

REVIEW OF THE OECD-EUROSTAT PPP PROGRAM

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KEY CONCLUSIONS AND RECOMMENDATIONS

In the 1980s and 1990s, comparisons of prices and volumes of GDP and its components for countries accounting for the greater part of world GDP have depended on the OECD-Eurostat PPP program. [1.1-3]

A fully functioning world statistical system should include, as one of its central elements, the capacity to make such comparisons. [2.15-19]

With the progressive development and implementation of international standards respecting statistical methodology and comparability, the PPP program should be capable of adaptation and extension as part of an integrated system to support inter-country comparisons of industrial structure, productivity, patterns of factor incomes and of the distribution of real incomes and expenditures of households. [5.20]

The resources employed in the PPP program are minuscule, and this is reflected in the quality of the results. [2.12-14, 6.1-32]

Improvement of the quality of the estimates and extension of their scope will require some expansion in the resources employed and, in particular, the full-time services of an expert co-ordinator who is familiar with, and capable of using to maximum advantage, the information available from databases in national statistical offices, other international organisations and other Directorates within the OECD. [6.33]

In order to obtain the additional resources required, funding assistance might be sought from the key international organisations which place increasing reliance on PPP estimates in their work. [2.16, 6.34]

Extensive liaison with national and international statisticians and other experts is essential, but the collection of data by standardised questionnaires should be kept to a minimum. [6.16]

Responsibility for the estimates should be accepted by OECD/Eurostat, and should not be shared with statistical agencies in Member countries. [6.2]

Initially, the focus of an enhanced PPP program should be to improve the quality and visibility of price and volume data in the comparison-friendly categories of final consumption expenditure. [6.1-27]

Collection of the prices of inputs for non-marketed services provided by governments serves little purpose. The possibility of using price parities derived from the prices of outputs of marketed services should be investigated. Co-operative studies by the Statistics Directorate and other Directorates of the OECD on the methodological issues involved in the measurement of performance in the provision of general government services would be of mutual benefit. [7.1-40]

Comparisons of prices and real values of expenditure on capital goods (construction and equipment) raise particular difficulties, and the outcome is of marginal value in relation to those uses of PPP estimates examined in this report. The case for increased resources to support this capital investment

component of the program requires study of the uses of PPPs for cross-country comparisons of output and productivity by industrial sector. [6.32, 8.1-10]

1. Introduction

1.1 This is a review of the OECD-Eurostat Purchasing Power Parity (PPP) program, which provides estimates of the volume of GDP and its component expenditures for countries accounting for the greater part of world GDP. The terms of reference of the review, as agreed at the initial meeting of the Steering Committee on 25-26 November 1996, are appended as Attachment A.

1.2 The consultant, Ian Castles, transmitted a draft report to the OECD and to members of the Steering Committee before having discussions with specialists in several national statistical offices and international organisations, and with Professor Robert Summers at the University of Philadelphia, in April 1997. Persons consulted in the course of preparing this report are listed as Attachment B. The consultant extends his thanks to all of those who assisted him so freely and wishes to recognise, in particular, the unfailing helpfulness and co-operation throughout the entire exercise of Derek Blades, David Roberts and their colleagues in the Statistics Directorate at the OECD.

1.3 At a further meeting of the Steering Committee on 24-25 April 1997, the consultant gave an oral report on his consultations with specialists, and discussed with the Committee and with experts at the Statistics Directorate the way in which he proposed to interpret his mission in finalising his report.

1.4 With the agreement of all participants in these discussions, the terms of reference have been interpreted broadly in this report. In particular, it was agreed that the review of the issue "How well do PPPs produced by OECD/Eurostat meet the needs of the users ...?" should extend to a consideration of the concerns expressed by specialist prices and national accounts statisticians about the reliability of the estimates. Whilst a comprehensive audit of the program was beyond the scope of the review, it was considered that it would be useful to apply some checks of consistency and plausibility to the results for selected components of expenditure, in order to test whether doubts about the quality of the estimates had substance.

1.5 The OECD-Eurostat PPP program was established in the early 1980s, with the purpose of enabling price and volume comparisons of GDP and its component expenditures to be made for OECD Member countries.

1.6 To date, such comparisons have been published for four benchmark years: 1980, 1985, 1990 and 1993. The 1980 and 1985 comparisons included, respectively, 18 and 22 OECD Member countries, and the 1990 and 1993 comparisons included all 24 countries which were then Members of the OECD.

1.7 The program is an independent one with its own methodology, timetable and *raison d'être*. However, its results were used in the 1980, 1985, 1990 and 1993 rounds of the European Comparison Programme (ECP) of the United Nations Economic Council for Europe (UNECE) and in the 1980 and 1985 rounds of the International (or global) Comparison Programme (ICP) of the United Nations Statistical Division.¹ The results of the four ECP comparisons were processed by Eurostat; Eurostat also processed the results of the 1985 ICP comparison.

1.8 Results of the 1996 round of the OECD-Eurostat program, which includes 28 countries, will be published by the OECD during the first half of 1998; and those for the 1999 round, which is likely to include 40 countries², are scheduled to become available during the first half of 2001.

1.9 In the meantime, Eurostat will continue to calculate and publish price and volume comparisons of GDP and of its component expenditures for EU Member States annually, as it has done since 1990.

These comparisons have the ECU as the numeraire and the EU as base, whereas the OECD comparisons have the US dollar as the numeraire and (since 1990) the OECD as base.

1.10 In order to calculate the price and volume comparisons, Eurostat and the OECD require for each participating country a common breakdown of national expenditure (over the whole range of expenditure on GDP), and a set of national annual average prices for a selection of products chosen from a common basket of goods and services. The basket is made up of product lists detailing the different types of goods and services to be surveyed, which are established by Eurostat and the OECD in consultation with the participating countries.

2. International Volume and Price Comparisons: Needs v. Resources

2.1 In the publication reporting the initial results of the 1980 benchmark study, the OECD gave the following explanation of its decision to undertake the program:

The decision by the OECD in the autumn of 1982 to embark again on the calculation of real GDPs and PPPs, after a break of over 25 years, has been influenced by two factors. First, the absence of PPPs creates a vacuum in a system of international statistics, as it is **impossible** to make price or volume comparisons between countries without them. The use of exchange rates as proxies for PPPs has become **quite unacceptable** in recent years as a result of major fluctuations in exchange rates which have made them erratic currency converters for statistical purposes. Second, the costs of any OECD program have been greatly reduced because PPPs for half of the Member countries of the OECD are already being calculated on a regular basis by the Statistical Office of the European communities (EUROSTAT)³ (emphasis added)

2.2 The claims about the merits of using PPPs rather than exchange rates to make inter-country comparisons of prices and volumes of expenditure and output, which were advanced as the first factor influencing the OECD's decision, are strongly supported in the writings of the most respected economists who have studied issues related to the measurement of income and wealth. There is a notable example in a recently-published essay entitled "The Concept of Wealth", by Amartya Sen, Lamont University Professor at Harvard University:

... in making international comparisons we may be misled by variations in relative prices. Real income comparisons are meant to be performed at constant relative prices, not - as is frequently done in making quick statements on international living standards - at their own respective prices adjusted for exchange rates. Even when constant relative prices **are** used, the results may depend on **which** set of relative prices is employed. The use of real-income techniques with varying prices needs a careful integration of theory with practice.⁴ (emphasis in original)

2.3 As an example of such careful integration, Professor Sen explicitly commended the ICP report *International Comparisons of Real Product and Purchasing Power*⁵, noting that "Many of the difficult issues of international comparisons have been tackled with great skill and imagination by Kravis, Heston and Summers (1978)."⁶

2.4 The world of floating exchange rates which was born in the early 1970s added weight to the argument that the use of exchange rates as proxies for PPPs was totally unacceptable. As Paul Samuelson pointed out:

One day in 1973 the United States moved from being decidedly the most affluent nation to being definitely below Sweden. Does anybody believe in such violent changes in relative real income? You must if you rely on official or market exchange rates for your purchasing power parity deflators.⁷

2.5 In the event, relationships between exchange rates and PPPs were to become even more uncertain in the years following the OECD's decision to embark again upon the calculation of real GDPs and PPPs. This is illustrated in Table 1 which shows, for selected years since 1970, Japan's GDP expressed as a percentage of the GDP at current prices of the United States, the total of the 15 Member States of the European Union as now constituted and Canada. The comparisons are based on the conversion of GDP in national currency units on the two different bases - at current exchange rates and at current PPPs - and the extent of divergence between the two bases of comparison is indicated by expressing each of the exchange rate-converted percentages as a ratio of the PPP-based percentages:

Table 1. GDP of Japan Expressed as % of GDP of United States, EU 15 and Canada, Converted at (A) Current Exchange Rates and (B) PPPs: Selected Years, 1970 to 1995

		1970	1978	1982	1988	1990	1995
United States	A. Exchange rates	20.1	43.6	34.5	59.7	53.4	73.5
	B. PPPs	29.0	32.2	36.9	37.5	39.6	39.3
	<i>Ratio: A/B</i>	<i>69.3</i>	<i>135.4</i>	<i>93.5</i>	<i>159.2</i>	<i>134.8</i>	<i>187.3</i>
EU 15	A. Exchange rates	26.2	38.6	36.8	53.9	43.6	60.7
	B. PPPs	28.2	31.3	34.5	37.3	38.7	39.4
	<i>Ratio: A/B</i>	<i>92.9</i>	<i>81.1</i>	<i>106.7</i>	<i>144.5</i>	<i>112.7</i>	<i>154.0</i>
Canada	A. Exchange rates	241.3	462.5	360.5	593.7	516.1	913.2
	B. PPPs	382.0	366.1	404.3	397.4	427.3	438.4
	<i>Ratio: A/B</i>	<i>63.2</i>	<i>126.3</i>	<i>89.2</i>	<i>149.4</i>	<i>120.8</i>	<i>208.3</i>

Sources: 1970-1990: Derived from OECD, *National Accounts Main Aggregates Volume 1 1960-1994*, Part VI, Table 13, pp. 128-9 and Part VII, Table 1, pp. 148-9.
1995: Derived from OECD, *Main Economic Indicators*, January 1997, pp. 198-201.

2.6 If the 1995 ratios based on exchange rates are compared with those for 1982, Japan's GDP relative to that of the United States is shown as **more than doubling** (from 34.5% to 73.5%) over the 13-year period. Yet the PPP results show Japan's economy growing only marginally relative to that of the United States between 1982 and 1990, and remaining unchanged in relative terms between 1990 and 1995 (notwithstanding a huge relative increase during this period in Japan's nominal GDP). The PPP results also showed little change between 1990 and 1995 in the scale of Japan's GDP relative to the total GDP of the European Union countries, despite an apparent increase of almost 40% in this relationship if exchange rate-converted values are used as a proxy for real values.

2.7 But the manifest unsuitability of exchange rate conversions emerges most obviously from the Japan/Canada comparisons in Table 1. The relationship of Japan's GDP to Canada's based on an exchange rate conversion, relative to that based on PPPs, increased 3.3 times (equivalent to an average compound rate of 5% per annum) over the 25-year period. By 1995, the PPP-based comparison showed Canada's GDP to have become **more than twice as great**, relative to Japan's, than would have been indicated by converting GDPs in national currencies on the basis of exchange rates.

2.8 In “Comparative Studies of National Incomes and Prices”, which was published in 1985, Irving Kravis had written:

Furthermore, ... the direction of bias [in measuring relative real incomes by exchange rate conversion] can be predicted: when a low-income country is compared with a higher income country, the exchange rate conversion tends to understate the relative income of the low-income country. **When the difference in income is large, the exchange-rate converted income figure can be as little as one-half or even one-third of the purchasing-power converted figure.**⁸ (emphasis added)

2.9 The 1995 comparisons revealed that the exchange-rate converted per capita income figure for one country (for example, Canada) could be as little as one-half of that for another country (for example, Japan), even when both countries were at similar levels of average real income as estimated with the use of PPPs.⁹ With divergences between the exchange-rate adjusted and PPP-converted levels of GDP as large and persistent as those which developed between 1985 and 1995, it has become more obvious than it was in the early 1980s that the use of exchange rates to compare output levels in different countries is quite unacceptable.

