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Volume Title: International and Interarea Comparisons of Income, Output, and Prices

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Volume Publisher: University of Chicago Press

Volume ISBN: 0-226-33110-5

Volume URL: <http://www.nber.org/books/hest99-1>

Publication Date: January 1999

Chapter Title: Introduction to "International and Interarea Comparisons of Income, Output, and Prices"

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Chapter URL: <http://www.nber.org/chapters/c8384>

Chapter pages in book: (p. 1 - 9)

Introduction

Alan Heston and Robert E. Lipsey

Comparisons across countries of prices and of income and output measured in real terms, and comparisons within countries across regions and cities, are an old ambition of economists. The appetite for cross-country comparisons has been attested to by the hundreds of citations of the estimates of real income and prices for many countries constructed by Alan Heston and Robert Summers, now known as the Penn World Tables. Almost the entire recent literature on the determinants of economic growth that covers large numbers of countries is dependent on these data. The Penn World Tables are derived from the UN International Comparison Program (ICP), but few of those who use them know their origin or ever examine the methods underlying the original expenditure and price measures. In organizing this conference, we intended to make the ICP more widely known in the profession; to discuss its problems and new developments, including its extension to the transition economies; to discuss the analogous issues in interarea comparisons; and to illustrate a few of the uses of international and interarea comparisons.

The typical method of making comparisons across countries in real terms before the ICP and the measures derived from it was to translate values from their original currencies into a common currency by the use of exchange rates. That method assumed identical prices everywhere, as do comparisons across areas within countries using nominal values. The absurdity of that assumption for international comparisons, and of the conclusions that result from accepting it, was pointed out by Irving Kravis (1984). His example was that “Japan’s per capita GNP was 47 per cent higher than that of the United Kingdom in 1978 and 5 per cent lower than the U.K. level in 1980” when measured by

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exchange rates, despite the fact that “the Japanese constant price series for GNP shows an increase of about 8 per cent on a per capita basis while the U.K. constant price series shows an approximate decrease of one per cent” (p. 2). The nonsense result of the exchange rate–based comparison stems from a large devaluation of the yen relative to the pound in these two years.

The ICP has now been running for over thirty years, and the purchasing power parities and real income, consumption, and investment measures derived from it are increasingly used in economic research in place of the distorted values derived from translating by exchange rates. The ICP-based numbers are now a regular feature of the national accounts publications of the European Union and the OECD. Over time, the coverage of the program has increased from the ten countries of the 1970 report to around sixty in 1980 and 1985 and to almost one hundred in 1993. In the last few years, the scope of the program has grown enormously, as it has been joined by China and the formerly planned economies of Central and Eastern Europe, including some of the states of the former Soviet Union. Because prices had been set so arbitrarily in these countries and played such a different role from that in the market economies, the inclusion of these countries presented a variety of new measurement problems.

The Conference on Research in Income and Wealth (CRIW) first took up the problems of international comparisons in one session of a 1945 meeting, the proceedings of which were published in CRIW (1947). Copeland, Jacobson, and Clyman (1947) discussed a report prepared for the Combined Production and Resources Board on the effect of World War II on the civilian economies of the United States, the United Kingdom, and Canada. Among the topics were problems still troublesome today, such as the choice between quantity and price measures, quality differences among products from the three countries, the treatment of differences in consumption baskets, and the increased severity of these problems if the comparisons were to be extended to countries more divergent in economic development than these three. A companion paper, Dominguez (1947), calculated rough purchasing power parities for fourteen countries from data for twelve food items, declaring that “the results will most likely constitute a definite improvement upon foreign exchange rates, the usual base” (p. 239). The average price level for fourteen Latin American countries, relative to the United States as 100, comes to 72. The paper also quotes (p. 236) an earlier estimate by Clark (1940, 52) of a price level of 66 in “the less economically developed part of the world for which records are lacking.” Curiously, this session of the conference was the only one for which no comments by other participants were recorded.

The first foundations for the current UN program were laid in the early 1950s, in the OEEC study for five European countries in 1952 by Gilbert and Kravis (1954), which for the first time collected price data for not only personal consumption but also the other elements of national expenditure, such as government consumption and capital formation. That and the subsequent report

by Milton Gilbert and Associates (1958) were followed by the beginning of the broader UN project in 1968, which extended the range of the comparisons to some developing countries. The project's progress was documented in a series of reports (Kravis et al. 1975; Kravis, Heston, and Summers 1978, 1982) that covered the growth of the program from ten countries in 1970 to thirty-four in 1975. These reports also contained extensive discussions of methods of price collection, the treatment of particularly difficult measurement problems, and some analyses of economic issues of which the new data permitted much more empirical examination than had been possible before.

