

NEW INSIGHTS INTO THE STRUCTURE OF THE WORLD ECONOMY*

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The United Nations' newly completed study of purchasing power parities covering 34 countries varied in region, income level, and form of economic organization shows the systematic differences between the usual view of the structure of the world economy arising out of international comparisons based upon foreign exchange rate conversions and the structure one sees when actual prices are available.

The real *per capita* GDP of developing countries is understated relative to developed countries when exchange rates are used in converting countries' national income accounts to a common currency, with the degree of understatement for any two countries being inversely related to the *per capita* income difference between them. The reason for this is that relative prices in the non-traded goods sector are lower relative to traded goods prices in low income countries. The systematic pattern observed in the 1975 data of the 34 countries has been extrapolated over time and space to get estimates of GDP for other years and countries.

In the absence of detailed price data, the real shares of final expenditures devoted to particular components of the total can only be estimated as the proportion of own currency total expenditure devoted to the components. The observed differences in the pattern of prices of poor countries relative to rich for different components makes this clearly wrong for international comparisons, and in systematic ways. For example, (i) the relative price of services compared with commodities in poor countries is lower than in rich; so the apparent tendency of the share of services to rise as a country's income rises disappears when *real* quantities are considered; similarly, (ii) the relative price of capital goods is greater in poor countries compared with rich ones, so the difference in investment ratios out of GDP between rich and poor countries is understated.

The structure of the world economy until now could only be viewed through a veil of exchange rates which conceal or distort many of its real features. Exchange rate conversions of Gross Domestic Product (GDP) to a common currency implicitly assume that price levels are the same in all countries whereas in fact there are wide and systematic differences across countries. As a result, the real GDP of some countries is two or three times larger relative to others than the exchange rate conversions suggest. Furthermore, not only national levels of prices but also price structures differ across countries. Consequently, exchange rate conversions of expenditures often give a distorted impression of the real quantity composition of GDP in one country relative to another. For example, of two countries with equal GDPs one may devote 20 percent of its GDP to capital formation and the other 15 percent, but if capital goods are much dearer in the former, it may wind up with less real investment than the latter.

The purpose of this paper is to call attention to some of the broad insights into the real structure of the world economy that emerges from a newly completed

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study of purchasing power parities for GDP and its final expenditure components including consumption, capital formation and government¹ and about 35 further subdivisions of these main aggregates. The new study, the third of its kind carried out by the United Nations International Comparison Project (ICP), provides benchmark price and quantity estimates for 34 countries—including 12 industrial, 4 socialist, and 18 developing countries—with a 1975 reference date. The estimates have been extrapolated to other years and to other groups of countries.

The present paper provides a sampling of some of the major findings following a brief summary of the methods of the study. The reader seeking more information is referred to the full report.²

ICP METHODS

The basic methodological approach has been to obtain quantity comparisons by means of price and expenditure comparisons. In the preponderance of the 151 detailed categories into which final expenditures on GDP have been divided, price comparisons of a number of carefully specified goods or services were made. To ensure that the price comparisons related to comparable qualities, written specifications were supplemented by correspondence, exchanges of samples, and inspections of items in shops by visiting experts. Price relatives (country *j* to numeraire country *n*) were computed and averaged in each category. These category price relatives or purchasing power parities (PPPs) were used to convert the category expenditures of each country to the currency units of the numeraire country so that all of the new expenditures are directly comparable. The ratio of a country's expenditures to that of the numeraire country would then reflect the ratio of the quantities consumed in the countries.

The method of summing the quantities of the detailed categories into higher level aggregates turns on the use of a set of "international prices" for the various categories. The international price for a category is defined to be the quantity-weighted average of the detailed category PPPs after they have all been made commensurate by being divided by their respective country PPPs. The international prices are used to value the category quantities of each of the countries in "international dollars" so that the category quantities can be added together to get total GDP or any subaggregates. The international prices have been estimated simultaneously with all the country PPPs using a procedure devised by R. C. Geary and amplified by S. H. Khamis.³

It should be added that an international dollar has the same purchasing power over the U.S. GDP as a whole as the U.S. dollar. However, its purchasing

¹For ICP purposes, public expenditures on education, health and recreation are treated as part of "consumption" rather than "government".

²Kravis, Heston, Summers (1982). The previous studies covered first 10 and then 16 countries with 1970 and 1973 reference dates. Kravis, Kenessey, Heston, Summers (1975) and Kravis, Heston, Summers (1978).

³In order to avoid having the international prices depend simply on the set of countries participating in the ICP, a "supercountry" weighting system was adopted to make the Geary-Khamis results representative of the whole world rather than just the 34 ICP countries. The Geary-Khamis calculations were applied to 34 supercountries each with a price and quantity structure identical to one of those observed in the ICP set but with expenditures scaled upward to equal the total of countries of the world outside the ICP group at the same level of affluence.

power over individual categories is different because it is determined by the structure of international prices.

In addition to the methodological problems usually associated with index number work, a number of special problems arose in the course of designing a worldwide system of price and quantity comparisons. Mention is made of three of them here:

1. A system was needed in which all countries were treated equally. Even if one country, the U.S., has been selected as the world reference country, the methods are such that the price and quantity relationships among the countries would be the same if some other country was taken as the numeraire country, though the results would be scaled differently and would be described in terms of “international pounds,” “international marks,” or the like.

