

# OVERVIEW

D.S. Prasada Rao and J. Salazar-Carrillo

Over the last three decades international organizations and individual researchers and research groups around the world have produced an extensive range of international comparisons of prices, real output, real income and productivity and purchasing power parities of currencies. Notable among these have been the International Comparison Program (ICP) of the Statistical Office of the United Nations which is now entering its sixth phase, and from the early 1980s, the International Comparison of Output and Productivity (ICOP) project at the University of Groningen. The increasing availability of internationally comparable real output and productivity estimates has proved a major boon for the community of economists and econometricians interested in the field of international economic comparisons.

It is perhaps surprising that despite the phenomenal growth in the supply of and demand for international comparisons, there has been no consistent growth in the number of readily available publications disseminating the developments in the methodological and applied works involving sectoral, regional and global comparisons. Arguably, the last eminent publication dealing with international comparisons was the 1982 seminal study "World Product and Income" authored by Kravis, Heston and Summers. Consequently, the present volume represents a modest but timely augmentation of the many journal articles yet minimal number of books and monographs on the subject of international comparisons by bringing together contributions from leading scholars from an extensive range of relevant discipline and geographical backgrounds.

The papers in this volume have been classified into two broad groups united by overlapping themes. Part I includes the first group of papers. These are essentially empirical papers intended to provide a clear picture of the various types of international comparisons that have been undertaken by various organizations and individuals. The papers relate to empirical studies of different sectoral and national income aggregates at both regional and global levels. The papers in Part II deal with methodological and analytical issues. As could be expected, discussion of the appropriateness of various aggregation methods for

international comparisons accounts for a major component of Part II. Two of the papers in the second section deal with real GDP comparisons, one based on a shortcut/reduced information concept and the other based on the notion of long-run real exchange rates derived using purchasing power parity theory. This section also includes a paper focusing on a theoretical model explaining national price levels which is then used in examining the effects of reduced defence spending.

The first paper by Zoltan Kenessey describes the International Comparison Program (ICP) and traces the historical roots of the project and the contemporary issues affecting ICP. The motivation for the paper stems from the recent publication of the results for Phase V of ICP, the results have an uneven coverage, especially for Latin America, and are based on the regionalised ICP approach. After a brief review of the results from ICP for different regions, the author embarks on a very interesting journey through the history of the project and makes a passionate appeal for the preparation of a detailed bibliography. Given that contributions made in the area of international comparisons are usually published in very disparate sources, and in many cases significant contributions to the debate are included in unpublished expert group meeting reports which are not available in the public domain. Another important factor that is usually not borne in mind by enthusiastic users of ICP results is the quality of the comparisons and the limitations associated with data collection, compilation and many assumptions made in the process of deriving such extensive results at the global level. The Chapter by Kenessey on the ICP in the 1980's and 1990's concludes with an account of many developments related to the ICP, where he describes international comparison work outside the domain of the ICP. This paper provides a useful backdrop to the issues and results described in the other papers of this volume.

The issue of absence of Latin American countries in the latest ICP global comparisons is taken up by Salazar-Carrillo, and he attempts to fill the gap for the region by providing a set of comparisons for the year 1985. The author uses his extensive knowledge of the region and the experience gained through his involvement in this region's comparisons over time to provide a set of results for the countries in Latin America. He uses very detailed category level national price deflators to update the price data to the year 1985 and uses the simple geometric-Walsh method to derive a completely consistent and transitive set of comparisons, and contrasts these results with some of the extrapolations for the Latin American countries from the Penn World Tables and the

## World Bank's World Development Report of 1992.

In contrast to the global and regional comparisons described in the previous two chapters, the paper by the Statistics Division of the FAO represents one of the most comprehensive empirical exercises undertaken at the sectoral level. The Food and Agriculture Organization has pioneered work on international comparisons and has been producing statistics in the form of global and regional agricultural output aggregates for over four decades. The present paper describes the latest effort undertaken by the Division to update its international comparisons to the most recent benchmark years of 1985 and 1990. The Division has also taken the opportunity to introduce some modifications to the methodology employed in deriving the purchasing power parities. Methodological improvements reported include a modified Geary-Khamis method which provides purchasing power parities (PPP) for the final output, which is gross output net of feed and seed. The second innovation involves the derivation of internationally comparable agricultural GDP figures. The input expenditures are converted into real terms using input PPPs derived through the use of a multilateral Theil-Tornqvist index formula applied to input price data collected through special surveys. These PPPs are used in deriving real agricultural GDP expressed in a common currency unit. This paper provides summary results, including the PPPs, international prices and real agricultural GDP aggregates for more than a hundred countries, and for the benchmark years 1970, 1975, 1980, 1985 and 1990. The FAO study includes the introduction a neutral currency unit, Agricultural Currency Unit (ACU) for purposes of presenting the results. But the tables in the paper provide all the aggregates in US dollars.