The CRIW returned to the issue of international comparisons in volume 20 of the *Studies in Income and Wealth* series (CRIW 1957), which contained papers on the subject by Brady and Hurwitz (1957) and Kravis (1957). The latter set forth the boundaries of economic activity that were the basis for the OEEC studies and were later carried over to the ICP despite the negative, and mostly impractical, comments by the discussants, Everett E. Hagen (1957) and Jacob Viner (1957).

When the CRIW next returned to this topic at its 1970 meeting (for the proceedings, see Daly [1972a]), the ICP was well under way, and the issue of international comparisons was of particular interest in connection with the desire to judge the relative positions of the United States and the Soviet Union. There were two general papers (Afriat 1972; and Daly 1972b), two papers on specific areas (Bergson 1972; and Grunwald and Salazar-Carrillo 1972), and one on capital goods price comparisons (de Vries 1972).

Since 1970, the CRIW has not held a meeting extensively devoted to inter-spatial comparisons of prices, incomes, and output, and only a few subsequent conference papers dealt with the issue at all. Jorgenson and Kuroda (1990) in volume 53 did include purchasing power parity calculations and the corresponding adjusted quantity measures for twenty-nine industries in the United States and Japan, based on data in Kravis, Heston, and Summers (1978) adjusted to producer price levels by removing indirect taxes and trade and transportation margins. And a paper by Kravis and Lipsey (1991) in volume 55 reviewed the status of the ICP at that time.

In the meantime, the availability of data, the number of countries covered, and the use of the data by economists have increased enormously, but there have been few opportunities for economists outside the club of practitioners to review the procedures, to learn of innovations, and to hear about the problems involved in extending the studies to the "formerly planned" economies. One purpose of this conference was to go some way to fill these needs and also to acquaint economists with some uses of these data beyond the measurements themselves.

Comparisons of incomes and prices across areas within countries are an even more neglected field than comparisons across countries. With no exchange rates to take into account, it is quite customary for statisticians and policy makers to ignore interarea differences in prices and assume identical

price levels across regions, states, and cities of a country, despite wide popular knowledge of differences in living costs. Some consequences of this official neglect for the measurement of poverty and for poverty programs were pointed out in Citro and Michael (1995), but there are many other areas where such information would be valuable. Even though the Bureau of Labor Statistics has had a program of research in this area for a number of years, the results are not widely known; we therefore included several papers in this area.

In addition to the ICP, which measures final expenditures in real terms, using prices for final products, there has been considerable recent research on measurement from the product side, mainly by the International Comparisons of Output and Productivity (ICOP) Program at the University of Groningen Growth and Development Centre. These measures have the virtue of producing comparisons for industries and for intermediate products. The methods have not been as fully presented as those for the final product measurements, and we hoped, with the papers here, to make the methods and the results more accessible.

Some of the recent extensions of the ICP to the transition economies are still in a very tentative state, as is the treatment of certain categories of consumption. Where we thought that full papers could not be prepared, we arranged for brief, informal presentations on some of these since the methods and problems are even less widely known than those of the ICP itself. Four of these presentations are included here, but some had to be omitted because the governments of the countries involved had not accepted the results.

Since these comparison programs and the literature discussing them have developed a specialized language describing the methods used and the economic issues underlying them, we have, as part of the effort to make the literature and the papers here more widely accessible, included a glossary of technical terms and index number formulas at the end of the book. We have also listed in the appendix to this introduction, some sources for the data used in the following papers to encourage further exploration of these topics.

Part I of this volume comprises a pair of papers on the theoretical bases of multilateral interspatial comparisons, asking, essentially, What should we measure, and how should we measure it? The paper by W. Erwin Diewert introduces the conference. It suggests a system of desirable axioms and properties for multilateral comparisons and selects four classes of measurement methods, not including the Geary-Khamis method favored by the ICP, as the best. Diewert's discussant, Irwin Collier, points out some of the assumptions underlying Diewert's tests and takes a more favorable view of Geary-Khamis. The paper by Robert J. Hill proposes a new way to order countries for international comparisons by chaining countries using a spanning tree approach. The spanning tree approach begins with the Paasche-Laspeyres spread in the binary comparison between each pair of countries and builds on the binary chain that minimizes the sum of the spreads.

