. 1988. The State of U.S. Economic Statistics: Current and Prospective Quality, Policy Needs, and Resources. Paper presented at the Fiftieth Anniversary Conference of the Conference on Research in Income and Wealth, Washington, D.C. May 12-14.
- Leamer, Edward E. 1989. We Need Standard Errors of the Standard Errors of the Measurement Errors of Our Data. Transcript.
- Lipsey, Robert E. 1990. Reviving the Federal Statistical System: International Aspects. American Economic Review 80 (May): 337-40.
- Miron, Jeffrey A., and Christina D. Romer. 1990. Reviving the Federal Statistical System: The View from Academia. American Economic Review 80 (May): 329-32.
- Norwood, Janet L. 1990. Distinguished Lecture on Economics in Government: Data Quality and Public Policy. Journal of Economic Perspectives 4 (Spring): 3-12.
- Triplett, Jack E. 1990. Reviving the Federal Statistical System: A View from Within. American Economic Review 80 (May): 341-44.