

# THE LEVEL OF WORLD INEQUALITY: HOW MUCH CAN ONE SAY?

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This paper constructs estimates of income and consumption inequality for the world (124 countries), using various measures of inequality. It then goes on to examine the possible effects of various sources of error in the estimates, and attempts to set rough limits to the size of such effects. Among the sources of error examined are purchasing power parities used for currency conversion, systematic errors in estimates of *per capita* incomes, differences in age structure, government tax and expenditure policy, and lifetime income effects. The paper concludes that, although the level of uncertainty in the estimates is too great to permit conclusions about, for instance, trends over time, it is clear that the level of world inequality is extreme, and that it is primarily due to differences in average incomes across countries rather than to intra-country inequality.

## 1. INTRODUCTION

The last decade or so has seen a dramatic expansion in the availability and use of data on income distribution, of summary measures of the degree of income inequality, and of the use of such evidence in discussions of policy. Expanded usage has been followed somewhat belatedly by increasing recognition of some of the weaknesses of the information in question. Inevitably however, conceptual and informational problems continue to create much ambiguity, especially in developing countries, as to what can be meaningfully said about levels of inequality. This paper discusses the inequality of material living standards at the world level, with emphasis on the major sources of uncertainty in the estimates and on their sensitivity to methodological alternatives.

Somewhat different methodological issues and problems arise according to whether one's concern is with (i) measurement of the degree of inequality characterizing a country or specific groups within a country (e.g. regions, groups defined by occupation, etc.); (ii) comparison of the degree of inequality between or among countries (or groups within countries); or (iii) measurement of the degree of inequality within supranational regions (e.g. groups of countries, the world<sup>1</sup>). In general, though, the larger the aggregate under discussion the more problems arise, so estimation of a world distribution involves the problems arising at the national level plus additional ones. We focus here on those we consider to be of greatest importance and those about which some quantitative judgements can be reached.<sup>2</sup>

<sup>1</sup>The difference between the aggregation of regions or other groups which form a country and the aggregation of the countries which form the world should not be exaggerated, since most of the problems which arise differ in degree rather than in kind. But this is a convenient way to distinguish types of problems from each other.

<sup>2</sup>A more detailed discussion appears in a lengthier version of this paper, "How Unequal are Material Standards of Living Within and Between Countries", by the same authors.

Estimates of world distribution reflect, among other things, (i) how the data for different countries are aggregated, i.e. how data are converted between or among currencies, (ii) what indicator of material living standards is used, e.g. pre-tax income, post-tax income, consumption, (iii) the accuracy of the data used, and (iv) the definition of the unit of observation, e.g. the individual, the family. With respect to (ii) and (iv), we accept that the most meaningful indicators of inequality use the person as the unit of observation and that the best measure of a person's relative material well-being is probably his/her lifetime consumption or potential lifetime consumption (e.g. actual consumption plus wealth at end of life).<sup>3</sup> Until recently, however, available data on distribution have referred almost exclusively to income and to households or income earners but not to persons (ranked, for example, by *per capita* household income<sup>4</sup>). Fortunately, it appears that the degree of inequality is in general not greatly different across these cases, so that any one of the distributions gives an approximate idea of the others, with some exceptions.<sup>5</sup>

There is no question that serious deficiencies characterize the basic data used to calculate the income and consumption distributions for many countries. Income data from household surveys, when blown up to an estimate of total personal income (i.e. when multiplied by the ratio of population to the size of the sample), typically amounts to 50 to 80 percent of the national accounts estimate of the same variable when the latter is calculated on the basis of output data.<sup>6</sup> Consumption is more likely to be 70–90 percent of the national accounts

<sup>3</sup>Potential consumption may be greater than actual consumption if the individual places a high enough value on risk aversion, on passing wealth on to the next generation, or on simply being wealthy. Clearly it would be inappropriate to consider a person poor if his wealth is high, even if his consumption is low. In this sense, then, potential consumption is the better measure of material welfare.

<sup>4</sup>The latter measures themselves are, of course, open to the criticism that intra family distribution is not equal.

<sup>5</sup>Morrisson concludes from data on about ten developing countries that the Gini coefficient tends to be a little lower (an average of about 0.03) for the household distribution than for the earner distribution, whereas in developed countries the Gini coefficient may average about 15 percent greater for earner inequality. (See Christian Morisson, "Income Distribution in Less Developed Countries: Methodological Problems", in *Personal Income Distribution*, International Economic Association, 1978, pp. 241–242). There may be a weaker positive relationship between family income and family size in developed countries.

The distribution of persons by *per capita* family income is usually about as unequal as is household distribution in less developed countries (*Ibid.* p. 243). Morisson reports that the Gini ratios are almost identical in Taiwan, Philippines and Trinidad-Tobago whereas in Hong Kong the inequality of personal income is greater (Gini of 0.467 vs 0.417). In Colombia, a small differential in the same direction is observed for 1974 (0.536 vs 0.51—calculations by A. Berry on the basis of data from Marcelo Selowsky, *Who Benefits From Government Expenditures?: A Case Study of Colombia*, Fairlawn, New Jersey, Oxford University Press, 1979). In developed countries, however, household inequality may exceed personal inequality. This conclusion is reached by Kuznets (1974) for West Germany (using his total disparity measure), though he finds about the same level of inequality for the United States. Evidently all these relationships must be studied in many countries before firm generalizations can be made.