2. The international comparison of certain services—notably education, health care and government—poses especially difficult problems. In intertemporal comparisons, national accountants often measure changing output on the basis of changes in the labor inputs, sometimes with and sometimes without an adjustment for changes in productivity. In the ICP efforts were made to take account of quality differences and differences in the inputs of capital. These adjustments were crude both methodologically and empirically. Fortunately, while alternative ways of treating these services can make substantial differences in their quantity comparisons, the impact on comparisons of GDP tends to be very small.

3. Consideration was given to a system built up in two stages: an initial stage in which comparisons were carried out for each geographical region, and a second stage linking the regions. This possibility was rejected in favor of a “universal” approach in which all countries were treated symmetrically in the aggregation of the detailed categories.⁴ From the standpoint of the UN Statistical Office with its worldwide responsibilities it is appropriate to treat comparisons for each pair of countries even-handedly, rather than to opt for a method that would seek to favor the quality of comparisons within regions.⁵ Another decisive objection to a two-stage procedure is that it is impossible to achieve full consistency between the regional and interregional results.⁶

NOMINAL AND REAL GDP

GDP in National Currencies, U.S. Dollars, and International Dollars

Table 1 shows the 1975 *per capita* GDPs of the 34 ICP countries first in national currencies, then in U.S. dollars after conversion by means of exchange

⁴Regional price relationships for items within the detailed categories were, however, taken into account in obtaining the average price relatives. Such relationships were used to take account of missing entries in the tableau of prices made up when the columns represented countries and the rows items.

⁵While the estimates of the relative incomes of two countries within the same region will differ when computed on a universal basis from the estimates when computed on a regional calculation, they will not differ as much, on average, as the estimates of the relative incomes of two countries in different regions differ when computed by the universal and regional approaches. The reasons are to be found in the operation of “own-price” effect, akin to the “Gerschenkron effect.”

⁶See Kravis, Heston, and Summers (1982, Chapter 4).

TABLE 1
POPULATION AND *PER CAPITA* GROSS DOMESTIC PRODUCT IN NATIONAL CURRENCIES, IN U.S. DOLLARS AT OFFICIAL EXCHANGE RATES,
AND IN INTERNATIONAL DOLLARS, 1975

Country	Currency Units	Population (Millions) (1)	In National Currency (2)	<i>Per Capita</i> GDP				Exchange-Rate-Deviation Index (5) ÷ (3) (7)
				In U.S. Dollars Converted at Exchange Rate		In International Dollars		
				U.S. \$ (3)	U.S. = 100 (4)	International \$ (5)	U.S. = 100 (6)	
<i>Africa</i>								
Kenya	Shilling	13.399	1,787	241	3.36	470	6.56	1.95
Malawi	Kwacha	5.044	119.8	138	1.93	352	4.90	2.55
Zambia	Kwacha	4.981	318.2	495	6.89	738	10.3	1.49
<i>Asia</i>								
India	Rupee	603.887	1,220	146	2.03	470	6.56	3.22
Iran	Rial	32.742	107,265	1,587	22.1	2,705	37.7	1.71
Japan	Yen	111.566	1,327,937	4,474	62.3	4,907	68.4	1.10
Korea (Rep. of)	Won	35.281	282,065	583	8.12	1,484	20.7	2.54
Malaysia	Ringgit	11.922	1,873	780	10.9	1,541	21.5	1.98
Pakistan	Rupee	70.260	1,879	189	2.64	590	8.23	3.12
Philippines	Peso	42.071	2,735	376	5.24	946	13.2	2.51
Sri Lanka	Rupee	13.496	1,957	183	2.55	668	9.30	3.65
Syria	Pound	7.354	2,656	718	10.0	1,794	25.0	2.50
Thailand	Baht	41.896	7,138	359	5.00	936	13.0	2.61

<i>Europe</i>								
Austria	Schilling	7.520	87,267	5,010	69.8	4,995	69.6	1.00
Belgium	Franc	9.801	231,635	6,298	87.8	5,574	77.7	0.88
Denmark	Kroner	5.060	43,087	7,498	104.5	5,911	82.4	0.79
France	Franc	52.748	27,555	6,428	89.6	5,877	81.9	0.91
Germany (F.R.)	Mark	61.829	16,724	6,797	94.7	5,953	83.0	0.88
Hungary	Forint	10.541	43,893	2,125	29.6	3,559	49.6	1.68
Ireland	Pound	3.176	1,184	2,673	37.2	3,049	42.5	1.14
Italy	Lira	55.830	2,245,670	3,440	47.9	3,861	53.8	1.12
Luxembourg	Franc	0.360	236,741	6,472	90.2	5,883	82.0	0.91
Netherlands	Guilder	13.660	15,331	6,061	84.5	5,397	75.2	0.89
Poland	Zloty	34.022	51,504	2,586	36.0	3,598	50.1	1.39
Romania	Lei	21.245	20,908	1,742	24.3	2,387	33.3	1.37
Spain	Peseta	35.515	169,480	2,946	41.0	4,010	55.9	1.36
U.K.	Pound	55.981	1,863	4,134	57.6	4,588	63.9	1.11
Yugoslavia	Dinar	20.110	28,937	1,664	23.2	2,591	36.1	1.56
<i>Latin America and Caribbean</i>								
Brazil	Cruzeiro	107.145	9,422	1,149	16.0	1,811	25.2	1.58
Colombia	Peso	23.676	17,436	568	7.92	1,609	22.4	2.83
Jamaica	Dollar	2.043	1,278	1,406	19.6	1,723	24.0	1.23
Mexico	Peso	60.145	18,312	1,465	20.4	2,487	34.7	1.70
Uruguay	New Peso	2.782	3,008	1,308	18.2	2,844	39.6	2.17
<i>North America</i>								
U.S.A.	Dollar	213.566	7,176	7,176	100.0	7,176	100.0	1.00

rates, and finally in international dollars (I\$). Only the latter set of figures in the table applies a common measuring rod—a set of international prices—to the quantities constituting the GDPs of the various countries.