2.10 The argument that differences in price levels can be ignored when comparing the aggregate output or expenditures of countries and regions cannot be sustained: it is no more sensible than a contention that statistical agencies could serve the needs of economic analysts by confining their time series data of the national accounts to estimates of GDP and its components in **nominal** terms. Whilst such estimates are produced and published, the main focus of interest in contemporary national accounts estimates is in the estimates of changes in GDP in constant prices. In fact, statements that a country's GDP has increased by x% or at an average annual rate of y% are, unless otherwise specified, invariably taken to be referring to trends in **real** rather than in nominal GDP.

2.11 Moreover, the measurement of movements in final prices, and in the real values of output and expenditure and of its components, absorbs a significant proportion of the resources of national statistical offices, and has long been seen by them as being at the heart of their function.

2.12 By way of contrast, the resources devoted to inter-country comparisons of prices and volumes are negligible, notwithstanding the very extensive use of such estimates by government agencies, the business community, universities and research institutes and, especially, international organisations.

2.13 Although comprehensive estimates of the cost of the PPP program to statistical offices of Member countries is not available, some indication is afforded by the results of a survey conducted by Eurostat in 1995¹⁰ which suggested that the staffing resources which EU countries devote to a major component of the PPP study - the collection of data relating to consumer prices (other than rent) - was of the order of 1 staff year per annum for each country. For non-EU countries, the average staff input devoted to this component would be significantly smaller.

2.14 In relation to the EU Member States, Eurostat makes a standard financial contribution of 16,500 ecus (\$US18,000 approx) per Member State towards the consumer price survey work. Eurostat also organises contracts with specialist firms in nearly all Member States to conduct price surveys relating to construction and capital equipment. In the case of the non-EU countries, the OECD does not make any financial contribution towards the consumer price survey work of the statistical offices, but does incur some expenditure in relation to data collection for equipment and construction prices in several countries. Relevant information, including the staffing resources devoted to the PPP program at Eurostat and at the OECD, is summarised in Table 2.

Table 2. Cost and Staffing Resources of PPP Program

	Eurostat	OECD	Total
	\$US '000	\$US '000	\$US '000
Consumer price survey: Financial contribution to EU Member States	262	Nil	262
Construction and capital equipment price surveys	<u>360</u>	<u>13</u>	<u>373</u>
Total	622	13	635
Staff resources (staff years)	11.3	2.5	13.8
Number of countries (1993)	15	9	24
% of World output at PPPs (1990)	20	34	54

Sources: Information provided by Eurostat and OECD (original data in ecus and FF).

% of World output at PPPs: IMF, *World Economic Outlook*, October 1993, pp. 122-125. The IMF's category Industrialised Countries consists of the then-Member countries of the OECD, with the exception of Turkey.

2.15 It will be evident that, in relation to a global statistical industry which costs billions of dollars annually, the total resources devoted to the program are minuscule. Addressing the fiftieth session of the International Statistical Institute at Beijing in 1995, Jean-Claude Milleron, Under-Secretary General of the United Nations, expressed the view that, in this area, "We cannot continue to be as weak as we are today." Mr. Milleron nominated the need for improved international comparisons of major macroeconomic aggregates as one of two particularly urgent priorities which called for major investigations, both conceptually and empirically in order to strengthen the global statistical system.¹¹

2.16 The unsatisfactory nature of comparisons of volume based on exchange rates has increasingly been recognised by the key international organisations with global interests and responsibilities. This is seen, for example, in:

- the use by the IMF of PPPs to estimate the weights of major regions in world GDP in *World Economic Outlook* (beginning in 1993)¹²
- the use of PPP-based estimates to offer ... an alternative view of a country's income level relative to others in the World Bank Atlas (introduced in the 1995 edition)¹³
- the extension of the use of PPPs in the 1997 edition of the World Bank's World Development Indicators¹⁴ from comparisons of GNP per capita in PPP terms for over 140 countries, comparisons of PPP price levels with exchange rates for over 120 countries, and comparisons of the structure of consumption in PPP terms for over 60 countries; and
- the use of PPP comparisons by agencies of the United Nations including, especially, the United Nations Development Programme (UNDP) in the widely cited Human Development Index (HDI) computations in its annual Human Development Report.¹⁵

2.17 Some indication of the extent of use of PPP comparisons in the academic literature is afforded by statistics of the number of citations of the benchmark monographs of the ICP and the associated Penn World Tables which have been listed in the Social Science Citation Index produced by the Institute for Scientific Information. By early 1995, the number of such citations had exceeded 1000 and the number of different (first) authors represented in the citations list approached 600.¹⁶

2.18 The reality that there are significant inter-country differences in price levels has always been recognised in the internal arrangements which all international organisations (and all national organisations with international activities) must make in order to manage their transnational operations. It is, for example, quite fundamental to the work of the International Civil Service Commission of the United Nations, whose function includes the making of recommendations to the General Assembly on "... the scales of salaries and post adjustments for staff in the Professional and higher categories"¹⁷ in the world-wide operations of the United Nations and other international organisations which participate in the United Nations common system.

2.19 There is a sobering contrast between the substantial resources which international organisations continue to devote to the collection and compilation of comparative price level and cost-of-living data for purposes related to the remuneration of their own officials, and the meagre resources which their statistical units have been able to direct to similar activities for the benefit of their organisations and of the world at large. As a step towards making more effective use of funds which must ultimately be provided by the taxpayers of member countries, every effort should be made to ensure that price and cost of living data collected by the international organisations for post adjustment purposes is exploited, to the maximum extent possible, for the benefit of the global statistical system.

3. Reporting of PPP Program Results in OECD Publications

3.1 As noted in paragraph 2.1, the OECD recognised many years ago that, without PPP measures, it is not possible to make valid price and volume comparisons between the economies of Member countries. Whilst this view has been maintained in the publications reporting the main results of the PPP benchmark studies - for example, the explanatory notes to the publications entitled *Purchasing Power Parities and Real Expenditures* state that **PPPs, and not exchange rates, are the appropriate currency conversion rates with which to make international comparisons of output and expenditure in volume terms.**¹⁸ (emphasis added) - it has not gained general acceptance, even within the OECD itself. On the contrary, a range of other OECD publications continue to use exchange rate conversions (to an equal or greater extent than PPP conversions) in making comparisons between economic quantities.

3.2 This section reviews the practices followed in reporting PPP program results and alternative data, and the explanations given in these respects, in some key OECD publications, including several in which comparisons based on PPPs appear to take second place to comparisons based on the conversion of values in national currencies by official or market exchange rates. For reasons which have been outlined in the preceding discussion, comparisons of the latter kind have serious limitations for **most** of the purposes for which they are commonly used - the key exception, as Irving Kravis recognised in his 1985 paper, being that "Exchange rate conversions are essential in the analyses of international transactions - involving trade flows, debt ratios and capital flows and for some related purposes".

(a) *National Accounts: Main Aggregates*

3.3 In this annual publication¹⁹, the set of time series tables entitled “Comparative tables based on exchange rates” occupies 24 pages and the set of time series tables entitled “Comparative tables based on PPPs” occupies only 8 pages. The explanation of the contents of these sections reads as follows:

Part six gives a set of comparative tables based on **exchange rates** ... The national accounts data have been converted into US dollars using market or official exchange rates. It must be emphasised that these rates do not **necessarily** reflect the relationships between the internal purchasing power of currencies and **may** consequently distort intercountry comparisons of GDP and its components.

Part seven contains a set of comparative tables based on **purchasing power parities**. These tables enable **direct comparisons** to be made **of the volumes** of final goods and services produced in the Member countries²⁰ (some emphases added)

3.4 Although the explanation of the comparative tables based on exchange rates recognises that intercountry comparisons may be distorted because they do not necessarily reflect purchasing power parities, it may be doubted whether these warnings are sufficient to discourage users from making, or accepting, (distorted) intercountry comparisons based on exchange rates as measures of volume, or economic quantity. And this implication is supported by the method of calculation of tables based on exchange rate conversions in which volume indices (1990 = 100) for zones (i.e., OECD - Total, OECD - Europe and EU 15) are calculated for GDP and its component expenditures - the exchange rate-converted volumes being used to derive weights for each of the composite indices.

3.5 Moreover, Part six of the publication (the exchange rate conversion section) includes tables expressed at the price levels and exchange rates of 1990. This means that it is **these** tables (rather than those in Part seven) which, if read horizontally, enable direct comparisons to be made [over time] of the volumes of final goods and services produced in [each of] the Member countries.

3.6 By way of contrast, all of the Part seven tables are denominated in current prices and current PPPs. It follows that, contrary to the clear implication of the explanation of their purpose, these tables can **not** be used to make comparisons of final volumes of goods and services over time. Because the values are expressed in the prices and PPPs of each year, with the PPPs being backdated to 1970 using each country's inflation relative to the United States, the volume comparisons which can be made from these tables are restricted to **vertical** comparisons: the relative real value of expenditure on goods and services in each OECD country in a particular year. Although the tables are in the form of time series, they do not permit the comparisons of volumes between one year and another - a significant drawback which probably discourages the use of PPPs and leads many analysts to make use of the group of “Comparative tables based on exchange rates” which are expressed at the price levels and exchange rates of 1990.

3.7 It would encourage the greater use of comparisons of volume based on PPPs if the OECD were to publish, in *National Accounts: Main Aggregates*, tables showing each Member country's expenditure on GDP and its major components, expressed at the price levels and PPPs of 1990 (or of the latest PPP benchmark year) - that is, a disaggregation by countries of the relevant section (Main aggregates based on PPPs) of the tables for OECD - Total, OECD - Europe and EU 15 in Part two of the publication.

(b) Main Economic Indicators

3.8 In the concluding section of each issue of the OECD's flagship monthly statistical publication *Main Economic Indicators*²¹, key economic indicators for each Member country are summarised under the heading Basic Structural Statistics. The only indicator of the total scale of each OECD economy in this

tabulation is the latest years figure for GDP using current prices and current **exchange rates** (emphasis added), expressed in billions of United States dollars.

3.9 The Basic Structural Statistics section of *Main Economic Indicators* also shows, for each OECD country, household disposable income per capita expressed in United States dollars. The method of conversion from national currency units into a common currency is not stated, but it is clear that current **exchange rates** have been used in preference to the superior alternatives (PPPs for GDP or PPPs for private final consumption expenditure) which have been produced by the PPP program.

3.10 The use of exchange rates in this section leads to such anomalous results as Japan's household disposable income per capita for 1994 being shown as \$25,306 in the same table as the much larger aggregate of GDP *per capita* for 1995 is given as \$21,795.²²

3.11 Japan's GDP for 1995 was shown in the January 1997 issue of *Main Economic Indicators*²³ as greater than Canada's in the ratio of 9.1 : 1, the comparison being based on an exchange rate conversion. The corresponding ratio revealed by the estimates from the PPP program was 4.4 : 1. The volume comparison based on PPP estimates - that is, from the program which was established for the specific purpose of making volume comparisons - is not shown explicitly in *Main Economic Indicators* and must be deduced by multiplying the per capita PPP estimates by population data.

3.12 The only comparison based on PPPs in Basic Structural Statistics is the **per capita** GDP for each country. Apart from any other aspect, the focus on the per capita measure tends to encourage users to take a league table interpretation of the data, and to concentrate their attention on country rankings. As the per capita GDPs (based on PPPs) of most OECD countries are bunched within a relatively narrow range²⁴, changes in rankings which appear to be significant can occur as a result of quite minor adjustments to PPP estimates or to differences in the way that the results are expressed (e.g., whether the per capita adjustment relates to the **total** population, which is the OECD's practice, or to the **employed** population, which might be regarded as more appropriate in the context of studies of productivity).

(c) *OECD Press Release, 19 January 1995 - Purchasing Power Parities and International Price and Volume Comparisons for the European Community and the OECD*

3.13 This point may be illustrated by an examination of the presentation of the initial results of the 1993 PPP study in an OECD press release of 19 January 1995.²⁵ The commentary in the text of the release focussed on the per capita results, suggesting that OECD Member countries (Turkey excepted) could be classified into four groups according to their **income** levels:

Within the OECD, four groups of countries can be identified on the basis of the per capita **volume** indices: a high income group - Luxembourg (149), the United States (128), and Switzerland (122); a high middle income group - Japan (108), Belgium (102), Denmark (102), Norway (102), Canada (101), Iceland (101), Austria (100), France (98) and Germany (97); a low middle income group - Italy (92), Netherlands (92), Australia (90), the United Kingdom (89), Sweden (88), Finland (82) and New Zealand (81); and a low income group - Ireland (73), Spain (70), Portugal (63) and Greece (57).