<sup>6</sup>For a review of several studies which have calculated this ratio see G. Pfefferman and R. Webb, *The Distribution of Income in Brazil*, World Bank Staff Working Paper #356, p. 18.

estimate.<sup>7</sup> National accounts are more likely to underestimate than to overestimate true values of the variables they seek to measure.

## 2. BENCHMARK ESTIMATES OF WORLD INCOME AND CONSUMPTION DISTRIBUTION

The data base on income distribution used here is from the developed countries and about forty less developed countries. For many L.D.C.s data at the national level is either non-existent or extremely weak.<sup>8</sup> For these countries, we have estimated the distribution of income on the basis of observed relationships between the shares of seven quantiles<sup>9</sup> in countries for which comparable and relatively good quality data do exist and a set of explanatory variables. The validity of a country's distribution data has been judged by direct evidence on the quality of surveys, by the consistency of the results with the national accounts, and by any other indicators available. Adjustments have been made in a number of cases to take account of biases in the original data and to provide conceptual comparability across countries; all figures are designed to reflect the distribution of income among individuals, ranked by *per capita* family income. The distribution of consumption, for which data are available for many fewer countries than in the case of income, is estimated for the capitalist countries on the basis of observed relationships between the two distributions when both are available.<sup>10</sup> For communist countries, the two distributions are assumed to be the same. The robustness of our results in the face of the likely errors implicit in these assumptions is discussed below.

It is well recognized that use of the exchange rate to compare *per capita* income across countries may lead to large errors. The empirical work on this issue, especially by Kravis and associates, has made it possible to use purchasing power parities or reasonable approximations to them for this purpose.<sup>11</sup> The

<sup>7</sup>Very little information exists on the magnitude of understatement by type of respondent. It may be hypothesized, however, that serious inaccuracies characterize the income reporting of independent workers (like farmers), as well as people with multiple sources of income, if only because of the complexity of the calculation needed to arrive at the true figure. In general, it seems probable that capital income will be less well recorded than labour income. There is no presumption that underreporting is similar across income levels, so it is quite probable that it leads to errors in the estimation of relative incomes.

<sup>8</sup>The data presented for these countries in some compilations and analyses are not credible. Jain's survey, for example, is quite complete but does not attempt to categorize countries by the quality of the data. (Shailesh Jain, *Size Distribution of Income: A Compilation of Data*, Washington, World Bank, 1975.)

<sup>9</sup>The bottom four quintiles, the ninth decile, the second 5 percent from the top and the top 5 percent.

<sup>10</sup>In a group of about eight countries where some evidence was available on both the income and consumption distributions, the Gini coefficient averaged about 10 percent higher for the former. (See our "How Unequal . . .", Annex 9.)

<sup>11</sup>For non-communist countries the conversion rate used in our calculations of world income are from I. B. Kravis, A. Heston, and R. Summers, "Real GDP Per Capita for More than One Hundred Countries," *Economic Journal*, Vol. 88, June, 1978. Alternative figures, which may be a little better but whose differences from those of Kravis *et al.* are relatively minor, are put forward by Isenman (Paul Isenman, *Inter-Country Comparison of Real (PPP) Incomes: Revised Estimates and Unresolved Questions*, World Bank Staff Working Paper 358, Nov. 1979). For most socialist countries the rates are based on a variety of sources, discussed in our "How Unequal . . .", Annex 4a. A useful discussion of some of the conceptual and other difficulties involved in these comparisons is R. Marris, *A Survey and Critique of World Bank Supported Research on International Comparisons of Real Product*, World Bank Staff Working Paper No. 365, Dec. 1979.

main source of the inadequacy of the exchange rate as a converter is the existence of different price vectors in different countries. One version of this situation arises because countries provide different services free (i.e. at a zero price) to their populations; the comparison of capitalist and communist countries is especially complicated by this factor.