Part II of the volume is concerned with interarea wage and price compari-

sons. Two papers, on experimental programs at the Bureau of Labor Statistics (BLS), make both theoretical and empirical contributions. The first of these, by Mary F. Kokoski, Brent R. Moulton, and Kimberly D. Zieschang, illustrates a two-stage process in which the BLS has used its CPI database to estimate entry-level price levels by region and then combined these indexes using weights to estimate city indexes for several commodity groupings. There is a parallel in this approach to what has been done in benchmark ICP comparisons where price parities are first generated at a heading or category level by the use of the country-product-dummy (CPD) method. The authors note that, instead of individual prices, the coefficients in these equations can be made available, a feature that avoids the violation of the confidentiality rules that statistical offices often face. These entry-level parities are then aggregated using a modification of bilateral Törnqvist indexes to produce a transitive multilateral index in a two-step aggregation process, very much like the EKS procedure. The authors suggest that one of the innovative features of their procedure would be applicable to the ICP's international comparisons—that is, the replacement of uniform narrow commodity definitions, prescribed for all respondents, by broader commodity categories, with respondents collecting information on product characteristics that can be used to achieve comparability across areas through hedonic quality adjustments. The discussant, Paul Pieper, expresses some skepticism as to whether this procedure reduces the burden on respondents or only substitutes one type of difficult requirement for another. The paper uses these methods to calculate multilateral place-to-place price indexes for the consumption of food at home for forty-four geographic areas of the United States. The authors find that the price level for the most expensive area, Honolulu, was more than 60 percent above that for the cheapest, Miami. Even within the contiguous states, there was a 25 percent difference between the most and the least expensive areas.

The second of the papers from the BLS, that by W. Brooks Pierce, John W. Ruser, and Kimberly D. Zieschang, provides an application of the same methodology to wage costs and labor compensation across regions of the United States. In a methodological contribution, they formulate the Törnqvist index in a way that incorporates the parameters of a CPD exercise into the index. Place-to-place labor input cost index numbers are constructed for thirty-nine geographic areas at the level of the eighteen thousand or so jobs priced in the BLS employment cost index. The adjustments for the composition of the labor force tend to reduce the measured geographic dispersion in wages. The determinants of wage differences across geographic areas, after industry and occupation are controlled for, are firm size, unionization, and the education and experience of workers. Joel Popkin, the discussant, points out the difficulty of distinguishing, in such measurements, between characteristics of the job and characteristics of the worker.

The other paper on interarea differences, that by Bettina H. Aten, found that, in contrast to the U.S. wage results, adjusting Brazilian income data for re-

gional price differences widened the estimated real income differentials between the poorer northern regions and the wealthier southern ones.

Part III of the volume consists of informal reports on methods and on the geographic expansion of the ICP. In keeping with the aim of displaying some of the measurement issues in "comparison-resistant" sectors and some of the results of the expansion of the ICP to new areas and its accompanying problems, several informal reports were invited, although the work is still in an early stage. These reports included one paper on a comparison-resistant sector by Giuliano Amerini and papers on the expansion of the ICP by Alfred Franz, Seppo Varjonen, and Daniela Elena Ștefănescu and Marilena Chișinevschi.

Also included in this section is a brief statement by Yuri Dikhanov, originally a comment on a paper by Angus Maddison (presented at the conference but not published in this volume; see Maddison 1998). Dikhanov describes the comparative-level calculations carried out by Soviet sources and, as an additional alternative, the linking of the level comparisons within Comecon with the ICP results for Soviet bloc participants in the ICP, such as Hungary. He also reminds the reader of some of the index number issues in these comparisons originally raised by Alexander Gerschenkron.

Three other informal informational reports were presented at the conference but not included in the volume. A paper in progress, "Methodology for Developing Monthly PPPs for the Countries of the CIS," was presented by Anne Harrison in collaboration with Seppo Varjonen. That work has subsequently developed into a full purchasing power comparison for consumption in 1993, 1994, and 1995 for ten of the former Commonwealth of Independent States (CIS) countries, using both Russia and Turkey as the numeraire countries for the comparison. The paper is of particular interest because the inflation rates, national accounts, and even exchange rates for most of these countries have not been readily available. Unfortunately, this paper has not been cleared with all the governments of these countries and therefore could not be included in this volume.