3.14 The categorisation of OECD countries would have been very substantially different if the data in the press release had been presented so as to show relative levels of income (rather than product) per head of the employed population (rather than the total population). With these two differences in presentation, Belgium would have ranked above the United States; and Switzerland, which was classified in the high income group in the press release, would have ranked below Belgium, France and Germany in the high

middle income group, Italy from the low middle income group and Ireland and Spain from the low income group.²⁶

(d) OECD in Figures: Statistics on the Member Countries

3.15 An annual lift-out supplement to *The OECD Observer* entitled *OECD in Figures*²⁷ aims to give a picture of the economies of the OECD member countries and the extent of structural adjustment within them. Outputs of the PPP program are published in a number of the tables in this publication:

- The table Money²⁸ shows, for each OECD country for the latest two years, two sets of **price** comparisons from the PPP program (Purchasing Power Parities for GDP and Comparative Price Level for GDP) and one set of **volume** comparisons from the program (Per capita Volume Indices for GDP, which show the size of the GDP per capita of each country relative to that of the United States).
- The table National Product²⁹ shows, for each OECD country for the latest available year, one set of volume comparisons from the PPP program (per capita GDP at current prices using current PPPs).
- The table Health³⁰ (sourced to OECD Health Data 96, OECD, 1996) shows, for each OECD country for the latest available year and 10 years earlier, the per capita expenditure on health in PPP \$.
- The table Research and Development³¹ (sourced to STI database, February 1996) shows, in current PPP \$ for each OECD country, the Gross Domestic Expenditure on R & D (both in total and in per capita terms) and the expenditure on R & D of the business enterprise sector and the higher education sector; and, again as totals in current PPP \$ for each OECD country, the Government Budget Appropriations for R & D.

3.16 Thus, in this publication, the only comparisons of the **total** GDPs of Member countries are based on exchange rate conversions. And the only volume measures for real (i.e., PPP-converted) GDP are shown not in total but in **per capita** terms.

3.17 The Research and Development table shows a series of inter-country comparisons of total R & D expenditures in PPP \$. These numbers represent expenditures on R & D in national currency units, converted into a common currency unit (US dollars) by using the PPPs for total GDP of each country. The estimates of expenditures per capita in PPP \$ in the Health table are derived in the same way: health expenditures per head, measured in national currency units, are converted into US dollars using PPPs for the total GDP of each Member country.

(e) Communications Outlook

3.18 The biennial publication *Communications Outlook*, which is prepared in the context of the OECD's work on the analysis of communication policy in Member countries, and is drafted by the staff working in the OECD's Science Technology and Industry Directorate³² (STI) includes detailed comparisons of the prices (tariffs) relating to selected telecommunication baskets in Member countries, which are expressed in US\$ based on PPP.

3.19 For example, the 1995 edition of the publication includes a table showing, for each Member country, the cost in January 1994 of the OECD basket of residential telephone charges (distinguishing fixed charges and usage charges including a representative basket of calls), denominated in 1993 US \$ based on PPP. The heading to the table, stating that the values express the average annual spending by a

residential user, in 1993 US\$ based on PPP, suggests that the comparisons relate to **expenditure** (in the same way as, for example, expenditure on health per capita in PPP \$ is compared in *OECD Health Data 96*). But in fact these tariff data compare the **prices** in each country, expressed in PPPs, of the specified basket of communication services. The information on tariffs underlying them was furnished by Public Telecommunications Operators to the STI Directorate, and was drawn together using the tariff comparison methodology developed within the OECD for the purpose.

4. Expenditures in PPP Dollars v. Real Expenditures

4.1 Whilst comparisons of expenditure in PPP \$, such as those in the Health table of *OECD in Figures*, are valid and valuable if their meaning is fully understood, it is important to recognise that they are neither pure price comparisons (as are the alternative sets of PPPs applicable to expenditure on telephone services discussed in the preceding paragraph), nor pure volume comparisons (such as the estimates of real value of final expenditure produced by the PPP program). Rather, they are a combination of a volume comparison of the relevant component of expenditure and the **relative** price of that component of expenditure.

4.2 Unfortunately, the explanation in *OECD in Figures* is ambiguous. Few users would realise that the concept **expenditure in PPP \$** is entirely different from the concept **real value of expenditure** (as shown, for example, in publications reporting PPP program results) - and that the pattern of inter-country relativities revealed by the two bases of comparison is also entirely different.

4.3 The relevant footnote to the Money table in *OECD in Figures* defines Purchasing Power Parities as the rate of currency conversion which eliminates the differences in price levels between countries. This means that a given sum of money, when converted into different currencies at these rates, will buy **the same basket of goods and services** in all countries³³ (emphasis added)

4.4 There are cross references to this footnote in the footnotes to the tables headed National Product, Health and Research and Development in the same publication. And another footnote to the Money table describes the comparative price level for GDP tabulation as showing the number of US dollars required in each country to buy **the same representative basket of final goods and services** costing \$100 in the United States.³⁴ (emphasis added)

4.5 These descriptions follow, with minor variations, the definitions and explanations in *Purchasing Power Parities and Real Expenditures*, *National Accounts Main Aggregates* and other publications of the Statistics Directorate. Strictly speaking, they are correct descriptions which are consistent with explanatory sentences included in the OECD news release which announced the results of the 1993 benchmark study.³⁵ But, as expressed, they would convey to many readers the impression that the PPP program seeks to establish the total price of a specific basket of goods and services which has **the same composition** in all countries.

4.6 In fact, of course, PPPs at the level of total GDP or of its major component expenditures are **weighted** averages of price relatives which take into account (subject to the constraints of index number problems) the patterns of expenditure within each of the countries which are the subject of the comparison. The way in which basic parities at the basic heading level are aggregated to higher levels, using as weights the composition of expenditure in the reference country, is carefully explained in the following extract from an article by Katharine Kemp of Statistics Canada:

A purchasing power parity at the most basic level is a ratio of prices for a particular commodity in two countries with the prices expressed in the two national currencies. Such a ratio is calculated by dividing the price of a specific quantity of an item of a specific quality in one country's currency by the price of the same item in the other country, in the currency of the other country. The purchasing power of the different currencies is thus equal (or has parity) in terms of the specific quantity of a particular good or service that can be purchased. The PPP can be described therefore as the rate of currency conversion that equalizes the purchasing power of different currencies. These parities have also been referred to as product-specific cross-currency price indexes. In practice, the ratios are determined for individual items by directly pricing the same good or service in different countries in their own currencies.

Individual item price ratios of this form are averaged to calculate parities for basic headings. These are groups of similar, well-defined commodities constituting the most detailed level of commodity classification in the PPP program. In principle, it would be preferable to weight the price ratios within basic headings ... but the expenditure data available are not sufficiently detailed. PPPs for larger aggregates, such as the Gross Domestic Product ... are obtained by aggregating parities at the basic heading level to higher levels using as weights expenditures on Gross Domestic Product categories **in the appropriate country** depending on the formula used..³⁶.(emphasis added)

4.7 This discussion also brings out the fundamental point that, because PPPs at the most basic level are simply ratios of the price of a defined item (or the total price of some composite combination of items) in different places, there is an infinite number of PPPs even in a two-country world. The PPPs which measure the price relationship of the goods and services composing one country's GDP and its component expenditures, *vis-a-vis* the corresponding aggregates in another country, are but part of the population of PPPs which measure price relationships between policy-relevant composites of commodities (e.g., the composite commodity represented by the objects of final expenditure by households of a particular composition and income level).

4.8 A recent application of PPPs outside the national accounting context was in the inter-country comparisons of real wages in various occupations in the World Bank's *World Development Report 1996*. In this study, the convertors applied to the nominal wage levels were stated to be exchange rates adjusted for purchasing power parity (PPP), which equalize the price of **the same** bundle of goods and services across countries.³⁷

4.9 It would have been preferable, if the information had been available, to measure the real levels of wages in specific occupations in different countries by applying commodity-specific PPPs to typical patterns of expenditure by the wage-earners concerned (see paragraph 7.4 below). It is legitimate to convert nominal wages into real terms by the use of parities derived as the relative price levels of macroeconomic aggregates (i.e., GDP or private final consumption expenditure), but it is not legitimate to present such parities as being derived by adjusting exchange rates. In practice, most of the wages of most employees in most countries are used to purchase goods and services whose prices are expressed in the same currency as the wages themselves.

4.10 The main title of the useful World Bank publication which draws together a comprehensive range of data from successive phases of the ICP - "Purchasing Power of Currencies" - raises a similar difficulty. The PPP studies do not seek to measure the purchasing power of different **currencies** but the purchasing power of money, on average, in different **countries**. This can be demonstrated by a simple example. In any particular place, the Belgian franc has the same value in exchange as the Luxembourg franc; but this common value varies from place to place and, in particular, has a different **average** value in

Luxembourg than it has in Belgium. Indeed, the PPP program results for the two most recent benchmark years have suggested that:

- in 1990, the average internal purchasing power of the Belgian and Luxembourg francs fell short of the corresponding exchange value (i.e., the average purchasing power of their equivalent in other currencies in the OECD as a whole) in both countries in 1990; but
- in 1993, the average purchasing power of the Belgian franc within Belgium exceeded its exchange value, whereas the average purchasing power of the Luxembourg franc within Luxembourg still fell slightly short of its exchange value.

5. PPPs and the National Accounts

5.1 Historically, the use of the concept of purchasing power parity to make price and volume comparisons between countries has been closely linked with the development of national accounting methodology, and the first study comparing real national income for many countries - Colin Clark's *Conditions of Economic Progress*³⁸, published in 1940 - was also the first comprehensive investigation of the relative value of money in different countries.

5.2 Explaining that measuring the real income of ... countries ... amounts to the same thing as the actual equivalent of goods and services produced ... measured at an international price level³⁹ Clark introduced the international unit (IU) of real income, which he defined as the quantity of goods and services exchangeable in the USA for \$1.00 over the average of the decade 1925-1934.

5.3 The next comprehensive international comparisons of real income and product - and the first by an international organisation - was the pioneering study by Milton Gilbert and Irving Kravis which was published by the OEEC (predecessor to the OECD) in 1954.⁴⁰ Again there was a close connection with the national accounts, as the OEEC had requested the submission of national income and product estimates for Member countries compatible with those set forth in a standard system of national accounts in 1953⁴¹ (i.e., in the preceding year).

5.4 It is important to recognise, however, that the **prime** purpose of the Gilbert and Kravis study was the comparison of levels of real product, not of the purchasing power of currencies. As Gilbert said in the first sentence of his Foreword:

This study was undertaken in order to explore the practical possibilities of securing realistic international comparisons of the level of real national product.⁴²

5.5 And it was stated in the introductory chapter:

that the comparisons of the individual product classes have been based **as far as possible on quantity information** and, hence, that the results are to a considerable extent independent of differences in the degree of statistical accuracy of the national product estimates of the various countries in value terms. Furthermore, we have not hesitated to make adjustments in the estimates of the various countries that were required on the grounds of ensuring comparability.⁴³ . (emphasis added)

5.6 In a report to the OECD in 1966, Wilfred Beckerman emphasised:

that the ultimate objective [of the Gilbert and Kravis studies] was to obtain the quantity comparisons - i.e., the relative levels of real national product and its components. Relative prices were only of interest insofar as they had to be used **for some items**, as a means of deriving relative quantities, given the relative values of expenditures on the items concerned. But where possible, direct quantity indicators were obtained, so that for these items the implied relative prices have to be interpreted in a rather special way.⁴⁴ (emphasis added)

5.7 In the subsequent development of the International Comparison Project (ICP) and the re-entry of the OECD into the field of PPP estimates (see paragraph 2.1 above), the emphasis has been reversed. The interest of Gilbert and Kravis in the collection of direct quantity indicators wherever possible has been replaced by a strong emphasis on the need to collect prices data wherever possible, including data for the comparison-resistant expenditures included in GDP. In a detailed exposition of the methodological approach of the ICP, Summers and Heston (1991) stressed that:

Basically, an ICP benchmark study is a **pricing exercise**. Prices of hundreds of identically specified goods and services prevailing in each participating country are collected and processed. The price comparisons that emerge are estimates of price parities for each country's currency at a number of aggregation levels, including an overall purchasing power parity ... The price parities and PPPs are used to convert the countries national currency expenditures to a common currency unit, thus making real quantity comparisons across countries possible.⁴⁵ (emphasis added)

5.8 Because PPP benchmark studies are primarily seen as pricing exercises, the units within national statistical offices which are primarily responsible for the provision of data for PPP estimates are usually those which compile prices statistics rather than the national accounts. In fact, the 1995 Eurostat survey⁴⁶ revealed that, of 19 statistical offices participating in the PPP program which responded to the questionnaire, 13 identified consumer price statistics as the unit primarily responsible for the PPP program and 2 said that the consumer price statistics and national accounts units were both primarily responsible. Of the remaining 4 countries, only 1 identified the national accounts unit as primarily responsible.