When binary (two country) comparisons of average income levels are made, although no amount of information permits one to isolate a "correct" purchasing power parity between the two currencies, it is possible under the assumption of the same utility function in the two countries to conclude that the true purchasing power parity lies between two values: those resulting from the application of the price vector of each country to the consumption (or absorption) baskets of both. Although the availability of directly calculated purchasing power parities represents a great improvement over the use of exchange rates, those parities may be quite sensitive to which country's value weights are chosen (or what other price vector is adopted to compare real incomes), as reflected in the fact that relative *per capita* incomes between poor countries and the U.S. can differ

TABLE 1  
RELATIVE PER CAPITA EXPENDITURES OF SELECTED COUNTRIES VIS-A-VIS THE U.S.,  
INCLUDING AND EXCLUDING SERVICES, FOR VARIOUS WEIGHTING SYSTEMS  
(U.S. EXPENDITURES PER CAPITA = 100)

	GDP (1)	GDP, Excluding Government (2)	GDP, Excluding Government, Education, Recreation and Medical Services (3)
Kenya			
U.S. weights	8.6	7.3	6.1
Kenya weights	4.0	4.0	3.6
International weights of Kravis <i>et al.</i>	6.3	5.8	5.5
India			
U.S. weights	8.5	8.0	7.2
India weights	4.3	4.3	4.3
International weights	6.8	6.6	6.8
Colombia			
U.S. weights	21.5	23.4	23.6
Colombia weights	11.8	11.9	12.3
International weights	18.1	18.7	19.8
Italy			
U.S. weights	53.5	57.8	55.9
Italy weights	42.7	45.8	42.2
International weights	49.2	48.8	46.4
Hungary			
U.S. weights	48.4	51.4	45.4
Hungary weights	32.8	34.4	29.8
International weights	42.7	44.9	40.9

Source: Col (1) is taken directly from, and Cols (2) and (3) are calculated on the basis of data presented in, I. B. Kravis, A. Heston, and R. Summers, *United Nations International Comparison Project: Phase II; International Comparisons of Real Product and Purchasing Power*, Baltimore, Johns Hopkins University Press, 1978, pp. 170-177.

by as much as 2:1 according to whether U.S. or the poor country's prices are used. Kravis *et al.*, by using an "international price vector" (average relative prices in the world, therefore giving high weight to the rich countries), come up with an intermediate result, usually somewhat closer to the use of U.S. weights. (See Table 1.)

When one wishes to aggregate across more than two countries, the fact that the true relative income *per capita* between two countries would, assuming the same preference system in each country, lie between that calculated using one country's prices and that calculated using prices of the other country becomes of less value. At a world level, and ignoring some conceptual complexities,<sup>12</sup> one might anticipate that use of a Kravis *et al.* type of "international" price vector would provide a downward biased estimate of world inequality;<sup>13</sup> a probably upward biased estimate might result from a procedure where it is assumed that the relative *per capita* income of each country *vis-à-vis* the U.S. is given by a conversion using its own price vector.<sup>14</sup> These two approaches are used here to provide benchmark Estimates 1 and 2 respectively.

Because data for some socialist countries are less reliable than those for non-socialist countries, while data for others are not statistically or conceptually fully comparable, we have run the estimation procedure both for 124 socialist and non-socialist countries representing 3.6 billion people in 1970 (Table 2) and also for 115 non-socialist countries representing 2.5 billion people. (Table 3)<sup>15</sup> The benchmark distributions are accompanied by several commonly used measures of inequality.

For our full set of countries the overall level of income inequality reported in Estimate 1 is virtually identical (the Gini coefficient is 0.65) to that reported recently by Whalley for 1972, using a similar methodology.<sup>16</sup> The inequality associated with Estimate 2 (where purchasing power parities of each country *vis-à-vis* the U.S. are based on that country's price vector) is as expected somewhat greater though not as great as that which results if country incomes are converted using exchange rates. It seems reasonably probable that, with similar utility functions across countries and disregarding other methodological problems for the moment, the true figure would lie between these two values.

The distribution of world consumption is somewhat less unequal than that of world income for two reasons; first, the savings rate is below average in many of the poorer countries (though the relationship is far from close when the

<sup>12</sup>Especially the fact that there is no obvious interpretation of any comparison of incomes of two groups not based on the relative prices of one of them.

<sup>13</sup>There appears no reason to believe that the true purchasing power parity between two countries would systematically lie closer to the limit defined by one country's prices than to that defined by the other country's prices.

<sup>14</sup>This approach suffers from the conceptual problem of the income relatives not being transitive. But all approaches suffer from one or more conceptual difficulties, so it is not obvious that the resulting calculation is less meaningful in this case than in that of the alternatives. Note also that this estimate is certainly not an upper limit in any sense of the word, nor is Estimate 1 a lower limit.

<sup>15</sup>See the list of countries in the Appendix.

<sup>16</sup>See John Whalley, "The Worldwide Income Distribution: Some Speculative Calculations", *Review of Income and Wealth*, Series 28, No. 3, Sept. 1979. Whalley converted incomes to a common base using the Kravis *et al.* purchasing power parities based on an international price vector, as we have for Estimate 1.