Attention is directed first to the “nominal” (exchange-rate-converted) figures (columns (3) and (4), since comparisons of this type are most usually cited. According to this measure, the *per capita* GDPs of 10 countries were less than 10 percent of that of the U.S. with several below 3 percent and one below 2 percent. One country, Denmark, had a higher exchange-rate converted GDP *per capita* than the U.S.

Of course, the *raison d’être* of the ICP is to go behind these comparisons of nominal GDPs. Comparisons relying on exchange rates do not properly reflect the differing relative purchasing powers of the currencies over all goods and services. They apply quite variable measures of value to the quantities in each country’s GDP.

The ICP comparisons presented in columns (5) and (6) are, on the other hand, obtained by applying a common set of prices, representative of the world price structure, to the quantities of the commodities and services entering into each country’s final expenditure or GDP. The quantities valued in international dollars are comparable from country to country for GDP as a whole or for any given subaggregate.

What difference does it make whether the GDPs are expressed in exchange-rate converted U.S. dollars (column (3)) or in purchasing-power-parity-converted international dollars? A major consequence is that the dispersion of real incomes is smaller. Only 5 countries have real *per capita* GDP of less than 10 percent of the U.S., and the lowest is 4.9 percent. Denmark’s real income is well below rather than slightly above that of the U.S.

Furthermore, there is a clear tendency for the international dollar (I\$) figures to be higher in countries that have low incomes. That is, the exchange-rate-converted estimates of GDP tend to understate the real GDPs of poor countries relative to the GDPs of the U.S. and Europe.

The systematic relationship between the ICP estimates and the exchange-rate-derived figures may be clearly seen by arranging the countries in order of increasing real GDP *per capita*; it can then be seen clearly that the ratio of real GDP *per capita* to exchange-rate-converted GDP *per capita*—the “exchange-rate-deviation index”—falls as *per capita* real GDP rises. See Figure 1.

A systematic association between the exchange-rate-deviation index and the level of real GDP *per capita* is a basic structural feature of the world economy. Table 2 shows the index of real *per capita* GDP for 1970, as well as for 1975, for 16 of the 34 countries for which 1970 estimates were made in an earlier study. Here the countries are arrayed in order of ascending 1975 real *per capita* GDP and the tendency of the exchange-rate-deviation index to decline with larger incomes can easily be observed in both years.

This phenomenon can be explained in terms of the differences in the productivity gap between high- and low-income countries for tradable and nontradable goods. International trade tends to drive the prices of tradable goods, mainly commodities, towards equality in different countries. With equal or nearly equal prices, wages in tradable goods industries in each country will

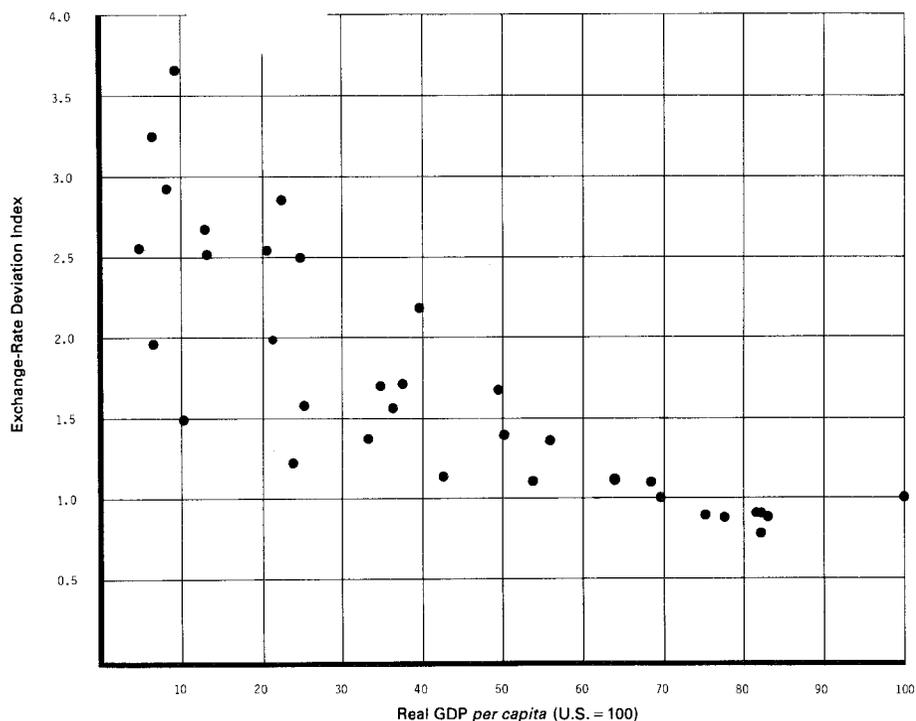


Figure 1. Exchange-Rate Deviation Index in Relation to Real GDP per Capita, 1975

depend upon productivity. Wages established in the tradable goods industries within each country will prevail in the country's nontradable goods industries. In nontradable goods industries, however, international productivity differentials tend to be smaller. Consequently, in a high-productivity country high wages lead to high prices of services and other nontradable goods, whereas in a low-productivity country low wages give rise to low prices of services and other nontradables. The lower a country's income, the lower will be the prices of its nontradable goods and the greater will be the tendency for exchange-rate-conversions to underestimate its real income compared with that of richer countries.