5.9 In the case of the United States, the Bureau of Labor Statistics (BLS) provides the prices data and the Bureau of Economic Analysis (BEA) provides information on the estimated value of expenditure within each basic heading. In many areas of expenditure, the degree of detail sought is greater than is used in the United States national accounts, though it is not necessarily greater than that available from other sources. For example, the value of expenditure on men's clothing and on women's clothing in the United States was reported to the OECD as identical in the 1985, 1990 and 1993 benchmark surveys, notwithstanding the fact that consumer expenditure surveys conducted by the BLS regularly showed that, in the United States as in most other countries, expenditure on women's clothing exceeded that on men's clothing by a large margin.

5.10 It is significant that the organisational units primarily responsible for the submission of data for the PPP program were generally concerned with **consumer** price statistics (rather than with statistics relating to the prices of government services and of investment goods) because it is, of course, in the areas of expenditure other than private consumption that PPP estimates face their most formidable conceptual and practical difficulties.

5.11 Critics of Colin Clark's pioneering estimates have noted that he relied on estimates of relative **consumer** prices in order to establish overall purchasing power relationships and real income levels. For example, Gilbert and Kravis claimed that:

While Professor Clark's work represents an enormous statistical *tour de force* and has been extremely useful and stimulating, it has not been fully adequate for the needs of recent years, both because its aim was extensive rather than intensive in the study of comparative income levels and because **purchasing power relationships for consumption only** were used in preparing the estimates.⁴⁷ (emphasis added)

5.12 And, 30 years later, Irving Kravis was to write:

A very different kind of comparison was Colin Clark's tour de force, *Conditions of Economic Progress* (1940). ... The comparisons were based on price materials gathered from an impressive variety of secondary sources. **Clark could not, however, include prices for capital goods and government product ...**⁴⁸ (emphasis added)

5.13 The argument in the succeeding sections will support the view that Clark's concentration on the prices of consumer goods and services may have been sound, and that his practice of deflating the values of other components of expenditure by the purchasing power relationships established for private final consumption expenditure may be preferable to the course which has in fact been followed in subsequent studies of real expenditures, i.e., the deflation of government final consumption expenditure and fixed capital formation by prices relating directly to those components of expenditure, rather than by the prices of consumer goods and services.

5.14 The reasons for this view differ as between the two main components of expenditure other than private final consumption expenditure. In the case of government final consumption expenditure, the deflation of expenditures by the prices of selected inputs used to produce government services in different countries raises difficulties similar to those faced by national accountants in measuring the real value of these expenditures over time (see paragraphs 7.37 - 7.38 below). In relation to fixed capital formation, the issue turns on whether the purpose of PPP estimates is to measure relative levels of real **output** - in which case the output of investment goods and consumer goods industries are equally relevant aspects of overall performance; or of real **income** - in which case the proportion of income which is not expended for current purposes (i.e., which is saved) may properly be conceived of, and measured, as consumption foregone (i.e., deflated by the price relatives applicable to consumer goods and services).

5.15 Because the OECD-Eurostat PPP program relies on the deflation of the value of final **expenditures** rather than of the value of **production**, the results are of limited value for analysts concerned with the measurement of the output or productivity of particular industries but are of much greater usefulness for those concerned with the measurement of real incomes and the command over goods and services enjoyed by the recipients of income in their capacity as consumers.⁴⁹

5.16 This was certainly Colin Clark's perspective. In the preface to the first edition of *Conditions of Economic Progress*, he wrote that:

Purposive scientific generalisation differs from the meaningless accumulation of facts only in that the former uses the method of **comparison**. Comparisons of economic welfare between one community and another, one economic group and another, and between one time and another, are the very framework of economic science. Anything which can be done to promote the scope and improve the technique of such comparisons is of fundamental importance ... Deprive economics of the concept of welfare and what have you left? Nothing ...⁵⁰ (emphasis in original)

5.17 It was also the perspective of J R Hicks, who concluded in his influential paper *The Valuation of the Social Income*⁵¹, which was published in the same year as *Conditions of Economic Progress*, that:

The measurement of economic welfare and the measurement of productivity are in fact **quite different things**. ... In practice, nearly every doubtful point about the Social Income is clarified by separating out these two distinct aspects. ... It is only consumption which contributes directly to current welfare. ... (If we do decide to include saving in our Welfare index, the appropriate concept of individual income can be nothing else but what the individual *thinks* he can consume without making himself worse off. ... When it comes to the measurement of productivity ... , consumption and investment goods are all on a par; there is no significant difference between them from this point of view.⁵² (emphasis added)

5.18 In their 1954 study for the OEEC, Gilbert and Kravis referred to this paper and appear to have accepted some of its implications: but their own study of national products and the purchasing power of currencies, and all of the subsequent PPP studies within the framework of the ICP and by OECD-Eurostat, have effectively assumed that the measurement of economic welfare and the measurement of productivity are in fact **the same thing**. In rejecting Hicks doubts, Gilbert and Kravis argued as follows:

It is essential to recognise that whether the quantitative comparison be focused on productivity or on economic welfare, one is dealing with the same complex of goods and services coming out of the productive process in the two countries. ... (T)he obvious fact that the purpose of economic activity is to satisfy the present and future wants of the population does not dictate that the welfare approach must be used or that it is somehow more fundamental than the productivity approach. The difference between the two approaches is only between concern with the relative cost or the relative utility aspects of output For this study the production approach is used as being more in keeping with its purpose of comparing the **relative economic strength** of the countries.⁵³ (emphasis added)

5.19 If the purpose of the present OECD-Eurostat PPP program was to measure the relative economic strength of the countries, one would expect the emphasis in the presentation of the results to be on the relative **total** GDPs of Member countries. In fact, as noted in paragraph 3.12 above, the focus of attention tends to be on per capita comparisons - and users are encouraged to treat the results as indicators of real income per capita.

5.20 In the decades since the publication of the pioneering Gilbert and Kravis study, the quality of the national accounts in most OECD countries has been greatly improved, as have the international standards respecting statistical methodology and comparability and their implementation by national statistical offices and international bodies. In many countries, the relationships between statistics of expenditure, production and income have been strengthened and the role of the national accounts in integrating many of the key elements in national statistical systems has increasingly been recognised. Accordingly, there is now an enhanced opportunity for the OECD-Eurostat PPP program to be adapted and extended as part of an integrated system to support inter-country comparisons of industrial structure, productivity, patterns of factor incomes and of the distribution of real incomes and expenditures of households.

6. Reliability of the PPP Estimates

6.1 In the Notes on Tables introducing each edition of *Purchasing Power Parities and Real Expenditures*, a general statement on the quality of the PPP benchmark results is made in the following terms:

The quality of the results published in the tables is dependent on the product specifications, the expenditure classification and the data collection and pricing methods agreed on by the

participating countries, Eurostat and the OECD. It is also dependent on the extent to which uniformity of procedures can be maintained across countries. While the overall reliability of the data is believed to be high, the reliability of individual expenditure categories can vary.⁵⁴

6.2 Whilst the observations in the first two sentences of this extract are factually correct, they reveal a situation in which there is considerable ambiguity about the locus of responsibility for the PPP estimates. There are substantial differences between the participating countries in the extent to which they can satisfy the requirements of the methodological desiderata upon which they have agreed; and, in any case, their agreement means little more than an acceptance that nothing better can be done within the framework of the program as it has developed, and within the constraints of the extremely limited resources available for its implementation (see paragraphs 2.12-15 above).

6.3 The statement in the concluding sentence about the reliability of the estimates raises a more fundamental issue. Whilst experts in national statistical offices believe that the central co-ordination of the PPP program results in Paris and in Luxembourg has been carried out with professionalism and competence, many of them are equally emphatic in dissenting from the view that the overall reliability of the data is ... high. Although it is accepted that the results at the aggregate (GDP) level appear reasonable, many national experts attribute this outcome to the effects of compensating errors. They are concerned about the apparent unreliability of the estimates in individual expenditure categories - not only because of doubts about whether the law of large numbers can be relied upon to produce sounder estimates at higher levels of aggregation, but also because they believe that much of the potential value of PPP results (e.g., to support the analysis of price structures and demand patterns) will not be realised unless the quality of the component estimates can be improved.

6.4 Whilst a comprehensive audit of the PPP program is beyond the scope of the present study, an examination of recent results for three selected basic headings within private final consumption expenditure - Telephone, telegraph, telex services, Men's footwear and Furniture and fixtures - has been undertaken in order to assess the plausibility of those results and to test whether concerns about the quality of the estimates have substance. The reliability of the results in the machinery and equipment expenditure category has also been tested by comparing, for each OECD country, the relative prices reported for two major components - non-electrical equipment and electrical equipment - from the two most recent benchmark surveys.

(a) Telephone services

6.5 As noted above (paragraphs 3.18-19), comparisons of the prices (tariffs) of selected telecommunications baskets in OECD Member countries have for some years been provided to the OECD to support the Organisation's work on the analysis of communications policy in Member countries. Relevant data relating to residential telephone charges for January 1994, denominated in 1993 \$US based on PPP (i.e., using the **global** PPPs produced by the OECD-Eurostat PPP program to express the tariff comparisons in a common currency), were included in a report presented to the Working Party on Telecommunications and Information Services Policy at its meeting on 13-14 June 1994, which was subsequently published as *Communications Outlook 1995*.

6.6 By converting the US \$ based on PPP prices of the OECD residential telephone basket in each country, as published in this report, back into national currency units, it is possible to derive commodity-specific PPPs for the residential telephone tariff package which can be compared with the PPPs produced from the 1993 round of the OECD-Eurostat PPP program for the basic heading Telephone, telegraph, telex services. As telegraph and telex services represent a very small proportion of total expenditure within this basic heading⁵⁵, the set of price relativities calculated from the data furnished by

Public Telecommunications Operators to the Science, Technology and Industry Directorate should, in principle, be similar to those calculated from the data on telephone charges provided to the Statistics Directorate by national statistical agencies in response to the prices survey conducted as part of the 1993 PPP benchmark study.

6.7 It might be supposed that the measurement of relative prices and real expenditures on telephone services would be simpler than for most components of expenditure. In fact, the difficulties of comparison in relation to this component of expenditure were recognised by Gilbert and Kravis in their pioneering study in 1954:

Another type of difficulty arises with services sold on the basis of rather diverse rate structures, such as telephone facilities. In measuring the quantity of services in one country, the problem might be solved by taking each type of service offered as a separate product - unlimited service, limited service types, one-party lines, multiple-party lines, phones with one extension, long-distance service, etc., though it is generally impracticable to work the measures out in this sort of detail. For international comparisons, this solution is not available, since the types of service offered and the basis of assessing charges are widely different. Hence the unit of product was taken to be a monthly service consisting of 50 local calls and 4 toll calls of a specified distance.⁵⁶

6.8 During the succeeding four decades the advance of communications technology, and the effects of increasing competition on the options for service available to customers and the associated tariffs, have added to the difficulties of making price and volume comparisons in this area. Against this background, it is perhaps not surprising that the 1993 price relativities for this component of expenditure which were produced from the PPP benchmark study differ substantially from the January 1994 price relativities implied in the report by the Science, Technology and Industry Directorate. The scale of these differences is illustrated in Table 3.

6.9 The table shows alternative estimates of PPPs and real final expenditure per head on telephone services for the non-European Member countries of the OECD which participated in the 1993 benchmark study. The reference country for all of the price and volume comparisons is the United States, and the results of the two compilations for that country are **assumed** to be identical. The table also shows, for each of the countries, the number of residential mainlines per 100 households: a volume indicator relating to final expenditure on telephone services which is independent of data on prices or values.