TABLE 2  
ESTIMATES OF WORLD PERSONAL INCOME AND CONSUMPTION DISTRIBUTIONS IN 1970  
(124 SOCIALIST AND NON-SOCIALIST COUNTRIES)

	Income (G.D.P.)		Consumption	
	Estimate 1 <sup>a</sup>	Estimate 2 <sup>b</sup>	Estimate 1 <sup>a</sup>	Estimate 2 <sup>b</sup>
Income or consumption shares (%):				
Decile 1	0.72	0.51	1.01	0.73
Decile 2	1.22	0.89	1.51	1.12
Decile 3	1.65	1.17	2.09	1.51
Decile 4	2.14	1.55	2.59	1.89
Decile 5	2.69	1.91	3.75	2.41
Decile 6	2.95	3.01	4.72	3.67
Decile 7	7.02	6.29	7.58	7.13
Decile 8	11.81	11.34	12.30	11.61
Decile 9	19.45	20.62	19.02	20.29
Second 5% from top	15.47	16.58	14.86	16.16
Top 5%	33.88	36.13	30.97	33.50
Inequality measures:				
Gini	0.649	0.693	0.609	0.659
Theil	0.797	0.923	0.685	0.814
Mean log deviation	0.845	1.043	0.702	0.885
Atkinson 1 ( $\epsilon = 0.75$ )	0.472	0.543	0.413	0.487
Atkinson 2 ( $\epsilon = 0.50$ )	0.345	0.399	0.299	0.355
Atkinson 3 ( $\epsilon = 0.25$ )	0.187	0.217	0.161	0.192
Variance log	1.580	1.985	1.296	1.656
Mean of top 5%	94.1	141.7	61.3	91.8
Mean of bottom 20%				
Mean World	0.247	0.233	0.255	0.238
Mean U.S.				

<sup>a</sup>National figures converted to a common base using the purchasing power parity conversion rates estimated by Kravis *et al.*, "Real G.D.P. *per capita*...", for capitalist countries and World Bank estimates for the socialist countries.

<sup>b</sup>Country values converted to U.S. dollars using own country weights.

socialist countries, and in particular China, are taken into account); second, the assumed intra-country distribution of consumption is less unequal than the income distribution.<sup>17</sup> Decomposition analysis of Theil's coefficient shows that the first effect accounts for approximately 70 percent of the fall in inequality,<sup>18</sup> a result attributable to the fact that although the inequality of intra-country income distribution is in general greater than that of consumption distribution, the difference is moderate.<sup>19</sup> Further, intra-country variance, whether of income

<sup>17</sup>A third factor, the difference between consumption purchasing power parities and income purchasing power parities, appears to have a mild tendency to increase inequality of world consumption relative to that of world income.

<sup>18</sup>A more extensive decomposition analysis of the Theil coefficient is undertaken below (see section 6).

<sup>19</sup>See the discussion in Berry *et al.* "How Unequal. . .", Annex 9.

TABLE 3  
ESTIMATES OF THE PERSONAL INCOME AND CONSUMPTION DISTRIBUTIONS OF  
NON-SOCIALIST COUNTRIES IN 1970 (115 COUNTRIES)

	Income (G.D.P.)		Consumption	
	Estimate 1 <sup>a</sup>	Estimate 2 <sup>b</sup>	Estimate 1 <sup>a</sup>	Estimate 2 <sup>b</sup>
Income or consumption shares (%):				
Decile 1	0.58	0.41	0.84	0.60
Decile 2	0.82	0.59	1.13	0.81
Decile 3	1.23	0.90	1.59	1.21
Decile 4	1.69	1.27	2.18	1.64
Decile 5	2.35	1.75	3.01	2.25
Decile 6	3.81	2.96	4.65	3.68
Decile 7	6.41	5.84	7.06	6.66
Decile 8	11.35	10.88	11.87	11.19
Decile 9	21.01	22.01	20.20	21.54
Second 5% from top	17.20	18.28	16.75	17.96
Top 5%	33.44	35.10	30.73	32.46
Inequality measures:				
Gini	0.676	0.709	0.635	0.675
Theil	0.860	0.964	0.739	0.850
Mean log deviation	0.976	1.167	0.805	0.981
Atkinson 1 ( $\epsilon = 0.75$ )	0.518	0.578	0.454	0.519
Atkinson 2 ( $\epsilon = 0.50$ )	0.378	0.424	0.328	0.377
Atkinson 3 ( $\epsilon = 0.25$ )	0.203	0.229	0.175	0.202
Variance log	1.901	2.330	1.541	1.915
Mean of top 5%				
Mean of bottom 20%	115.3	171.2	73.2	108.2

<sup>a</sup>National figures converted to a common base using the purchasing power parity conversion rates estimated by Kravis *et al.*, "Real G.D.P. *per capita* . . .", for capitalist countries and World Bank estimates for the socialist countries.

<sup>b</sup>Country values converted to U.S. dollars using own country weights.

or consumption, is not the dominant source of worldwide inequality, which is mainly due to variance between countries.<sup>20</sup>

Inequality is somewhat higher for the set of non-socialist countries (Table 3) than for the world. The range given by Estimates 1 and 2 for the Gini coefficient of the income distribution is 0.68–0.71, whereas it was 0.65–0.68 when socialist countries were included. Although all inequality measures are in agreement on that point, it must be noticed that no distribution strictly dominates the other in terms of the Lorenz curve,<sup>21</sup> whereas this is true when comparing consumption and income distributions for one or the other sample of countries.