In 1970 the real GDP per capita of the fifteen countries relative to that of the United States ranged from more than 20 percent higher than indicated by the exchange-rate-converted figures (Germany, F.R.) to more than three times as great (India).

The depreciation of the U.S. dollar relative to European currencies between 1970 and 1975⁷ brought European/U.S. exchange rates into closer alignment with purchasing-power-parities; the exchange-rate-deviation index for all the

⁷The extent of the dollar depreciation against individual currencies between 1970 and 1975 can be seen in columns (1) and (2) of Table 2. Against the weighted basket of 16 currencies that for a time constituted the SDR, the dollar depreciated by nearly 18 percent between 1970 and 1975. (Based on data in IFS (1978).)

TABLE 2
 PER CAPITA GROSS DOMESTIC PRODUCT IN NATIONAL CURRENCIES AND IN INTERNATIONAL DOLLARS, SIXTEEN COUNTRIES, 1970 AND 1975

	Exchange Rates (Currency Units per U.S. Dollar)		Indexes of <i>per capita</i> GDP Converted by Exchange Rates (U.S. = 100)		Indexes of Real GDP <i>per capita</i> (U.S. = 100)		Exchange-Rate- Deviation Indexes	
	1970 (1)	1975 (2)	1970 (3)	1975 (4)	1970 (5)	1975 (6)	1970 (7)	1975 (8)
Kenya	7.1429	7.4113	2.97	3.36	5.88	6.56	1.98	1.95
India	7.499	8.376	2.08	2.03	6.45	6.56	3.10	3.23
Philippines	6.0652	7.2746	3.94	5.24	11.7	13.2	2.95	2.52
Korea (Rep. of)	310.42	484.0	5.53	8.12	11.8	20.7	2.13	2.55
Malaysia	3.0797	2.4016	6.87	10.9	15.6	21.5	2.27	1.98
Colombia	18.352	30.869	7.19	7.92	17.2	22.4	2.39	2.83
Iran	76.38	67.639	7.98	22.1	19.4	37.7	2.43	1.70
Hungary	30.0	20.66	21.3	29.6	41.4	49.6	1.94	1.68
Italy	627.16	652.85	35.8	47.9	48.0	53.8	1.34	1.12
U.K.	0.4174	0.4501	45.6	57.6	62.7	63.9	1.37	1.11
Japan	358.15	296.8	39.7	62.3	58.5	68.4	1.47	1.10
Netherlands	3.6166	2.5292	50.5	84.5	68.3	75.2	1.35	0.89
Belgium	49.656	36.781	55.5	87.8	72.3	77.7	1.30	0.89
Germany (F.R.)	3.6465	2.4605	63.7	94.7	76.5	83.0	1.20	0.88
France	5.5289	4.2864	57.9	89.6	71.9	81.9	1.24	0.91
U.S.A.	1.0	1.0	100.0	100.0	100.0	100.0	1.00	1.00

Note: The *per capita* U.S. GDPs which are the base values for columns (3) to (6) are: 1970, 4,814; and 1975, 7,176.

European countries and Japan is closer to 1 in 1975 than in 1970. The same was true of four of the others; for three, all of which depreciated their currencies against the dollar, the exchange-rate-deviation index was larger in 1975.

The large changes in exchange rates relative to PPPs in these years underline the unreliability of comparisons based on exchange-rate conversions.⁸ The exchange-rate-converted figures in the case of the United Kingdom, for example, imply that its *per capita* GDP relative to that of the United States rose from 45.6 percent in 1970 to 57.6 percent in 1975. In fact, estimates based upon purchasing power parities show that the United Kingdom's real GDP *per capita* relative to that of the United States remained almost constant. The latter result is much more closely in accord with the relative growth of the real *per capita* GDP (that is, as measured in constant internal prices) between the two years in the two countries; real GDP *per capita* increased by 8.12 percent in the United Kingdom and by 7.97 percent in the United States.⁹

The variation in the exchange-rate-deviation index from country to country means that the relative *per capita* income levels of the countries cannot be inferred from exchange-rate-converted GDP *per capita*. In a number of instances even the ordinal ranking based upon international prices differs from that based upon exchange-rate-conversions. For example, the use of international prices produces a higher 1975 *per capita* GDP for Colombia than for Malaysia, which is the opposite of the result obtained when exchange rates are used to convert the countries' GDPs to U.S. dollars.

Table 2 was confined to two years for which benchmark estimates are available. In Table 3 the benchmark estimates of real *per capita* GDP are extrapolated for 30 countries for a number of years for which there were no benchmark studies. (Because it is the base year of Table 3 the 1975 benchmark figures of the preceding table are repeated for the sake of completeness.) The extrapolations place these indexes on a different footing from the much more substantially based benchmark figures, but they much better trace the changes in the relative standings of different countries than do the exchange-rate-converted figures.

Individual countries' national accounts aggregates in constant prices were used in the extrapolation process. The extrapolations were carried out so as to take account of the impact of changes in the terms of trade. In any one year, a country's income and product, taken at current prices, are the same. But between two years a country's income may diverge from its production because of changes in its volume and terms of international trade. The difference between changes in income and production has been particularly important in recent years for oil

⁸Table 2 by giving the U.S. value of GDP for each year in the footnote makes it possible for the reader to convert the indexes to *per capita* GDP in international dollars. However, direct comparisons of the value aggregates (in international dollars) should not be made between the two years. It would be wrong, for example, to think that the real *per capita* GDP of the Philippines went up by 68.2 percent $\{(13.2 \times 7176) \div (11.7 \times 4814)\}$ between 1970 and 1975. The reason is that the purchasing power of the 1975 international dollars and that of 1970 international dollars is not the same.