6.10 The figures in bold type highlight the most extreme difference between the two sets of comparisons: that between New Zealand and Japan. Whereas the PPP benchmark study implies that the real value of final expenditure per head on telephone services in New Zealand is **less than one-fifth** of that

Table 3. PPPs and Real Expenditure per head on Telephone Services 1993

		Australia	NZ	Japan	Canada	US
1	Expenditure per head (units of national currency)	197.66	319.65	24.296	224.15	264.37
	Units of national currency /\$US					

2	Exchange rate	1.471	1.851	111.19	1.290	1.000
3	PPP: Telephone: Stat (a)	0.892	3.744	55.44	1.458	1.000
4	PPP: Telephone: STI (b)	1.403	1.446	151.74	0.862	1.000
	Price level (US = 100.0)					
5	PPP: Telephone: Stat (a)	60.6	202.3	49.9	113.0	100.0
6	PPP: Telephone: STI (b)	95.4	78.1	136.5	66.8	100.0
	Real expenditure per head (\$US) compared using:					
7	PPP: Telephone: Stat (a)	221.59	85.38	438.24	153.74	264.37
8	PPP: Telephone: STI (b)	140.88	221.08	160.12	259.97	264.37
	Real exp. per head (US = 100.0)					
9	PPP: Telephone: Stat (a)	83.8	32.3	165.8	58.2	100.0
10	PPP: Telephone: STI (b)	53.3	83.6	60.6	98.3	100.0
11	Memo.: Residential mainlines per 100 households, 1992 (c)	98.9	96.9	88.0	112.4	103.9

(a) PPPs for Telephone, telegraph, telex services from 1993 PPP benchmark study.

(b) Implied PPPs for the OECD basket of residential telephone charges, January 1994, converted from 1993 US\$ based on PPP prices in OECD, *Communications Outlook 1995*, Table 5.2, p. 57, using EKS PPPs. The estimates of real expenditure per head were derived by deflating nominal values from the PPP benchmark survey by the implied PPPs for the OECD basket of residential telephone charges.

(c) Source: OECD, *Communications Outlook 1995*, Table 4.2, p. 40.

in Japan, the alternative estimate shows real expenditure per head in New Zealand as **almost 40% higher** than in Japan. The direct quantity measure (Line 11) suggests that the PPP study results are highly implausible. In Table 4, the alternative estimates of real expenditure per head on telephone services (as in lines 7-8, Table 3) are presented for 23 Member countries.⁵⁷

6.11 The countries are ranked according to the index in the final column, which relates the real value of expenditure per head on telephone services implied in the *Communications Outlook 1995* table to that estimated for the basic heading telephone, telegraph, telex services in the PPP study.

**Table 4. Real Final Expenditure per head on Telephone Services 1993:
PPP Benchmark Study and STI Report**

	(1) PPP Study \$US	2) STI Report \$US	(2) as % of (1)

New Zealand	85.38	221.08	259.0
Canada	153.74	259.97	169.1
Norway	150.58	220.20	146.2
Belgium	69.31	100.83	145.5
Germany	156.86	213.39	136.0
Ireland	84.64	100.74	119.0
Austria	128.20	146.58	114.3
Finland	150.33	164.85	109.7
United Kingdom	177.52	190.78	107.5
Denmark	293.33	312.79	106.6
Netherlands	175.09	179.99	102.8
Switzerland	220.88	221.29	100.2
United States (a)	264.37	264.37	100.0
Iceland	162.99	162.57	99.7
Sweden	299.27	290.56	97.1
Spain	71.11	67.59	95.1
Italy	121.75	108.79	89.4
Portugal	78.36	68.97	88.0
France	208.25	170.58	81.9
Turkey	29.23	20.84	71.3
Greece	196.15	125.87	64.2
Australia	221.59	140.88	63.6
Japan	438.27	160.12	36.5

(a) The alternative estimates for the U.S. are equated **by assumption**. No inference should be drawn that the results of the two surveys are more consistent for the U.S. than for other countries.

6.12 An alternative way of testing the PPP results for telephone services is to compare the relative real values of expenditure revealed by the 1990 and 1993 benchmark studies. It is recognised that each PPP benchmark study is a discrete exercise, the purpose of which is to provide spatial rather than temporal comparisons. There are conceptual as well as practical reasons why the relative real values disclosed by successive benchmark exercises are not strictly comparable, even if the underlying data are accurate and comprehensive.

6.13 Nevertheless, if successive benchmark studies at intervals as short as three years show dramatically different results for particular components of expenditure, it is impossible to avoid the conclusion that at least one of those sets of results must have been highly inaccurate. Such a conclusion emerges from Table 5:

Table 5. Real Expenditure per head on Telephone Services 1990 and 1993

	No. of prices	Mainlines per 100 (a)	Indices of Real Value per head (US=100)		Rank	
	1993	1992	1990	1993	1990	1993

Japan	3	88.0	67.8	165.8	15	1
Luxembourg	8	103.1	162.0	149.1	2	2
Sweden	8	120.2	102.2	113.2	6	3
Denmark	8	103.3	140.4	111.0	3	4
United States	5	103.9	100.0	100.0	7	5
Australia	11	98.9	72.8	83.8	14	6
Switzerland	8	91.1	79.9	83.6	13	7
France	8	119.8	93.1	78.8	9	8
Greece	8	87.6	99.1	74.2	8	9
United Kingdom	5	86.9	62.1	67.2	17	10
Netherlands	8	93.5	87.6	66.2	10	11
Netherlands	8	132.0	105.4	61.7	5	12
Iceland	8	87.3	80.1	59.3	12	13
Germany	9	112.4	81.3	58.2	11	14
Canada	11	91.7	62.1	57.0	16	15
Norway	8	101.5	115.5	56.9	4	16
Finland	8	n.a	58.5	48.9	18	17
Austria	8	88.0	53.2	46.1	19	18
Italy	3	96.9	246.6	32.3	1	19
New Zealand	8	77.2	32.3	32.1	21	20
Ireland	8	59.2	28.6	29.6	23	21
Portugal	8	89.5	51.5	26.9	20	22
Spain	8	89.1	28.7	26.2	22	23
Belgium	11	58.7	23.2	11.1	24	24
Turkey						

(a) Residential mainlines per 100 households (Table 4.2, *Communications Outlook 1995*).

6.14 In this table, OECD countries are ranked in order of the real value of their final expenditure per head on telephone, telegraph, telex services as estimated from the 1993 PPP benchmark study. In addition, details are given of the number of prices provided under this basic heading by each country in 1993 and - as an indicator of volume which is independent of information on prices and values - the number of residential mainlines per 100 households in 1992.

6.15 Again, many of the results are implausible. That New Zealand's real per capita expenditure on telephone services could have approached four times the corresponding total for Japan in 1990 seems just as improbable as the 1993 relationship in the reverse direction which has already been noted (paragraph 6.10). It is not credible that Finland's per capita expenditure decreased from 15% above that of the United States in 1990 to over 40% below that of the United States in 1993 - especially given the fact that Finland remained among the minority of OECD countries in which the number of residential mainlines exceeded the number of households. And it seems unlikely that Belgium's real per capita expenditure on telephone services was lower than the corresponding average for Portugal - given that real values implied in the tariff data for the cost of the OECD residential basket (see Table 4) and the numbers of residential mainlines per 100 households (see Table 5) both showed Belgium ahead of Portugal by a margin of more than 50%.

6.16 As indicated in Table 5, the maximum number of prices provided by each country for this basic heading of expenditure in the 1993 PPP benchmark study was 11: the monthly rental of a private

telephone, the cost of local calls of 3 minutes and 10 minutes from a private line and a public box, the cost of day and night calls over distances of 75 kilometres and 750 kilometres from a private line, and the cost of night calls over the same distances from a public box. Whilst these product specifications and the pricing methods would have been agreed upon by the participating countries, Eurostat and the OECD, a comparison of the results with those published in *Communication Outlook 1995* suggests that estimates prepared from data collected from standardised questionnaires will be far less reliable than those produced by specialists within the framework of a carefully developed methodology.⁵⁸

(b) Men's footwear

6.17 The next table compares the indices of real value of expenditure per head on Men's footwear in 1990 and 1993, with countries being ranked according to the relevant estimates from the 1993 PPP benchmark study.

**Table 6. Real Final Expenditure per head on Men's Footwear:
PPP Benchmark Studies 1990 and 1993**

	No. of prices	Indices of Real Value per head (US=100)		Rank	
	1993	1990	1993	1990	1993
Spain	13	173.5	137.8	1	1
Italy	19	148.7	123.2	2	2
Portugal	13	81.7	117.5	9	3
United States	5	100.0	100.0	3	4
Ireland	10	82.0	98.2	8	5
Switzerland	20	89.4	87.3	6	6
Austria	21	97.0	72.4	4	7
Luxembourg	17	70.7	71.5	12	8
Belgium	18	68.1	65.3	16	9
United Kingdom	16	88.4	65.1	7	10
Norway	16	69.5	64.2	14	11
Germany	20	74.0	58.7	11	12
Denmark	15	56.1	57.2	18	13
Sweden	14	95.2	56.1	5	14
Canada	4	68.8	54.9	15	15
Iceland	14	75.9	51.7	10	16
France	18	47.1	47.0	21	17
Turkey	20	47.3	46.3	20	18
Netherlands	15	57.3	46.1	17	19
Japan	6	43.2	44.1	22	20
Finland	10	55.3	38.8	19	21
Australia	6	70.0	38.8	13	22
Greece	14	30.3	30.1	24	23
New Zealand	9	37.4	27.1	23	24

6.18 It is true that movements in the indices of real values between the 1990 and 1993 benchmark studies may reflect a variety of factors, including the cumulative effect of errors of measurement in price levels either in the United States or the comparator country, and in either or both of the surveys. Making full allowance for these factors, however, some of the movements appear to be exceptionally large. In no

less than 11 countries the decreases in real value per head, relative to the United States, exceeded 20% - and in the cases of Sweden and Australia these reductions exceeded 40%.

6.19 The range of difference in the levels of real per capita expenditure in 1993 also raises questions. Accepting the possible effects of inter-country differences in consumer tastes and preferences, it is not easy to credit that real per capita expenditure on men's footwear in Spain could have been more than five times that in New Zealand in 1993 - a margin of difference which would imply that the volume of purchases of New Zealanders with high incomes fell short of that of Spaniards with low incomes. Statistics on the value and volume of production and trade might be used to provide an independent check on the accuracy of some of these results of PPP benchmark studies.

6.20 Errors in PPP results at the basic heading level may reflect deficiencies in the data on nominal values of expenditure (for example, differences in the national classifications of expenditure used in the national accounts of individual countries) or in the representativeness and/or accuracy of data on prices. As national statistical agencies devote substantial resources to measuring **changes** in prices as accurately as possible, it is reasonable to assume that changes in the true PPPs at the basic heading level should be consistent with the relative movements in relevant component indices of national price indices (especially of indices of consumer prices). If changes in measured PPPs differ from the movement which would be expected on the basis of the national data, it must be presumed that it is the PPPs rather than the national data which are in error.

6.21 Consider, for example, the estimates of the real value per head of expenditure on men's footwear in Australia, which is shown in Table 6 as declining from 70% of the United States level in 1990 to 39% in 1993. The main factor contributing to this outcome was that, according to the results of the successive PPP benchmark studies, the number of Australian dollars required to buy the volume of men's footwear which 1 US dollar would buy in the United States in 1990 was 1.36, whereas the number required in 1993 had risen to 2.11: an increase of 55%. None of this massive change can be attributed to differential movements in the price of men's footwear: in fact, the relevant component of Australia's consumer price index increased by only 2.1% during the three-year period, which was significantly **less** than the increase in the corresponding component of the United States index (6.6%).

6.22 Published results of the PPP program at the basic heading level (e.g., men's footwear) distinguish the expenditure category footwear including repairs. For this category, the apparent real value of expenditure per head for Australia according to the PPP benchmark studies was, at less than one-half of the United States level in 1990, already implausibly low; but by 1993 this ratio had fallen to less than one-third (EKS results).

6.23 The main factor contributing to the reduction was that the successive PPP studies implied that the number of Australian dollars required to purchase in Australia the volume of footwear which 1 US dollar could buy in the United States had increased by 55% (men's), 15% (women's) and 36% (children's) over the three-year period. If allowance is made for the relative movements in the national CPIs, the excess increase in Australian footwear prices vis-a-vis those in the United States which was implied in the PPP results was 61% (men's), 24% (women's) and 33% (children's).