These figures indicate that about 50 percent of the world's goods and services go to the top 10 percent of persons (46–53 percent according to which column of Table 2 we use) while the bottom 20 percent get only 1.4 to 2.5 percent; on

<sup>20</sup>For example, in Estimate 1 of world income distribution, the Theil coefficient would be 0.51 even if distribution was perfectly equal within each country, while the actual Theil coefficient was 0.80.

<sup>21</sup>In the non-socialist distribution, the income of the 9th decile and the second 5 percent from the top are higher, whereas that of the bottom of the distribution and the top 5 percent are lower, as compared to the world distribution.

a *per capita* basis the top decile thus fares about 40–50 times as well as the bottom quintile. The Gini coefficient ranges between 0.60 and 0.69 and the Theil coefficient between 0.68 and 0.92. The degree of inequality is probably not equalled within any country, even that with the worst inequality. In Rhodesia, with its extreme inequality in 1970, the income shares of the top decile and the bottom quintile are estimated to have been 45 percent and 8 percent respectively.

### 3. DEGREE OF POSSIBLE ERROR OF THE BENCHMARK ESTIMATES

The above figures could err for many reasons, as is evident from our earlier discussion. But consideration of the probable margins of error associated with the various sources of error suggests that they are rather robust.

#### 3(i). *Errors in Estimates of Relative Purchasing Power of Different National Currencies*

As noted above, the presence of different price vectors in different countries means that the real incomes of one country relative to another can only be specified as falling within a range; the gap between our Estimates 1 and 2 reflects this fact, though it must be recalled that they do not provide absolute lower and upper limits to the degree of world inequality.<sup>22</sup> Such limits would be firm ones if (a) we had chosen the combination of weights which, in converting to a single base, respectively minimized and maximized inequality,<sup>23</sup> and (b) if purchasing power parities calculated directly from price data were available for each country—in fact Kravis *et al.* parities for 1970 were available only for 16 countries, while those for other countries were, as noted above, estimated on the basis of regression equations. Two issues arise here: first, how accurate are the regression based parities, and second, how sensitive are the parities based on detailed price data to possible changes in country price vectors, e.g. those which might occur in a short period of time. A comparison of the most recent (1975) Kravis *et al.* parities<sup>24</sup> with those of 1970 suggests that world distribution is not very sensitive to these problems. Table 4 presents the 1975 *per capita* income relatives of 29 other non-socialist countries *vis-à-vis* the U.S., based on detailed price data of that year (Col. 1), and 1975 *per capita* income relatives estimated earlier by these authors on the basis of the 1970 purchasing power parity data (Col. 2). For 13 of these countries included in the Kravis *et al.* study for 1970, the 1975 relative incomes (extrapolated from the 1970 relatives on the basis of growth of GDP *per capita* in each country measured with its internal price vector and change in the terms of its international trade) differ rather little on average from the actual 1975 relatives of Col. 2. The unweighted average difference (regardless of direction) is 2.6 percentage points; the average net difference when positive and negative differences partially cancel each other out is 1.7 percentage points. These differences reflect the sensitivity of purchasing-

<sup>22</sup>Even in the absence of any of the possible sources of error discussed below.

<sup>23</sup>The weights chosen would have to be different depending on the inequality indicator used.

<sup>24</sup>For the 1975 parities see Irving B. Kravis, Alan Heston, and Robert Summers, *World Product and Income: International Comparisons of Real Gross Product*, Baltimore, Johns Hopkins Press, 1982.

TABLE 4  
ALTERNATIVE ESTIMATES OF 1975 PER CAPITA INCOME RELATIVES OF THIRTY  
COUNTRIES

	Based on 1970 Price Data and 1970-75 Trends in <i>Per Capita</i> Income and Terms of Trade (1)	Based on 1975 Price Data (2)
Malawi	4	4.90
Kenya*	6	6.56
India*	7	6.56
Pakistan	9	8.23
Sri Lanka	9	9.30
Zambia	14	10.3
Thailand	11	13.0
Philippines*	13	13.2
Korea*	16	20.7
Malaysia*	18	21.5
Colombia*	19	22.4
Jamaica	24	24.0
Syria	19	25.0
Brazil	31	25.2
Mexico	28	34.7
Iran*	44	37.7
Uruguay	33	39.6
Ireland	44	42.5
Italy*	48	53.8
Spain	45	55.9
U.K.*	62	63.9
Japan*	66	68.4
Austria	59	69.6
Netherlands*	72	75.2
Belgium	80	77.7
France*	80	81.9
Luxembourg	75	82.0
Denmark	75	82.4
Germany*	81	83.0
U.S.*	100	100.0

\*Included in Kravis *et al.* 1970 sample of countries for which detailed price information was obtained.