⁹The figures on GDP in constant prices and the population figures for the two countries are taken from United Nations data.

TABLE 3
GROSS DOMESTIC PRODUCT AND INCOME *PER CAPITA* SELECTED COUNTRIES AND DATES

	Country Name	1950			1955			1960			1965			1970		
		GDP	GDY	Ratio												
1	Malawi	3.8	3.7	0.98	4.3	4.0	0.92	4.5	4.4	0.98	4.2	4.0	0.95	4.6	4.4	0.96
2	Kenya	8.9	9.8	1.10	8.0	9.5	1.19	7.9	8.5	1.08	6.2	6.5	1.05	6.9	7.4	1.07
3	India	8.0	7.4	0.93	7.8	7.3	0.94	8.3	7.9	0.95	7.0	6.7	0.95	7.2	6.8	0.55
4	Pakistan	7.8	9.0	1.16	7.1	7.3	1.03	7.2	7.7	1.08	8.7	9.0	1.04	8.6	8.4	0.98
5	Sri Lanka	9.4	11.4	1.21	8.8	10.8	1.24	8.4	10.2	1.22	8.4	8.8	1.05	9.3	9.5	1.02
6	Zambia	9.0	11.0	1.22	9.8	15.0	1.53	12.5	15.3	1.22	12.7	15.0	1.18	10.8	15.5	1.43
7	Thailand	11.1	9.9	0.89	7.4	7.6	1.03	9.2	9.5	1.03	9.6	10.1	1.06	11.1	11.7	1.05
8	Philippines	9.9	10.6	1.06	11.0	11.7	1.07	13.1	12.7	0.97	13.2	11.8	0.89	12.8	12.1	0.55
9	Korea, Rep. of	9.4	10.3	1.09	11.1	11.0	0.99	11.5	11.3	0.99	11.8	11.7	0.99	15.8	16.4	1.04
10	Malaysia	14.6	17.5	1.20	15.5	18.4	1.18	16.6	19.9	1.20	17.6	19.3	1.10	18.8	19.1	1.01
11	Colombia	21.0	21.7	1.03	20.8	22.0	1.06	20.9	20.4	0.98	19.1	18.7	0.98	20.2	20.3	1.01
12	Jamaica	12.3	12.6	1.02	17.3	18.2	1.05	22.7	23.3	1.02	23.8	23.0	0.97	29.3	28.6	0.98
13	Syrian Arab Rep.	16.4	17.1	1.04	18.9	0.0	0.00	18.1	16.4	0.91	20.1	17.0	0.85	19.7	17.1	0.87
14	Brazil	15.3	15.2	0.99	15.8	15.5	0.98	18.4	18.2	0.99	17.1	16.4	0.96	19.4	18.6	0.96
15	Mexico	28.0	25.5	0.91	28.4	25.6	0.90	32.8	28.9	0.88	33.7	29.8	0.88	36.5	32.4	0.89
16	Iran	14.4	10.5	0.73	13.9	11.9	0.85	19.9	14.5	0.73	20.3	13.2	0.65	27.9	16.8	0.60
17	Uruguay	54.1	54.8	1.01	57.9	60.5	1.05	53.2	54.2	1.02	44.1	42.9	0.97	43.0	43.6	1.01
18	Ireland	33.9	33.0	0.98	33.8	32.9	0.97	36.0	35.5	0.98	36.5	36.2	0.99	40.7	41.4	1.02
19	Italy	33.4	31.9	0.95	38.1	36.4	0.95	47.8	44.6	0.93	50.4	47.5	0.94	58.8	55.9	0.95
20	Spain	26.9	26.5	0.99	32.0	31.4	0.98	34.7	33.7	0.97	42.6	42.7	1.00	49.7	49.0	0.99
21	United Kingdom	62.3	61.5	0.99	62.5	62.0	0.99	66.5	66.8	1.01	64.4	64.9	1.01	64.9	65.6	1.01
22	Japan	18.4	18.4	1.00	22.6	22.9	1.01	31.5	32.1	1.02	40.8	41.8	1.02	61.6	63.3	1.03
23	Austria	38.6	37.9	0.98	43.8	43.4	0.99	53.9	53.4	0.99	54.9	54.7	1.00	63.1	62.2	0.99
24	Netherlands	54.5	52.8	0.97	57.4	56.5	0.98	63.3	62.1	0.98	64.7	64.0	0.99	72.7	72.2	0.99
25	Belgium	53.6	53.6	1.00	53.7	54.7	1.02	57.9	58.6	1.01	61.8	62.2	1.01	69.9	71.0	1.02
26	France	50.6	50.3	0.99	51.3	52.3	1.01	61.6	61.7	1.00	65.3	65.3	1.00	75.9	75.5	0.99
27	Luxembourg	72.4	59.7	0.82	67.3	67.1	1.00	75.7	81.4	1.07	79.5	77.1	0.97	82.3	88.9	1.08
28	Denmark	63.5	61.9	0.97	58.9	58.4	0.99	71.0	70.2	0.99	75.7	75.6	1.00	81.6	81.8	1.00
29	Germany, Fed. Rep.	44.6	42.6	0.96	57.7	55.9	0.97	73.3	70.9	0.97	75.0	72.5	0.97	82.3	80.2	0.97
30	United States	100.0	100.0	1.00	100.0	100.0	1.00	100.0	100.0	1.00	100.0	100.0	1.00	100.0	100.0	1.00
Addendum																
	U.S. <i>per capita</i> in 1975 dollars	4,490	4,491		5,134	5,127		5,231	5,234		6,091	6,093		6,672	6,662	