Chapter 4 examines the problem of international comparisons of capital stock. Measurement of capital stock and its comparison over time and across countries is a formidable task, and Ward's paper draws on a recent World Bank study which presents approximate but consistent capital stock estimates for 96 countries. The study applies the standard perpetual inventory model to country specific gross fixed capital formation series in constant 1987 US dollars from the year 1950. The author examines the conceptual issues in the measurement of capital and then discusses the role of capital at length. The results presented show that the rate of capital accumulation in East Asia is much faster than in other regions and most of the growth in assets in that region has been in machinery, transport and other equipment. The author also observes that the relative share of plant, machinery

and equipment in the capital stock declined in the 1980's in the case of Europe, Sub-Saharan Africa, Latin America and the Middle East and North Africa. The strengthening of the capital base in East Asia provides a rational explanation as to why economic growth has been most significant in the newly industrialised countries in the region. Appendix Tables for the paper should provide useful information to empirical researchers working on the issues of economic development.

On the subject of economic development and rapid growth, Dirk Pilat's paper focuses on one of the Asian economies, Korea, with the focus on a comparison of prices, output and productivity in Korea and the United States over the period 1963 to 1990. This paper is very impressive in that it attempts to undertake a comparison of the gross domestic product in these countries from the production side of the national accounts. It is a very labour intensive project and the smooth presentation belies the enormous empirical work that lies behind this piece of work. Pilat uses the industry-of-origin approach to the comparisons and compares the real output levels in the agricultural, mining, manufacturing and service sectors of these two economies. The paper outlines the procedures followed in the work, such procedures would be enormously useful for other researchers attempting similar work in this field. Productivity issues are examined using the partial measures of labour and capital productivity as well as the total factor productivity. The productivity gap between these two countries, which is quite wide, is explained in terms of capital intensity, quality of labour inputs, and other factors which include lack of natural resources, land scarcity, poor organisation of production and slow diffusion of knowledge. Time series analysis of productivity suggests that Korea has shown fast growth in productivity, but as the country came from such low levels, its average productivity level is still quite low. Pilat concludes that if Korea succeeds in maintaining the fast productivity growth it has experienced over the last three decades, it may be able to reach productivity levels comparable to those of industrialised countries by the end of the century.

The next paper in this section is a fascinating paper by Robert Michael Field on real gross domestic product of China using a direct comparison of prices in China with those of the United States. The author attempts to answer several questions including: Is China the world's largest economy? Is it the third largest, ranking just ahead of Germany? Is its GDP more than half of the GDP of the United States? In the literature there are several estimates of China's GDP ranging

from 300 billion US dollars to more than a 3 trillion dollars, depending on whether the Chinese GDP is converted using the official trade rate of exchange or it is converted using the purchasing power parities. Field's study represents an in depth study of China, and a serious attempt to derive Chinese GDP in US dollars using the industry-of-origin approach. This approach requires a reconciliation of the differences in the accounting approaches followed in the two countries. Michael Field derives a figure of 1137 billion dollars. His figure is towards the bottom range of that in other published papers. A number of useful references and sources of Chinese data are listed in the paper and an appendix containing detailed Chinese and US data for different sectors of these economies is also provided.

The last paper in this section by Lawrence Officer studies the financing of the United Nations (UN) from the perspective of the apportionment of its expenses among member states as determined by the United Nations itself. It examines the tensions; conflicts; and inconsistencies in this process over the entire history of the United Nations. The issue of burden-sharing in international organizations has fallen out of fashion in the academic literature. It is resurrected in Officer's paper for two reasons: first, burden-sharing has continued to be a controversial issue within the UN itself; second, new and improved purchasing-power-parity data has enhanced empirical analysis of the topic. This paper represents a timely analysis and provides an excellent view of the inside workings of the organization on sensitive issues like the assessments. From the view point of the present volume, this paper is a good example of how the results from international comparisons can improve the methodologies underlying the issues such as the UN assessments. The paper provides a succinct account of the methodologies underlying the UN procedures and provides some new and improved methods based on purchasing power parity data.

The Part II of the volume deals with a number of methodological and analytical issues. The first paper in this section by Bert Balk describes the Van IJzeren method for international comparisons. Balk provides a simple description of the Van IJzeren method. The method itself is mathematically complex, and is based on a set of interdependent equations. Properties of this method are described in detail and then contrasted with those of the Geary-Khamis method, the main aggregation procedure used in most international comparisons to date. The paper ends with a simple numerical illustration which provides results from a number of alternative methods. The main purpose of the

paper is to popularise this somewhat analytically difficult procedure.