Sources: 1970, Kravis, *et al.*, *International Comparisons of Real Product*, Basic Data Table. 1975, Kravis *et al.*, *World Product and Income*, p. 15.

power-parity-based income relatives between any two countries to changes in the international price vector used to effect the comparisons and/or to differences in the quality of data. For the other 16 countries the figures of Col. (1) are estimates based on Kravis *et al.*'s regressions explaining the exchange rate deviation as a function of *per capita* income and other variables. The figures of Cols. (1) and (2) could differ either because the 1970 estimates were inaccurate (they were not based on price data for these countries) or because of the reasons mentioned for the other 13 countries. As expected, the discrepancies between the two figures are somewhat greater than for the 13; the unweighted average difference is 4.6 percentage points and the average net difference 3.1 percentage points. In a few cases (e.g. Spain, Austria) the discrepancies are striking.

TABLE 5  
ELASTICITIES OF THE WORLD THEIL COEFFICIENT WITH RESPECT TO PER CAPITA INCOMES  
AND THEIL COEFFICIENTS OF SELECTED COUNTRIES AND GROUPS OF COUNTRIES, 1970

Country or Group of Countries	Weight in world population (%)	Index of income per capita (U.S. = 100)	Elasticity of the world Theil coefficient with respect to national or regional per capita income <sup>1</sup> (×100)	Elasticity of the world Theil coefficient with respect to national Theil coefficients <sup>2</sup> (×100)
Burundi	0.09	3.6	-0.04	0.01
Honduras	0.07	12.3	-0.03	0.03
Lebanon	0.08	22.4	-0.03	0.05
Uruguay	0.08	61.3	-0.01	0.05
New Zealand	0.08	61.3	0.07	0.04
Mali	0.14	2.9	-0.05	0.01
Afghanistan	0.40	3.6	-0.17	0.03
Kenya	0.31	7.0	-0.14	0.09
Peru	0.37	22.0	-0.13	0.25
Belgium	0.27	61.8	0.32	0.22
Ethiopia	0.69	3.9	-0.32	0.05
South Korea	0.88	13.2	-0.74	0.13
Colombia	0.61	15.8	-0.35	0.26
Poland	0.91	41.9	-0.11	0.41
Canada	0.60	77.5	1.40	0.59
Bangladesh	1.98	4.0	-0.91	0.14
Nigeria	1.85	5.6	-0.96	0.20
Brazil	2.59	18.9	-0.89	1.76
Japan	2.92	55.9	1.88	1.72
France	1.42	72.1	2.99	1.57
India	15.05	5.8	-8.34	1.64
China	23.69	7.8	-16.59	1.66
U.S.S.R.	6.79	46.1	0.23	3.00
U.S.A.	5.73	100.0	25.72	8.26
East-European Socialist countries <sup>3</sup>	4.13	10.25	-0.48	44.5
All developing non- Socialist countries	11.10	46.41	-23.20	9.6
Developed non- Socialist countries	20.28	19.65	23.68	70.2
All countries	35.51	100.00	0.0	26.7

<sup>1</sup>Variation of World Theil for a 1% increase of the country's (region's) G.D.P. per capita.

<sup>2</sup>Variation of World Theil for a 1% increase of Theil coefficient within countries. In the case of groups of countries, the Theil coefficient has been increased by 1% for each country.

<sup>3</sup>Excluding the U.S.S.R.

While it is evident from Table 4 that cross country comparisons of *per capita* income may be somewhat sensitive to the international price vector chosen, and that estimates not based on price data for the country in question may involve considerable error, these are not serious problems for the estimation of world income distribution. The intercountry distribution of income for the 30 countries

listed in Table 5 is, for example, characterized by Gini coefficients of 0.733 if one uses the figures of Col. (1) and 0.748 if one uses those of Col. (2), an insignificant difference.<sup>25</sup> While this 1970–1975 comparison is only one test of the robustness of the world distribution to possible short run variation in purchasing power parities, it strongly suggests that this is not a significant source of difficulties.

### 3(ii). *Elasticity of World Inequality with Respect to Individual Country Income and Distribution Data*

One test of the robustness of our benchmark estimates of world inequality in 1970 (Tables 2 and 3) is provided by computing the elasticities of those estimates with respect to the income and distribution data of countries or groups of countries. As an example, a reduction of 20 percent in the estimates of *per capita* incomes for East-European countries (for which the estimation of a correct purchasing power parity exchange rate is at this time problematic) leads to almost no change in the world Gini coefficient (0.648 instead of 0.649) or the world Theil (0.792 instead of 0.797) for Estimate 1 of Table 2, although the shape of the Lorenz curve is somewhat affected. In fact, the sensitivity of the world Theil coefficient to income and distribution data for individual countries is very small except for some large countries like India, China and the U.S.A.<sup>26</sup> The elasticities of the world Theil coefficient for a selected set of countries are reported in Table 5. With the exception of China it seems quite unlikely that errors in specific county estimates of income *per capita* or its distribution would significantly bias the world measure. Serious errors are thus much more likely to come from systematic errors for *groups* of countries. Such systematic errors are unlikely for non-socialist developed countries where statistical information is uniformly of a rather good quality. Data for non-socialist developing countries are certainly much less satisfactory. One major possible source of systematic bias in the estimate of their *per capita* income (in international prices) relative to developed countries—the exchange rate used in the calculations—has already been accounted for by the distinction between Estimates 1 and 2 (Tables 2 and 3). As far as inequality figures in those countries are concerned, Table 4 indicates that even a downward bias of say 15 percent in all of them, which seems an extreme assumption, would not produce more than a 1.7 percent change in the world Theil coefficient—i.e. that coefficient would be 0.810 instead of 0.797 in Table 2 (Estimate 1). For European socialist countries, we have already seen that world inequality was little sensitive to the estimate of their level of income *per capita*. The same is true for inequality within those countries (the elasticity is 0.04).