TABLE 3 (PART 2)

	Country Name	1973			1975			1977			1978	1979	1980
		GDP	GDY	Ratio	GDP	GDY	Ratio	GDP	GDY	Ratio	GDP	GDP	GDP
1	Malawi	4.9	4.4	0.90	4.9	4.9	1.00	5.0	4.8	0.95	4.8	4.5	4.1
2	Kenya	6.8	6.9	1.01	6.6	6.6	1.00	6.6	6.9	1.04	6.9	6.4	
3	India	6.3	6.0	0.95	6.6	6.6	1.00	6.5	6.3	0.97	6.2		
4	Pakistan	7.9	8.0	1.01	8.2	8.2	1.00	7.8	8.1	1.03	7.9	7.3	7.1
5	Sri Lanka	9.2	8.6	0.94	9.3	9.3	1.00	9.8	10.0	1.02	9.8	11.4	
6	Zambia	9.6	12.9	1.35	10.3	10.3	1.00	9.1	8.4	0.92	8.8	7.3	
7	Thailand	11.6	12.3	1.06	13.0	13.0	1.00	12.8	13.0	1.01	13.4	12.9	12.4
8	Philippines	12.6	11.6	0.93	13.2	13.2	1.00	13.9	12.7	0.91	13.4	12.8	12.2
9	Korea, Rep. of	17.8	18.1	1.02	20.7	20.7	1.00	22.9	23.6	1.03	24.5	24.0	21.3
10	Malaysia	20.2	20.7	1.02	21.5	21.5	1.00	22.4	24.1	1.07	22.5	22.2	21.8
11	Colombia	20.8	20.9	1.00	22.4	22.4	1.00	22.1	23.6	1.07	22.5	18.8	
12	Jamaica	27.0	25.2	0.94	24.0	24.0	1.00	19.9	20.3	1.02	18.5		
13	Syrian Arab Rep.	19.5	17.5	0.90	25.0	25.0	1.00	23.4	24.9	1.06	23.7	22.2	
14	Brazil	23.0	22.2	0.97	25.2	25.2	1.00	26.2	25.7	0.98	25.4	24.5	
15	Mexico	35.6	31.8	0.89	34.7	34.7	1.00	34.1	31.1	0.91	34.6	33.7	
16	Iran	33.8	26.1	0.77	37.7	37.7	1.00	36.6	38.3	1.05			
17	Uruguay	37.7	39.8	1.06	39.6	39.6	1.00	38.3	38.0	0.99	38.0	38.2	37.1
18	Ireland	40.9	44.2	1.08	42.5	42.5	1.00	41.1	41.9	1.02	42.2	39.7	
19	Italy	57.5	53.9	0.94	53.8	53.8	1.00	57.9	53.5	0.92	57.0	57.1	
20	Spain	53.4	53.4	1.00	55.9	55.9	1.00	53.8	53.1	0.99	52.5	49.2	
21	United Kingdom	65.1	65.2	1.00	63.9	63.9	1.00	62.9	62.7	1.00	62.4	60.9	58.6
22	Japan	66.5	68.5	1.03	68.4	68.4	1.00	68.1	69.3	1.02	68.4	70.2	
23	Austria	65.4	65.5	1.00	69.6	69.6	1.00	70.2	69.4	0.99	68.3	67.7	69.7
24	Netherlands	72.0	72.6	1.01	75.2	75.2	1.00	73.2	73.3	1.00	71.5	67.8	63.7
25	Belgium	72.2	74.2	1.03	77.7	77.7	1.00	75.0	76.4	1.02	74.2	70.5	
26	France	77.5	78.3	1.01	81.9	81.9	1.00	80.8	81.3	1.01	80.5	80.0	
27	Luxembourg	87.0	94.1	1.08	82.0	82.0	1.00	78.6	77.7	0.99	80.4		
28	Denmark	81.5	82.2	1.01	82.4	82.4	1.00	82.7	81.1	0.98	80.4	77.5	71.7
29	Germany, Fed. Rep.	81.2	80.1	0.99	83.0	83.0	1.00	83.4	83.3	1.00	83.5	84.6	87.4
30	United States	100.0	100.0	1.00	100.0	100.0	1.00	100.0	100.0	1.00	100.0	100.0	100.0
Addendum													
	U.S. per capita in 1975 dollars	7,449	7,434		7,176	7,176		7,802	7,751		8,110	8,698	9,310

exporters and some oil importers. Even if the domestic output of every single type of product, including petroleum, had remained constant, and even if the exports had remained constant, an oil exporter's real income would have increased because of the rise in the price of petroleum. Some of the gain would show up in the country's increased domestic absorption of consumers goods, public goods or investment goods, and the rest of its gain would show up in its net foreign balance. Because the figures derived on this basis reflect the terms of trade as they are found in each year, they have been labeled "gross domestic income," GDY. The simple extrapolation of the ICP benchmark year estimates by each country's change in its GDP yields a measure of relative physical production at constant base year prices for petroleum and all other products and these are also given in Table 3 under the heading of real GDP *per capita*.