(c) **Furniture and fixtures**

6.24 The third basic heading selected for examination was Furniture and fixtures. Table 7 shows, for this component of expenditure, similar details to those shown in Table 6 for men's footwear:

Table 7. Real Final Expenditure per head on Furniture and Fixtures:

PPP Benchmark Studies 1990 and 1993

	No. of prices		Indices of Real Value per head (US=100)		Rank	
	1993	1990	1993	1990	1993	1993
Luxembourg	115	204.6	180.1	1	1	
Austria	86	165.0	109.4	3	2	
Switzerland	103	82.6	101.8	13	3	
United States	21	100.0	100.0	10	4	
Belgium	85	132.5	99.1	6	5	
Germany	85	172.2	98.8	2	6	
Norway	40	139.0	84.8	4	7	
Italy	117	132.1	84.1	7	8	
Iceland	27	96.0	73.6	11	9	
Netherlands	110	109.7	68.7	9	10	
France	124	111.3	67.2	8	11	
Sweden	86	135.5	57.4	5	12	
Denmark	25	81.4	55.7	14	13	
Spain	65	68.5	46.6	16	14	
Canada	10	77.9	39.7	15	15	
United Kingdom	60	65.1	34.4	17	16	
New Zealand	56	54.2	30.8	18	17	
Australia	81	52.2	30.4	19	18	
Finland	40	90.0	27.7	12	19	
Turkey	71	40.1	24.2	21	20	
Ireland	33	28.0	23.2	23	21	
Portugal	65	47.3	17.6	20	22	
Japan	17	31.7	14.0	22	23	
Greece	43	14.6	11.9	24	24	

6.25 To an even greater extent than in the case of men's footwear, real expenditure per head on furniture declined in most countries relative to the United States. In only one of the 23 other countries (Switzerland) was there an increase relative to the United States, and in 15 countries the relative decrease was more than one-third. Errors or biases in either benchmark study, and in either the United States or the comparator country, can contribute to these movements. The most likely explanation for the preponderance of large relative decreases in real values was, therefore, that relative prices of furniture in the United States were lower than those reported for the PPP study in 1990, or higher than those reported in 1993, or both. It is relevant to note in this connection that the number of furniture prices reported for the United States was only 21, whereas most countries reported more than 60 prices and five countries reported more than 100 prices within the basic heading furniture and fittings.

6.26 As with men's footwear, almost the whole of the apparent decrease in relative real expenditure in Australia can be attributed to a reported change in the PPPs for furniture which is not reflected in the relevant component of the national CPIs. Whilst the increase in the furniture component of both CPIs between 1990 and 1993 was 6.7%, the number of Australian dollars required to buy the same volume of

furniture in Australian as 1 US dollar in the United States, as estimated in the successive PPP studies, was 1.55 in 1990 and 2.50 in 1993: an increase of 61%.

6.27 As the basic heading Furniture and fittings accounts for much the greater part of the Furniture, floor coverings and repairs component of expenditure in all countries, the apparent errors or biases in the PPPs for furniture have a major influence on the published data.

(d) Machinery and equipment

6.28 The published results of the PPP benchmark studies distinguish three components of final expenditure on machinery and equipment: transport equipment, non-electrical equipment and electrical equipment. In this section, the reliability of the PPP results is tested by comparing, for each OECD country, the ratio of the final prices of electrical equipment to non-electrical equipment reported for the 1990 and 1993 benchmark studies. The results, using the EKS aggregation method, are shown in Table 8.

**Table 8. Ratio of Electrical to Non-electrical Equipment PPPs:
PPP Benchmark Studies 1990 and 1993**

	Ratio: Elec./Non-elec. PPPs		Rank	
	1990	1993	1990	1993
Norway	81.3	129.9	20	1
Japan	68.8	113.5	24	2
Greece	122.8	108.0	3	3
Germany	98.1	107.1	11	4
Sweden	88.8	105.9	16	5
Switzerland	72.5	104.9	23	6
Belgium	99.7	102.3	9	7
Turkey	153.9	101.0	1	8
Italy	97.2	98.7	12	9
Australia	82.0	98.5	19	10
Denmark	88.3	95.3	17	11
United Kingdom	84.3	94.4	18	12
Canada	109.7	93.3	5	13
France	105.4	93.0	7	14
Netherlands	100.4	91.9	8	15
Portugal	98.9	90.7	10	16
Austria	107.9	90.3	6	17
Luxembourg	89.4	89.7	15	18
Iceland	96.6	88.0	13	19
Ireland	76.7	84.6	21	20
United States	126.0	83.8	2	21
New Zealand	95.4	80.9	14	22
Finland	72.6	74.9	22	23
Spain	121.9	74.4	4	24
Total OECD	100.0	100.0		

6.29 In this table, the average relationship between final prices in the two categories of expenditure for the OECD as a whole is taken as the base (Total OECD = 100). Values of more than 100 mean that, for the country and year concerned, final prices of electrical equipment were estimated to be higher, relative to the final prices of non-electrical equipment, than in the OECD as a whole - and *vice versa*. Countries are ranked according to the price levels of electrical equipment (compared with non-electrical equipment) in 1993.

6.30 In theory, substantial changes in the ratios of electrical to non-electrical PPPs in any country could result from large differences in price relativities within and between the basic headings included in each of these categories, combined with large compositional changes in expenditure. Whilst this conjunction must be recognised as a possible explanation for some of the sharp movements in PPP relativities shown in the table, the overall extent of these movements in as short a period as three years must raise serious doubts about the quality of the PPP estimates for machinery and equipment.

6.31 For example, the only country included in the top 7 (i.e., highest relative prices for electrical equipment vis-a-vis non-electrical equipment) in both years was Greece. The only countries in the bottom 7 in both years were Ireland and Finland. The United States and Spain were in the top 4 in 1990 and the bottom 4 in 1993, whereas Japan, Switzerland and Norway were in the bottom 6 in 1990 and the top 6 in 1993. Other countries whose ranking changed by 8 places or more between 1990 and 1993 included Austria (11), Sweden (11), Australia (9), Canada (8) and New Zealand (8).

6.32 The most significant change, in terms of its implication for the overall credibility of the estimates in this area, was the reversal of the relative positions of the United States and Japan, which together account for the bulk of expenditure for the OECD as a whole. In 1990 the relative price of electrical equipment to non-electrical equipment in the United States was 83% **higher** than in Japan, whereas in 1993 the corresponding relative price was 27% **lower** in the United States than in Japan. Apparent anomalies of this magnitude must raise serious questions about the value of the PPP estimates in the capital goods components of expenditure.

(e) **Conclusion**

6.33 The results of the quality checks reported in this section raise serious questions about the reliability of the estimates produced by the OECD-Eurostat PPP program, at least at the sub-aggregate level. There is, however, little doubt that reasonably reliable comparisons of the relative prices and volumes of these components of expenditure could be made if the resources and expertise were available for a centrally-directed program, utilising the full-time services of an expert co-ordinator, which could make effective use of the mass of relevant information now available in the databases of national statistical agencies and of international institutions.

6.34 As it is unlikely that the additional resources required to implement a reorganised program could be provided by individual Member countries (many of whom do not see the PPP estimates as having a high priority), funding assistance might be sought from the group of international organisations which are the principal users of PPPs. Several of these **do** attach a high priority to the program, and place increasing reliance on its output in their work (see paragraph 2.16 above).

7. Treatment of Comparison-resistant Goods and Services

7.1 This section discusses the treatment of what have come to be called comparison-resistant goods and services. For these components of expenditure, the problems which inhibit reliable comparisons are

conceptual rather than practical. As is pointed out in the Notes on tables introducing each issue of the OECD's *Purchasing Power Parities and Real Expenditures*:

... certain expenditure categories are highly resistant to comparison because they cover products or services which are difficult to specify for pricing across countries, or because they cover consumption for which no market prices exist.⁵⁹

7.2 For this reason it may be necessary to accept that, for important and growing components of expenditure, it is no longer possible for statisticians to capture relative quantities or real values. The implications for inter-country and other inter-spatial comparisons such as the PPP program are obvious, though the problem is more commonly brought to notice in the form of increasing doubts about the viability of conventional inter-temporal comparisons (e.g., movements in real GDP). In a recent leading article in *The Economist* it was argued that:

The fact is that economies are becoming increasingly unmeasurable, at least in precise ways. The world must learn to live with it.⁶⁰

7.3 A supporting article in the same issue of *The Economist* developed the argument in some detail:

New goods, shorter product cycles and rapid quality improvements make it harder to measure changes in output and prices over time. Isn't it great that faster recovery times from operations mean patients spend less time in hospital? Not from a statisticians point of view: If measured by occupancy of hospital beds, output would show a decline. ... The problem here is insoluble. To measure the increase in real output over time it is necessary to define a unit of production. This is easy for basic goods, such as tonnes of steel, but for a growing slice of the economy the concept of a unit of output is becoming increasingly fuzzy. [I]t is probably an unavoidable, if ironic, fact that in the so-called information age, when super-computers crunch mountains of data and satellites can track the precise movements of every man or machine, peoples knowledge about the economy may be less exact than it was back when adding machines ruled the earth.⁶¹

7.4 If it proves impossible to establish acceptable indicators of volume for particular categories of comparison-resistant goods and services, the least worst alternative procedure may be to deflate nominal expenditures in these categories by the PPP relatives applicable to the widest possible composite of goods and services which are not comparison-resistant. The resulting estimates would not be meaningful measures of volume of the relevant component expenditures themselves, but rather as measures of the real value of expenditure on other goods and services which had been foregone in order to support expenditure in the relevant comparison-resistant categories.

(a) Housing

7.5 The housing services component of expenditure on GDP is identified in the PPP studies as Gross rent and water charges. Rents are not included in the main price collections for the PPP program, but are the subject of special inquiries undertaken once every three years. Statistical agencies in participating countries report national average rents obtained from rent surveys or censuses of housing, which are adjusted by Eurostat or the OECD to annual average rents for the benchmark year using temporal indices for rent provided by the countries.

7.6 Non-European countries have difficulties matching the common rent specifications priced by European countries, and report rents for their national specifications instead. However, by using regression methods and rent data collected for its consumer price index, the United States is able to

estimate prices for the rent specifications priced by the other non-European countries and for the rent specifications priced by European countries. Thus, for the comparison of rents, the United States is the link both between the European and non-European countries and among the non-European countries themselves.

7.7 The main source of difficulty in comparing the real value of expenditure on gross rents is the fact that, in most OECD countries, the prevalent form of housing tenure is owner occupancy. In 1993, the value of actual rents exceeded that of imputed rents in only two OECD countries (Norway and Switzerland), and in 16 of the 24 countries the value of actual rents was less than one-half of imputed rents. In most countries, therefore, national accountants have necessarily been obliged to rely to a large extent on data relating to the **volume** of the stock of housing (i.e., data concerning its quantity and quality, usually derived from censuses and housing surveys) in order to impute, on the basis of the value of rents actually paid for dwellings which are otherwise similar, the rental value of a (much larger) stock of dwellings which are owned by their occupiers. Gross rent and water charges in the national accounts represents the total of actual rents paid and the rental value of houses occupied by their owners.

7.8 A further difficulty arises because the rental values which are generalised from actual rents paid are determined on the basis of a range of physical characteristics and can take no account of location. The reason for this approach was explained in the following terms by Kravis, Heston and Summers, in the context of the release of the results of Phase III of the International Comparison Project (ICP):

An important rent-determining factor that is not taken into account in these [physical] specifications is location. Obviously, a dwelling with a given set of physical characteristics in central Paris or Warsaw is more highly valued by consumers than one in a rural area in the same country.

The ICP, however, has deliberately treated location as a price-increasing factor rather than as a quality variable adding to or subtracting from quantity. Although urban rents are universally higher than rural rents, the view adopted here ... is that the streams of housing services flowing from two identical dwelling units, one in the country and the other in the city, should be valued the same. Therefore, every housing specification is priced at the national average rental for the specification. This has the advantage of simplicity; it avoids the need to match places in different countries having equivalent scarcity values. ... Taking account of the scarcity value of land might lead to the conclusion that, given two countries with identical housing stocks, the country with the more concentrated population has a larger real quantity of housing. Clearly, this is not in the spirit of the ICP.⁶²

7.9 If this argument is accepted, it should be possible to derive relative real expenditures on gross rents from the wealth of quantitative information available from censuses and housing surveys which is used to compile the expenditure component Gross rents in each country's national accounts. For PPP purposes, the only use made of value data on gross rents would be to determine the weight of this item in total expenditure.