There were also two informal reports involving China: "Comparison of Shanghai with Japan," by Sultan Ahmad, and "China's Regional Disparities," by Albert Keidel III. The preliminary results for 1993 presented in the former paper have not been thought to be robust, but a second part of these 1993 comparisons, between Guangdong and Hong Kong, have now been completed and will be integrated into comparisons by the Economic and Social Commission for Asia and the Pacific (ESCAP). The binary comparisons suggest that the price level in Guangdong is about 48 percent of that in Hong Kong. Of course, one would also wish to know how Guangdong Province compares with the rest of China, and to this end the State Statistical Bureau is currently making comparisons between the coastal and the interior provinces.

Part IV consists of reports from the ICOP Program that extend international comparisons to the product or industry side. These reports also represent extensions of the scope of that project, in terms of both industry and geographic

coverage. The paper by Nanno Mulder measures productivity differences in these difficult sectors, adjusting, where possible, for quality differences. Productivity in these sectors in Mexico and Brazil ranges from 15 to over 35 percent of that in the United States, while in France the range is from a third of U.S. levels in communications in the early years to over 90 percent in some years in the transport sector.

The second paper from the ICOP project, by Bart van Ark, Erik Monnikhof, and Marcel Timmer, finds labor productivity in manufacturing in Central and Eastern Europe to have been between 18 and 29 percent of the U.S. level from 1970 through 1987, with a declining relative trend in most cases. Only in East Germany was there a major change after that: more than a doubling relative to the United States between 1987 and 1994 and a more than 50 percent rise relative to West Germany by 1993. Aside from the productivity estimates collected here, the authors examine the nature of price and quantity distortions in the “centrally planned economies” by analyzing the relation between Paasche and Laspeyres price and quantity indexes.

The last part, part V, is on applications of international comparison data, illustrating some uses for price and quantity comparisons. The first paper, by Patricia M. Danzon and Allison Percy, examines the effects of drug price regulation on productivity and productivity growth in five countries. The authors find that estimates of both productivity and productivity growth are sensitive to the choice of price measures used for deflation.

The paper by Edward N. Wolff found that manufacturing industry specializations of fourteen OECD countries remained quite constant from 1970 through 1993 and that changes in relative labor productivity were excellent predictors of changes in country market shares. Rates of capital formation were important for low-tech industries, less so for medium-tech ones, and not at all for high-tech ones, and labor costs were a significant influence on market shares only in low-tech industries and only in the 1970s.

Using both aggregate and disaggregated price-level data from the ICP, Robert E. Lipsey and Birgitta Swedenborg found that higher wage dispersion is associated with lower price levels. The relation exists for both goods and service items but is more frequent and stronger for services. As Andrew Levin points out in his discussion, the equations here imply that the Scandinavian countries, for example, would have substantially lower price levels if their wage structures and agricultural policies were like those of the United States and Canada.

In another application, Robert Summers and Alan Heston examine the material well-being of the world during the period 1960–92. They conclude that differences in average incomes across countries are greater than differences in incomes within countries for nearly all the countries of the world. Alternative measures of well-being are discussed, as are some considerations relating to nonmaterial well-being.

Appendix

Sources of Comparative Data

Benchmark data from the ICP for 1970, 1975, 1980, and 1985 are available on a website at the University of Pennsylvania, pwt.econ.upenn.edu.

The Summers and Heston annual estimates of real GDP, price levels, and other aspects of the ICP, extrapolated to cover countries not participating and periods of nonparticipation for participating countries, are available from the NBER at its website, www.nber.org, under ONLINE DATA, PENN WORLD TABLES.

OECD calculations of purchasing power parities of member countries for fifty expenditure categories, both EKS and GK results, for 1993 are available in three publications listed under PURCHASING POWER PARITIES on the OECD home page, www.oecd.org. The indexes themselves are not on the website.

The results of ICP rounds after 1975 are reported in three publications: UN Statistical Office (1987), UN Statistical Division (1994), and World Bank (1993).

The ICOP Program has been described most recently in van Ark (1996).

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