The estimates of GDY in Table 3 thus are the results of relative changes in production, in the volume of net exports, and in the terms of trade. The role of the last two factors looms large in small countries or low income countries where international trade is large relative to GDP. The decline in the Zambia index between 1970 and 1975 of GDY is attributable mainly to a shift from a positive net foreign balance (Exports minus Imports) equivalent to 17 percent of GDP in 1970 to a negative one of about 20 percent of GDP in 1975 (both comparisons in Zambian current prices) and to the role played in this deterioration by a 22 percent decline in the price of copper,¹⁰ Zambia's chief export. In fact it can be seen that real GDP actually rose in the two years.

Table 3 mirrors the basic relative growth rates found in each country's national accounts which are joined here to ICP data. It reflects the general tendency for relative incomes *per capita* to rise through time for most countries. Most of European countries found in the last lines had GDYs in the range of 70 to 84 percent of the U.S. in 1977 compared to the 40 to 60 percent range in 1950. Middle income developing countries also gained, some like the Republic of Korea and Iran very quickly. No other country, however, matched Japan in its catching-up speed; Japan overtook Italy by 1970 and the U.K. by 1975. At the opposite extreme, with comparatively little economic growth, are the lowest income countries, especially the first half dozen poorest countries.

A second set of non-benchmark estimates provided in the full study consists of the extensions of the 1975 estimates of real GDP *per capita* to groups of other countries. Briefly, an estimating equation is formed from the 34 country data by regressing real GDP *per capita* against nominal (i.e. exchange-rate-converted) GDP *per capita* and certain other variables, and this equation is then used to estimate 1975 real *per capita* GDP for other countries.¹¹ The results for individual countries, of course, are subject to wider margins of error than the benchmark estimates. The regional aggregates (excluding centrally planned economies) are as follows:

¹⁰IFS (1978), May, p. 423.

¹¹This procedure is described in detail in Kravis, Heston, and Summers (1978) and then applied to cover the period 1950, 1960-77 in Summers, Kravis and Heston (1980).

	<i>Nominal GDP</i>		<i>Real GDP</i>		Exchange-Rate- Deviation Index (5) = (3) ÷ (1)
	(bn \$U.S.) (1)	% (2)	(bn I\$) (3)	% (4)	
Africa	175	3.5	324	5.6	1.85
Asia ^a	974	19.5	1,471	25.0	1.51
Europe	1,774	35.5	1,757	29.9	0.99
Latin America ^b	546	10.9	806	13.7	1.48
North America	1,528	30.6	1,520	25.8	0.99
World	4,997	100.0	5,878	100.0	1.18

^aincludes Oceania

^bincludes Caribbean

If the countries are reclassified according to stage of development, the resulting *per capita* figures are:

	Nominal	Real
a. Industrialized*	5,734	5,737
b. Developing†	534	1,020
c. Ratio, a to b	10.7	5.6

*20 countries: Members of OECD excluding Greece, Portugal, Spain and Turkey, but including Australia, New Zealand and South Africa.

†98 market economies, 32 with nominal GDP of \$250 or less in 1976, 9 oil exporters, and 57 middle income countries.

This more correct way to measure real income differences does not change the reality that the gaps between rich and poor in the world are large as measured by real income, or by indicators like nutrition levels, health facilities, housing and the like. However, an important inference is that efforts to narrow the gap in incomes between the developing and industrialized countries is not as hopeless as the exchange-rate-converted figures suggest (Leontief, 1977). That is, the growth rates of real GDP as measured by countries in their own currencies are not subject to a systematic distortion like exchange rates, so that they may be compared across countries.¹² Thus the differential growth rates required to close the gap in real GDP between the developing and industrial countries are less formidable and more realistically achievable, when GDP levels are stated in real terms.

COMPONENTS OF GDP

The new data provide some important insights into the way in which the quantity composition of GDP and the structure of prices change as incomes rise.

¹²This is not to say that GDP growth rates are measured without substantial error, but only that as between countries grouped by income level, there is no obvious reason that the errors would be systematic as is the case with exchange rates versus PPP conversion of GDPs.

The examination of these changes here is quite selective. Furthermore, it is presented in terms of (unweighted) averages for 6 groups of countries classified by level of *per capita* GDP. The country composition of the groups is shown in Table 3. The class intervals are as follows:

Group	Range of Real <i>Per Capita</i> GDP (U.S. = 100); 1975	Number of Countries
1	0-14.9	8
2	15.0-29.9	6
3	30.0-44.9	6
4	45.0-59.9	4
5	60.0-89.9	9
6	90.0-100.0	1 (U.S.)

Not only does this averaging economize on space, but it serves as a smoothing device that makes it easier to see the association of quantities and prices with *per capita* incomes.

The full report contains expenditure data and price and quantity comparisons for 35 summary categories, as well as for 151 detailed categories. The latter are presented in the spirit of providing worksheet materials for other investigators to aggregate according to their own needs; they are not to be regarded as individually reliable indexes. Such aggregations are made possible by the valuation of the results in terms of international dollars. In this form the figures referring to any category (in the rows) give the correct quantity relationships for the various countries (in the columns) while at the same time the figures in any combination of categories for any country may be summed to obtain the desired subaggregate of GDP. It is on this basis that the aggregations of Table 4 have been obtained, and the following features of that Table may be particularly noted.

1. In real (international dollar) terms capital formation (line 7) is a smaller share of GDP than is capital formation in own currency (line 3) in the lowest income countries (Group 1) while the opposite is true in the high income countries (Groups 5 and 6).

2. The reason is to be found in the price structure of different countries. For GDP as a whole (line 15) prices rise from 40 percent of the U.S. level in Group 1 to a little over the U.S. level in Group 5. Capital goods (line 17), however, are relatively expensive in the price structure of the Group 1 countries. That is, the internal purchasing power of the currencies in these countries is much smaller with respect to capital goods than it is with respect to consumption goods or government.