7.10 In fact, the PPP program has followed the alternative course of deflating the values of gross rents from the national accounts by price relatives derived from the reported rental values of representative dwellings. Some of the results emerging from this procedure appear to be implausible.

7.11 For example, the 1990 PPP benchmark study showed Japan's real expenditure per head on gross rents to have exceeded Norway's by 55% (EKS results) or 69% (GK results). And in the 1993 benchmark

study, Japan's real expenditure per head on this item exceeded that of Norway (where most dwellings are tenanted - see paragraph 7.7 above) by 57% according to both the GK and the EKS results.⁶³

7.12 Census and housing survey results indicate that the average household size in Japan is approximately 3.0 persons⁶⁴, or about 25% greater than the average household size in Norway (2.4 persons). The PPP results therefore imply that the rental value of the average occupied dwelling is approximately **twice as great** in Japan as in Norway, notwithstanding the fact that the latter country's *Population and Housing Census 1990* revealed that its housing standards were quite high: for example, 94% of households had both bath and WC, 88% possessed a kitchen of 6 square metres or more and 56% were 30 years old or less.⁶⁵

7.13 Many other examples of apparently anomalous results could be cited, reinforcing the view that estimates of the real value of Gross rents should be supported, to the maximum extent possible, by direct quantity comparisons. If the PPP program is to continue to rely on indirect measures of the relative real value of housing services which depend on the deflation of nominal values by price (rental) data estimates, there will be a need to establish procedures to identify the reasons for apparently anomalous outcomes and to adopt remedial procedures.

(b) Medical and health care

7.14 National accounts data provided to the OECD for the 1993 PPP benchmark exercise showed that expenditure on medical and health care (ICP classification, measured in nominal values and converted at current exchange rates) represented 9.6% of expenditure on GDP for the OECD as a whole. The proportion was highest in the United States, at 13.0%, and was relatively low in Japan, at 6.9%. The very substantial differences between OECD countries in the proportion of GDP devoted to health care is, of course, the subject of widespread attention - as is the apparent weakness of the relationship between, on the one hand, the ratios of expenditure on health care to GDP and, on the other, most of the more commonly quoted measures of health **outcomes**.

7.15 Whilst ratios of expenditures to GDP provide the most readily available and most frequently quoted indicator of relative levels of spending on health care in different countries, the PPP program provides measures based on two alternative approaches.

7.16 The estimates based on the first of these approaches are derived by converting health expenditures in national currency units into real values using PPPs specific to such expenditures, and are published for benchmark years in publications entitled *Purchasing Power Parities and Real Expenditures*. The health-specific PPPs are not derived from the main prices collection for PPP purposes but are the subject of special inquiries undertaken once every three years. The prices reported by countries for medical goods (including pharmaceuticals) and medical services are either market prices or quasi-market prices (that is, the price which the consumer would have to pay if the products were not subsidised). They are obtained from the government or quasi-government bodies responsible for the pricing of such goods and services. The national prices so obtained are adjusted to annual average prices for the benchmark year by Eurostat or the OECD using the temporal indices provided by countries for that purpose.

7.17 The estimates based on the second approach are derived by converting health expenditures measured in national currency units into PPP \$, using PPPs for the **total GDP** of each country. As noted above, the estimates published in *OECD Health Data 96* and in *OECD in Figures* are on the latter basis.

7.18 Estimates on both bases from the 1993 benchmark study, using both the EKS and GK aggregation methods, are shown for the United States and Japan in Table 9. For comparison, the nominal

values on an exchange-rate converted basis are also shown. All of the comparisons are expressed in per capita terms:

Table 9. Japan and United States: Per capita Expenditure on Medical and Health Care (ICP Classification) 1993, Various Bases

	Japan	United States	<i>US as Index</i>
	\$US	\$US	<i>(Japan = 100)</i>
Nominal (converted at current exchange rates)	2329	3154	135.4
Real expenditures at international prices:			
EKS method	2673	2322	86.9
GK method	2718	2392	88.0
Expenditures in PPP\$:			
EKS method	1587	3561	224.5
GK method	1666	3460	207.6

Sources: Derived from OECD, *Purchasing Power Parities and Real Expenditures: EKS Results Volume I, 1993*: Tables, 1.3, 1.8 and 3.1; and OECD, *Purchasing Power Parities and Real Expenditures: GK Results Volume II, 1993*: Table 1.4.

7.19 Whilst all of the numbers in the table are derived from the OECD publications reporting the results of the 1993 PPP benchmark study, those for Expenditure in PPPs are reasonably close to the relevant estimates reported in the Health I table in *OECD in Figures 1996 Edition* (United States, 3498 PPP \$ per capita; and Japan, 1484 PPP \$ per capita).

7.20 The striking feature of the table is the huge difference - in a ratio of the order of 2.5 : 1 - between the comparisons based on real expenditures (i.e., using PPPs specific to health expenditures in the two countries) and expenditures in PPP \$ (i.e., using PPPs for Total GDP of the two countries). The health publications of the Directorate for Education, Employment, Labour and Social Affairs use the latter basis on the advice of the Statistics Directorate, because of the uncertainty of the validity of volume comparisons derived from PPPs specific to health expenditures.

7.21 These doubts are justified. The difficulty in deriving PPPs specific to health expenditures reflects ambiguity in specifying the commodities which are the subject of those expenditures and in measuring and valuing the volume of such commodities which are the subject of final expenditure. For example, average bed-day prices or costs in various countries of a specified quality of in-patient care in hospitals with specified health care facilities may, with difficulty, be established; but the relevance of the data would depend on a range of other factors which might vary between countries - for example, in what circumstances is hospitalisation regarded as necessary and for what period? what is the role of out-patient treatment and domiciliary care? and are preventative care practices reducing the incidence of illness and therefore the need for any treatment, intensive or otherwise?

7.22 It is doubtful whether adequate estimates of real expenditures on health care can be made by refining or extending the range of information collected for PPP purposes by the Statistics Directorate. In fact, it can be argued that the prospect of obtaining such measures depends on a flow of information in the

opposite direction: that is, that it may be possible for analysts in the area of medical and health care to identify indicators of output or outcomes in this area which have been devised for policy purposes (including for the funding of health care programs) but which would be suitable as measures of volume within the PPP program.

(c) Education

7.23 In the publication *Education at a Glance: OECD Indicators*⁶⁶ (prepared by the Statistics and Indicators Division of the OECD Directorate for Education, Employment, Labour and Social Affairs) estimates based on PPPs are presented in the section headed F3: Expenditure on Educational Services per Student.⁶⁷ At the outset, it is stated that This indicator provides information on annual expenditure per student in **absolute** terms (in equivalent US dollars converted at purchasing power parities).⁶⁸

7.24 As expressed, this description could convey the impression that expenditures per student have been deflated by price relatives produced by the PPP program, derived from the prices of specified education commodities (e.g., the compensation of employees in selected occupations in education).

7.25 Under the heading Definitions, however, it is made clear that the PPP exchange rates used pertain to GDP ...⁶⁹, and a fuller explanation at Annex 2 of *Education at a Glance* includes the statement that

Thus, when expenditure on GDP for different countries is converted into a common currency by means of PPPs, it is, in effect, expressed at the same set of international prices so that comparisons among countries reflect only differences in the **volume** of goods and services purchased.⁷⁰

7.26 In the context, this part of the explanation to the expenditure on educational services per student section of the publication may be misleading, because it appears to imply that the statistical comparisons relate to the **volume** of expenditure **on education** (e.g., to the numbers of teaching staff, support staff, etc). In fact, like the comparisons in PPP \$ in *OECD Health Data 96*, the data on expenditure on educational services per student in *Education at a Glance* are strongly influenced by the **relative** price of expenditures on education *vis-a-vis* the prices of all final goods and services in the country concerned.

7.27 Thus, *Education at a Glance* shows the 1993 level of expenditure on educational services per student, converted using PPPs, to have been much **higher** in the United States (\$7341) than in Canada (\$6466) or Denmark (\$5902)⁷¹ whereas the 1993 PPP benchmark study showed the real value per head of final expenditure on Education (ICP classification) to have been **lower** in the United States (\$1387) than in Canada (\$1462) or Denmark (\$1933).⁷²

7.28 Whilst there are other factors which affect the comparisons, undoubtedly the main reason for the different impressions given by the two OECD sources is that those in *Education at a Glance* take into account, and those in *Purchasing Power Parities and Real Expenditure* abstract from, the **relative** price level of expenditure on education. The importance of this factor is shown by the estimates of relative price levels of [each component of] final expenditure on GDP given in the PPP publication: these show that, by comparison with the price level of expenditures on GDP as a whole, the relative price of expenditure on education was 25% higher in the United States, 4% higher in Canada and 15% lower in Denmark.⁷³

7.29 The authors of *Education at a Glance* are fully aware of the important impact of relative price levels for education services upon the inter-country comparisons of expenditure made in the publication, as the following extract shows:

Finally, differences in national price levels for educational services, in so far as they deviate from overall price levels accounted for in the purchasing power parities, impact on the differences in unit expenditure across countries.⁷⁴

7.30 Yet the authors are also aware that educational **outcomes** may not be adversely affected by relatively low levels of education **expenditure**, as is indicated in the immediately succeeding sentence:

It would be misleading to equate lower unit expenditure generally with a lower quality of educational services and lower outcomes. The Czech Republic, Japan and Korea, for example, which report comparatively moderate expenditures per student, are the countries with the highest level of performance by students in mathematics and science around age 13....⁷⁵

7.31 Finally, the introductory paragraphs of the section in *Education at a Glance* which compares relative levels of expenditure on education per student in OECD countries using PPPs is worth quoting as an indication of the policy context in which analysts in the education field see such estimates as useful:

OECD countries face a continuing debate on whether the amount spent on each student's education is too high, too low, or "just right" given the demand for high-quality education, on the one hand, and the need to avoid an undue burden on taxpayers, on the other. Policy-makers must balance the need to expand access to educational opportunities. ... Since there are no absolute standards for the resources per student needed to ensure optimal returns for both the participant and society as a whole, international comparisons of national investment in education provide an important source of insight.⁷⁶

7.32 Just as the estimates of the PPPs applicable to expenditure on medical and health care produced by the PPP program are not used for the purposes of inter-country comparisons in *OECD Health Data 96*, the corresponding estimates of the PPPs applicable to expenditure on education are not used in calculating expenditure on educational services per student in *Education at a Glance*. In both cases the PPPs for GDP as a whole are used in preference to the category-specific PPPs, which are produced at some cost both to the OECD and to the national authorities which furnish the prices information for the PPP program.

7.33 This raises the question of whether information on prices of commodities in comparison-resistant areas such as education and health is sufficiently useful to justify the costs of collection and conversion into price relatives. As is shown by the reference in *Education at a Glance* to the distinction between, on the one hand, relative levels of unit expenditures and, on the other, the quality of educational services and outcomes, education analysts are conscious of the vital difference between the investment of resources and the end-result in terms of performance. If possible quantitative measures of the latter gain widespread acceptance among specialist analysts, they will be available to be considered as direct measures of quantity for use in measuring the comparison-resistant components of expenditure. Continuing liaison between the Education, Employment, Labour and Social Affairs Directorate and the Statistics Directorate should help to ensure that all of the relevant information relating to education which is available from national sources is fully utilised in the work of both.

(d) Collective government services

7.34 The price collections for government services in the PPP program cover compensation of employees only, the prices data applicable to government intermediate consumption being derived from the PPPs for equivalent types of household expenditure.

7.35 The prices relating to compensation of employees in collective government services are based on returns from countries of the average compensation paid in the benchmark year to those working in a selection of occupations in general government, in public health and in public education. The final product lists for the 1993 comparison covered 34 such occupations, selected on the basis that they are believed to be representative of the education levels and occupational categories usually found in public administrations. For the purposes of the PPP project, the job descriptions have been taken from the 1968 and 1988 versions of the International Standard Classification of Occupations (ISCO).

7.36 In addition to gross salary, compensation includes employers contributions to social security, pension and life assurance schemes. (When such schemes are unfunded, employers contributions are imputed in line with the national accounting practices followed by the country.)