<sup>25</sup>Our choice of 1970 as the benchmark year for our calculations thus loses little from the fact that Kravis *et al.* had price data for only 16 countries in that year but for 34 in 1975. While error related to the accuracy of estimates of the relative purchasing power of currencies would have been a shade less in 1975, the information on country income distributions would have been considerably less, so on balance 1970 appears the safer bet.

<sup>26</sup>The small income elasticity for the U.S.S.R. comes from its standing roughly at the middle of the world income distribution.

It remains then to examine the cases of India and China. For the former a 10 percent in the income estimate<sup>27</sup> would produce less than a 1 percent change in the overall Theil coefficient. For China, a 20 percent error is perhaps possible in which case Estimate 1 in Table 2 would change by 3.2 percent, i.e. rising to 0.822 in the case of a 20 percent reduction of the Chinese income.<sup>28</sup> China, however, is clearly an exception, being the country with the most unreliable data and the greatest possible impact on world inequality. Even in this extreme case, the order of magnitude of the potential bias in our estimates of overall inequality is hardly dramatic.

With the possible exception of China, then, it is clear that the estimates of world distribution are not seriously sensitive to errors in single country data and, more generally, are unlikely to be far from the true values unless the statistics of many nations err in the same direction, a phenomenon which might occur if there are systematic sources of error affecting the data of many countries. We now turn to several possibilities of this sort.

### 3(iii) *Systematic Errors in Estimates of Per Capita Income and Consumption of Countries*

Our benchmark estimates of world distribution could be wide of the mark if there were a general tendency for differences between national accounts estimates and true values to be related to average incomes of countries. The most likely sort of errors are downward biases due to various sorts of underreporting of income or output, and a general tendency not to estimate unreported income or output. Such a bias is probably greater in poorer countries than in developed ones. Underreporting might be expected to lie frequently in the range of 5–20 percent in L.D.C.s but to seldom exceed 10 percent in developed countries. If the relative underestimate were a positive function of income and averaged 15 percent for the poorest countries *vis-à-vis* the richest, this would imply a fall in our Estimate 1 Theil coefficient of about 3.5 percent, or from 0.80 to 0.77. The percent fall in the Gini coefficient would probably be a little less.

### 3(iv) *Differences in Age Structure across Countries*

The use of *per capita* income or consumption as a measure of welfare creates a bias against the poorer countries because of their higher population growth rates and correspondingly younger populations.<sup>29</sup> Applying the same conversion

<sup>27</sup>The difference between Estimates 1 and 2 already takes account of income errors due to conversion. Errors could also be the result of inadequate national accounting procedures, or errors in population.

<sup>28</sup>Different sources vary considerably in their local currency estimates of *per capita* income or output. A recent discussion is Dwight Perkins, "Issues in the Estimation of China's National Product," in Alexander Eckstein (editor), *Quantitative Measures of China's Economic Output*, Ann Arbor, University of Michigan Press, 1980. Further, estimating the purchasing power parity of the Chinese currency is more difficult than for most countries.

<sup>29</sup>Further, it may be generally true that within countries the distribution of income (or consumption) among adult equivalents is a little less unequal than that among persons; this would be expected where families with less income per adult tend to have more children than better off families. We have not attempted any adjustment for this factor here.

factors in all countries, the ratio of adult equivalents to people is 12 percent higher in the U.S., for example, than in a very poor country like Bangladesh.<sup>30</sup> Taking this factor into account leads to a modest reduction in estimated world inequality. For example, correcting consumption *per capita* figures by the ratio of adult equivalents per person, with the person as the population unit, brings