3. In real terms in Group 1 countries the share of government (line 8) is higher relative to the government share measured in own-currency (line 4). In high income countries, the opposite is the case. The result is that the often noted tendency for government spending to rise with the level of income, disappears. Again, the explanation is the low price of government services (line 18) in low income countries and their high price in high income countries. These price differences are heavily influenced by the importance of compensation of government employees in government spending.

TABLE 4
 DISTRIBUTION OF EXPENDITURES, REAL QUANTITY INDEXES, AND PRICE INDEXES FOR
 MAIN COMPONENTS OF GDP, FOR 34 COUNTRIES, GROUPED BY PER CAPITA GDP, 1975

		Group					
		1	2	3	4	5	6
Composition of GDP:							
1	In own currency:	100	100	100	100	100	100
2	Consumption	75	71	65	65	65	72
3	Capital Formation	16	19	25	27	24	17
4	Government	9	10	10	8	11	11
5	International dollars:	100	100	100	100	100	100
6	Consumption	72	70	67	67	65	70
7	Capital Formation	13	20	22	26	26	20
8	Government	14	10	11	7	9	10
Per capita quantity indexes (U.S. = 100)							
9	GDP	9	23	37	52	76	100
10	Consumption	9	24	36	51	71	100
11	Capital Formation	6	22	40	66	99	100
12	Government	12	23	40	37	63	100
13	Commodities	9	23	38	54	77	100
14	Services	9	23	37	49	73	100
Price indexes							
15	GDP	40	52	65	74	107	100
16	Consumption	40	50	60	69	103	100
17	Capital Formation	60	64	92	93	122	100
18	Government	25	46	57	74	132	100
19	Commodities	57	66	83	94	119	100
20	Services	21	34	41	46	95	100

N.B.: The ICP categories of consumption and government differ from the UN System of National Accounts in an important respect: ICP "government" excludes public expenditures on health care, education and recreation, and includes them in consumption.

Services include final expenditures on non-storable goods. All government expenditures are counted as a service and all of construction is counted as a commodity.

4. The *per capita* quantity indexes for commodities (line 13) are very similar to the *per capita* quantity indexes for services (line 4). This is in marked contrast to the exchange-rate-converted ratios which are as follows:

Group	Index of expenditures on	
	Commodities	Services
(U.S. = 100)		
1	5.0	2.0
2	15.2	8.1
3	31.1	15.5
4	50.6	23.4
5	92.7	69.1
6	100.0	100.0

Once again the root of the difference is the much lower level of service prices (line 20) than of commodity prices (line 19) in poor countries relative to rich countries. This tendency for services to be cheap in poor countries, as measured here, has been widely observed by travellers. When the expenditure figures are not corrected for this difference, low income countries seem to be consuming relatively less of the kinds of goods that are cheap in their countries (services) and relatively more of the kinds that are expensive (commodities). This anomaly disappears when PPPs rather than exchange rates are used for conversion.

In this and a number of other ways the patterns in which GDP is absorbed tend to be more similar across countries than would appear to be the case from exchange rate converted final expenditure. This suggests the hypothesis that tastes are similar the world around, a hypothesis which is explored with generally favorable results in the full study.

USES OF THE ICP

As a general matter the ICP data should be useful wherever there is a need to use comparative data on GDP or its final expenditure components. Exchange rate conversions are superior where international trade statistics are concerned and own-currency values are of course more relevant in many contexts in which resource allocation is under study. Even in the latter cases, however, an important comparative insight is given by the PPP-converted expenditure data.

For some analytical uses, the data for the 34 countries—varied as they are in income level, location, and economic system—will be sufficient. In time, the system will be expanded to more countries; the UN Statistical Office hopes in the next stage of the work to extend the comparison to around 70 countries. Meanwhile, where data for additional countries are required, it is recommended that estimates extrapolated from these benchmark data be used.¹³ The extrapolations described earlier have sizable errors (the standard error is usually in the 10 to 15 percent range), but on average the errors are much smaller than those involved in taking exchange-rate-converted GDP as the estimate of real GDP; for low income countries, the exchange rate error is often 100 percent and sometimes more than 200 percent. (See the exchange-rate-deviation index in Table 1.)

CONCLUSION

The availability of ICP-type comparative price and quantity data provide a new opportunity for a reappraisal of what has been learned about the processes of comparative economic development and for the further extension of our insights into this important process in the improvement of human well-being.

¹³Kravis, Heston, Summers (1978); Summers, Kravis, Heston (1980).

REFERENCES

- International Financial Statistics*, May 1978.
- Kravis, I. B., Kenessey, Z., Heston, A., and Summers, R. *A System of International Comparisons of Gross Product and Purchasing Power*, Johns Hopkins University Press, Baltimore, Md., 1975.
- Kravis, I. B., Heston, A., and Summers, R., *International Comparisons of Real Product and Purchasing Power*, Johns Hopkins University Press, Baltimore, Md., 1978.
- , Real GDP Per Capita for More Than One Hundred Countries, *Economic Journal*, June 1978.
- , *World Product and Income: International Comparisons of Real GDP*, 1982.
- Leontief, Wassily, *et al. The Future of the World Economy*, Oxford University Press, New York, 1977.
- Summers, Robert, Kravis, I. B., and Heston, A., International Comparison of Real Product and Its Composition: 1950–77, *The Review of Income and Wealth*, Series 26, No. 1, March 1980.