7.37 The special difficulties encountered in making inter-country comparisons of PPPs and real expenditures on collective government services arise because such services are not marketed. There is, therefore, no information on relative prices for expenditures on those services and, in many cases, no commodity which is capable of being specified as the object of the expenditure.

7.38 Under national accounting conventions, expenditure on general government services in individual countries is measured by the cost of the relevant inputs rather than on the value of the resulting outputs. Consistently with this, intertemporal comparisons of real expenditures on general government services rely upon the deflation of nominal expenditures by the prices of inputs (e.g., the compensation of employees in representative occupations).

7.39 It is not clear than any useful purpose is served by collecting these input prices. Consideration could be given to the possibility of using price parities derived from the prices of outputs of marketed services. Co-operative studies by the Statistics Directorate and other Directorates of the OECD on the methodological issues involved in the measurement of performance in the provision of general government services would be of mutual benefit.

8. PPPs for Gross Fixed Capital Formation

8.1 The collection of prices of capital goods is an important part of the PPP program. For the 1993 benchmark comparison, the final product lists included 186 types of equipment goods (plus some 50 types of motor vehicles) and 16 construction projects (7 residential buildings, 4 non-residential buildings and 5 civil engineering works).

8.2 In EU countries, the pricing both of machinery and equipment and of construction projects are undertaken for Eurostat by independent experts who are nominated by Member States and funded by Eurostat.

8.3 In non-EU countries, responsibility for the collection of prices for capital goods rests with the national statistical services. The pricing of machinery and equipment in these countries is undertaken by the national statistical services themselves (except in Canada where it is contracted out to a private

consultancy firm). Most countries conduct special surveys of producers of domestic products and of distributors of imported products. The pricing of construction projects in non-EU countries has to be done by experts outside the national statistical services (except in Canada where the work is undertaken within Statistics Canada). Usually the bills of quantities, which specify in detail the material and factor inputs, are completed by another government or quasi-government agency or by private consultants. Although the bills are the same for all countries, pricing standardised bills of quantities requires some flexibility to accommodate differences in national standards, regulations and practices. Countries are required to follow the pricing guidelines that have been drawn up to minimise the quality differences that can arise as a result.

8.4 In principle, however, the PPPs and real values of final expenditures on capital goods are no more difficult to establish than those for expenditure on consumer goods. The purchase of a passenger car, for example, is treated in the national accounts as final expenditure on consumption by households if the buyer is an individual, but as Gross fixed capital formation (GFCF) if the same car is bought by an enterprise. In this case, the price is no more difficult to determine in one case than in the other. The practical difficulties of the pricing exercise are, however, significantly greater than for most components of consumption expenditure.

8.5 Moreover, GFCF and GDP are, by description and definition, **gross** measures. They have been chosen in preference to net measures for practical reasons - not because they are superior in principle. On the contrary, the **net** measures are to be preferred on conceptual grounds, for reasons explained by Gilbert and Kravis in the 1954 OEEC study:

The choice of gross product, which includes gross investment without allowance for capital consumption, in place of net product which allows for capital consumption, ... rests on practical rather than on theoretically desirable grounds. Insofar as relative depreciation and obsolescence among countries differ, as they would, say, between a predominantly industrial and a predominantly agricultural economy even if both had the same stock of capital relative to total output, the net national product would be the more appropriate concept for international comparisons. For if one country must put aside more of its current production than another to replace capital currently being consumed, then it has less available for its current needs and for increasing its capital stock. The net product concept is not used, however, because the available estimates of depreciation are so incomparable as to be virtually meaningless in this context, and means are not available at present for preparing better estimates.⁷⁷

8.6 During the succeeding four decades the estimates of Consumption of fixed capital (CFC) produced by national statistical agencies have been greatly improved. Estimates for recent years, as published by the OECD in *National Accounts: Main Aggregates 1960-1994*, show that inter-country differences in the relative scale of CFC are substantial. For example, CFC was estimated to have exceeded GFCF - i.e., **net** fixed capital formation (NFCF) was estimated to be negative - in four OECD countries (Denmark, Finland, Iceland and Sweden) in 1994; and in that year it was equivalent to the greater part of GFCF in all but three Member countries (New Zealand, Portugal and Switzerland).

8.7 Reflecting the rapid growth in CFC and a marginal decline in GFCF, the ratio of NFCF to NDP for the OECD as a whole has declined from 13.7% in 1970 to 8.2% in 1994. The latter ratio is far below the corresponding ratio of GFCF to GDP (about 20%). In the case of expenditure on Machinery and equipment, as distinct from Construction, the difference between the net and the gross measures would be even greater.

8.8 As Gilbert and Kravis pointed out in the 1954 OEEC study, if one country must put aside more of its current production than another to replace capital currently being consumed, then it has less available for its current needs and for increasing its capital stock. It follows that the aggregates which are appropriate for international comparisons of real income or product should make allowance for capital consumed in the process of production: NDP is, in principle, a better measure than GDP of total income or product and NFCF (8% of NDP for the OECD as a whole) is a better measure than GFCF (20% of GDP for the OECD as a whole) of the resources used to increase the capital stock rather than to meet current needs.

8.9 Thus, the use of **gross** measures (GDP and GFCF) leads to a large overweighting of the capital formation component of expenditures, whether the purpose is to measure output and productivity or income and economic welfare. As J R Hicks pointed out in 1940:

If we are content to measure **gross** productivity, the problems of capital maintenance and accumulation simply do not arise; even if we desire a measure of **net** productivity (deducting wear and tear) it would seem that the right method theoretically is to regard the using-up of equipment as negative production, to be weighted by the cost of replacement. I do not suppose that much can be done on these lines, but merely state what seems to be the most defensible procedure.⁷⁸

8.10 It seems reasonable to conclude that, having regard both to the particular difficulties involved in comparing the prices and real values of expenditure on capital goods and to the marginal value of the results in relation to those uses of PPP estimates examined in this report. The case for increased resources to support this capital investment component of the program requires study of the uses of PPPs for cross-country comparisons of output and productivity by industrial sector.

TERMS OF REFERENCE

Background

With cognizance of the broader review which the United Nations is proposing to make of the International Comparison Programme, the OECD review will focus on a series of specific aspects of the OECD-Eurostat PPP Programme that are either not central to the the review of the ICP or where the answers may be rather different for OECD countries than for the entire coverage of the ICP.

The term “Purchasing Power Parities (PPPs)” is used below to refer to the PPPs themselves as well as the related price and volume indices and the data base of prices and expenditures that underlies them.

Terms of Reference

To write a report, in electronic form (preferably Word 6) on the following issues:

- i) Why and how are PPPs, in electronic and other formats, used by analysts in:
 - a) OECD and EU (Eurostat and DGs)?
 - b) Other international organisations?
 - c) Government agencies?
 - d) Business community?
 - e) Universities and research institutes?
 - f) The Media?
- ii) How well do PPPs produced by OECD/Eurostat meet the needs of the users listed in i) above?
- iii) What analytic uses could be served by better exploitation of the price and expenditure data provided by countries for the OECD-Eurostat PPP programme?
- iv) Are there alternative ways of comparing “comparison-resistant” goods and services, such as housing, health, education, collective government services or construction and equipment goods?
- v) What is the burden, additional to national statistical purposes, on participating countries:
 - a) under the existing programmes?
 - b) if the consultants’ recommendations under iv) are implemented?

ATTACHMENT B

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NOTES

1. Detailed results of successive rounds of the ICP have been published in 1975, 1978 and 1982 by the World Bank and in 1986/7 and 1994 by the United Nations.
2. The 1999 round is expected to cover 30 OECD Member countries and 10 non-OECD Member countries. Of the 30 OECD Member countries, 15 are EU Member States and another four are pre-accession countries (or PACs) which have applied to join the EU. Of the 10 non-OECD Member countries, seven are PACs and three are other countries (China, Israel and Russia) which are to participate in the 1999 round on an experimental basis.
3. Ward, Michael (1985) *Purchasing Power Parities and Real Expenditures in the OECD*, OECD 1985.
4. Sen, Amartya (1996). "The Concept of Wealth" in Myers, Ramon H.
5. Kravis, I.B., A.W. Heston and R. Summers (1978).
6. Sen, Amartya (1996), *op.cit.*, p.18.
7. Samuelson, Paul (1974). "Analytical Notes on International Real-Income Measures".
8. Kravis, Irving B. (1984). "Comparative Studies of National Incomes and Prices".
9. Following the sharp depreciation of the yen during 1995 and 1996, Japan's domestic price level, defined as the ratio of the PPP for private final consumption expenditure to exchange rates, was 69% higher than Canada's in January 1997.
10. Eurostat (1995).
11. Milleron, J-C (1995), "Global Aspects of a Statistical System in the World Today".
12. IMF.
13. World Bank (1995).
14. World Bank (1997).
15. United Nations Development Programme (1996).
16. Information provided by Professor Robert Summers, from a citation list prepared in mid-1995 for a proposal submitted to the US National Science Foundation.
17. International Civil Service Commission (1987).
18. OECD (1995).

19. References are to the 1996 edition, which provides annual data for the years 1960-1994.
20. OECD (1996).
21. References are to the January 1997 issue.
22. OECD (1997).
23. The relevant figures at current prices and exchange rates - \$5114 billion for Japan and \$560 billion for Canada are, in fact, shown in two tables: the Basic Structural Statistics on p. 198 and Gross Domestic Product on p. 206.
24. In the case of the estimates of per capita GDP in 1995, the Basic Structural Statistics indicate that half of Member countries had per capita GDP within a range of \$18,000-\$22,000.
25. OECD (1995).
26. Estimates of Consumption of Fixed Capital are those for 1993 in OECD (1996).
27. References are to the 1996 edition.
28. OECD (1996).
29. OECD (1996).
30. OECD (1996).
31. OECD (1996).
32. OECD (1995).
33. OECD (1995).
34. OECD (1995).
35. Purchasing power parities between currencies are calculated using the prices collected in the different countries for a basket of comparable and representative goods and services. For the 1993 calculation, the basket included some 3000 items and covered the entire range of final goods and services which make up GDP OECD (1995).
36. Kemp, Katherine (1993). "International Price and Quantity Comparisons: Purchasing Power Parities and Real Expenditures, Canada and the United States" in Statistics Canada.
37. World Bank (1996).
38. Clark, Colin (1940).
39. Clark, Colin (1938).
40. Gilbert, Milton and Kravis, Irving B (1954).
41. Kendrick, John W (1970). The Historical Development of National-Income Accounts.

42. Gilbert, Milton and Kravis, Irving B. (1954).
43. Gilbert, Milton and Kravis, Irving B. (1954).
44. Beckerman, Wilfred (1966).
45. Summers, R. and Heston, A. (1991). The Penn World Tables (Mark 5): An Expanded Set of International Comparisons, 1950-1988.
46. Eurostat (1995).
47. Gilbert, Milton and Kravis, Irving B (1954).
48. Kravis, Irving B (1984).
49. For a discussion of the relative merits of PPP estimates based on production data and on expenditure data.
50. Clark, Colin (1940).
51. Hicks, J. R. (1940). "The Valuation of the Social Income".
52. Hicks, J. R. (1940). "The Valuation of the Social Income".
53. Gilbert, Milton and Kravis, Irving B (1954).
54. OECD (1995).
55. OECD (1995).
56. Gilbert, Milton and Kravis, Irving B (1954).
57. All Member countries in 1994, except Luxembourg were included in the Science, Technology and Industry Directorate study.
58. The tariff comparison methodology for the OECD baskets of telephone charges is described in OECD, ICCP Series No. 22, "Performance Indicators for Public Telephone Operators".
59. OECD (1993).
60. "Damned lies".
61. "The unmeasurable lightness of being".
62. Kravis, Irving B., Heston, Alan and Summers, Robert (1982).
63. OECD.
64. Japan, Statistics Bureau (1997).
65. Norway, Central Bureau of Statistics (1992).
66. OECD (1996).

67. OECD (1996).
68. OECD (1996).
69. OECD (1996).
70. OECD (1996).
71. OECD (1996).
72. OECD (1995).
73. OECD (1995).
74. OECD (1996).
75. OECD (1996).
76. OECD (1996).
77. Gilbert, Milton and Kravis, Irving B. (1954).
78. Hicks, J.R. (1940).