The paper by Khamis examines the principle of consistency in aggregation and argues that the Geary-Khamis method is the natural choice when one is looking for a procedure that satisfies this principle. He argues that the definitions of international prices and purchasing power parities in the Geary-Khamis method provide index numbers satisfying the property of additive consistency. Khamis comments on the use of the EKS method by the OECD and points towards inconsistencies between sub-aggregates and the aggregates at a higher level. His final conclusion is that until a suitable alternative is found the Geary-Khamis method remains as the only method satisfying the principle of aggregation.

The stochastic approach to the construction of index numbers is expounded in the paper by Rao and Selvanathan. The paper describes the stochastic approach which considers the index number problem as one of finding the price change from a set of price relatives. This paper demonstrates the feasibility of deriving standard index number formulae such as the Laspeyres, Paasche and Theil-Tornqvist index numbers, and then proceeds to establish the versatility of stochastic approach in dealing with the problem of multilateral comparisons. The transitive multilateral index numbers due to Caves, Christensen and Diewert and its generalizations are also derived using the stochastic approach. In the last section Rao and Selvanathan derive Geary-Khamis purchasing power parities and international prices using the stochastic approach. One of the advantages of the stochastic approach is that it provides standard errors associated with purchasing power parities unlike the standard index number methods used in international comparisons. This paper advocates the use of regression based methods for international comparisons. The subgroup of papers on aggregation methods for international comparisons conclude with a short paper by Prasada Rao and Salazar-Carrillo on log-change index numbers. In particular, the geometric-Walsh and Rao systems for multilateral comparisons are described and their properties are enunciated. A number of important properties of the Rao system, including its close similarity with the Theil-Tornqvist and Ikle indices, are highlighted.

The last three papers of the volume are different in content to the other papers in this section. Those by Ahmad and Lancieri address the problem of deriving meaningful conversion factors for as many countries as possible and for as many years as possible. Given the background

of these authors, they focus mainly on the issue of deriving purchasing power parities or real exchange rates which are stable and simultaneously provide meaningful real per capita income comparisons. Notably these two authors pursue entirely different routes to achieve their goals. Ahmad's paper uses the regression method of shortcut estimation by modelling the deviation of exchange rates from purchasing power parities, for the ICP countries. Estimated models which explain these deviations are then used to obtain extrapolations for countries and time periods outside the period covered by the ICP. The approach used here is similar to that followed in the preparation of the Penn World Tables. The author contrasts his results with those of the World Bank Atlas, Penn World Tables - Mark 5 (PWT5), and attempts to answer the question: Which set of estimates is better? The paper also identifies a number of fruitful areas for further research.

In contrast, Elio Lancieri uses the purchasing power parity (PPP) doctrine to define the long term real exchange rates and provides a new method for estimating real gross domestic product. The paper begins with an excellent summary and critique of the conversion factors available to date, the ICP parities, Penn World Table conversion factors and those from the industry-of-origin approach. Lancieri argues quite convincingly that the situation is far from satisfactory in terms of the reliability of the available conversion factors and their timeliness. He proposes a new method which provides long term exchange rates which perfectly compensate, year-by-year for the inflation differential between countries, in line with the relative PPP doctrine. The resulting exchange rates are termed Adjusted Long Term Exchange Rates (ALTER) and the author provides algebraic proofs of transitivity of the results and demonstrates that these rates can handle situations involving countries experiencing hyper inflation.

The volume concludes with an analytical paper by Jeffrey Bergstrand which tackles the problem of explaining national price levels. Results in this paper form the theoretical basis for empirical regression procedures used in shortcut methods similar to that described in Ahmad's paper. The paper follows on from the author's own work as well as that of Kravis, Lipsey and Clague, which attempts to explain the variability in general price levels across countries using mainly productivity differentials and relative factor endowment differences. The author then turns to the role of fiscal spending on price level differences through a theoretical model. He then examines the effects of reductions in defence spending in industrialized nations on relative national price

levels. Bergstrand concludes that, theoretically, the effect of military spending reductions is ambiguous; that the effects depend upon relative factor intensity in production of civilian versus military goods and of civilian tradable versus non-tradable goods, and upon the relative importance in utility of civilian tradable versus nontradable goods. The model developed in the paper is used in an empirical study and the author's conclusion is that reduction in military expenditures are predicted to result in a small real depreciation of a country's currency and thus result in a relatively minor fall in the national price level relative to the world average. Bergstrand's paper demonstrates the need for analytical models which can lay the foundation for shortcut methods which are generally based on intuition and economic reasoning.

In summary, the present volume provides a set of stimulating studies on international comparisons of prices, output and productivity. The papers cover only a small sample of a vast number of developments and innovations in this research field. The papers provide a broad view of the whole exercise of international comparisons. It is the editors' sincere hope that these papers provide a useful reference source for many interested researchers around the world.