TABLE 6  
BENCHMARK ESTIMATES OF WORLD DISTRIBUTION OF CONSUMPTION AMONG  
ADULT-EQUIVALENTS<sup>1</sup>

	Distribution of Consumption Among Persons Ranked by Family Consumption per Adult Equivalent		Distribution of Consumption Among Adult-Equivalents Ranked by Family Consumption per Adult-Equivalent	
	Estimate 1	Estimate 2	Estimate 3	Estimate 4
Consumption Shares (%):				
Decile 1	1.09	0.80	1.06	0.76
Decile 2	1.63	1.22	1.59	1.18
Decile 3	2.25	1.63	2.21	1.58
Decile 4	2.79	2.06	2.74	2.05
Decile 5	3.56	2.59	3.53	2.57
Decile 6	5.06	3.96	5.32	4.21
Decile 7	7.71	7.30	7.94	7.62
Decile 8	12.48	11.79	12.60	12.14
Decile 9	18.62	19.93	18.70	19.94
Second 5% from top	14.48	15.84	14.48	15.86
Top 5%	30.33	32.88	29.84	32.09
Inequality Measures:				
Gini	0.594	0.646	0.593	0.643
Theil	0.652	0.780	0.642	0.764
Mean log deviation	0.659	0.835	0.660	0.834
Atkinson 1 ( $\epsilon = 0.75$ )	0.394	0.468	0.393	0.466
Atkinson 2 ( $\epsilon = 0.50$ )	0.285	0.341	0.283	0.338
Atkinson 3 ( $\epsilon = 0.25$ )	0.153	0.184	0.151	0.181
Variance log	1.213	1.557	1.236	1.592
<hr/>				
Mean consumption of top 5%				
Mean consumption of bottom 20%	0.556	0.822	0.563	0.844
<hr/>				
Mean World consumption	0.263	0.244	0.274	0.256
Mean U.S. consumption				

<sup>1</sup>In Cols. (1) and (2) for a family of 6 persons and 4 adult equivalents whose total consumption is  $x$  a consumption of  $x/4$  is imputed to each of the 6 people, whereas in Cols. (3) and (4) in the same situation  $x/4$  is imputed to each of the four adult equivalents.

<sup>30</sup>The following conversion factors have been used: 0.3 for children less than 5 years old, and 0.6 for children between 5 and 15.

the world Gini (Theil) coefficient down from 0.61 (0.69) to 0.59 (0.65) for Estimate 1.<sup>31</sup> (compare Tables 6 and 2.)

### 3(v). *Effects of Fiscal (Tax and Expenditure) Policy*

The literature well demonstrates the complexity of measuring with precision the impact of fiscal activities on income distribution. Complicated matters of tax incidence arise, and the distribution of the benefits of government expenditures is little studied. In terms of judging the impact of fiscal activities on the world distribution, however, these problems are less severe than might at first appear. For developed capitalist countries, some general information is available on the incidence of some taxes and some expenditures, and it is clear that the total redistributive effect can be substantial. In many L.D.C.s the public sector's activities are too small to have a major impact even if the typical dollar involved has a considerably progressive effect. In socialist countries the expenditure incidence is hard to estimate.<sup>32</sup>

To illustrate the possible effects of fiscal activities on world distribution, we have tried to get some idea of their redistributive impact within each country from the level of government receipts (direct and indirect taxes) and expenditures (education, social security and health, subsidies to the agricultural sector) relative to private consumption expenditures, under the assumption of a more or less constant progressivity<sup>33</sup> of the typical dollar involved in those operations. This has been done by reference to a small sample of countries assumed to be representative of both developing and developed countries.<sup>34</sup> Socialist countries have been excluded from this analysis because of the almost complete lack of data for them.<sup>35</sup>

Table 7 gives an estimate of the world post-tax and transfer income distribution for non-socialist countries. It has been obtained from Table 3 by simply adjusting intra-country distributions for the impact of fiscal activity, keeping

<sup>31</sup>Were the adult equivalent chosen as the population unit, there would be almost no change in any of the summary measures. The Lorenz curves corresponding to the two cases (distribution of income among persons, ranked by *per capita* family income and distribution of income among adult-equivalents, ranked by per adult equivalent family income) would cross each other twice at the middle of the distribution. There is nothing abnormal in such a result. Replacing persons by adult equivalents increases the weight of rich countries since children are a smaller percent of their population. This necessarily increases the income (or consumption) share of the middle of the distribution and reduces that of both the bottom and the top, the result which emerges in Table 6. Part of the decrease is due to the fact that when the population unit is the adult equivalent rather than the person, the share of population units in the countries with fast growing populations falls (the other side of the coin being the increase in income per population unit). An interesting related question is whether after this adjustment one is overestimating inequality among the world's adults and underestimating that among the world's children or vice versa. Relative consumption of children *vis-à-vis* adults appears to be lower in some of the very poor countries.

<sup>32</sup>The redistribution effects of public expenditures are in part already taken into account to the extent that the distributions we are using include services rendered in kind by the state to households.

<sup>33</sup>For a definition of this concept, see N. Kakwani, "Measurement of tax progressivity: an international comparison", *The Economic Journal*, vol. 87, 1977.

<sup>34</sup>This estimation relies essentially on C. Morrisson. "Income Distribution in Less Developed Countries. . .". See our "How Unequal. . .", Appendix G, for details.

<sup>35</sup>Although it would perhaps not have been too rough to assume identity between pre- and post-tax and transfer distributions.

TABLE 7  
EFFECTS OF FISCAL ACTIVITIES ON WORLD INEQUALITY  
(NON-SOCIALIST COUNTRIES)

	Pre TTE <sup>a</sup> Incomes (GDP/Capita)		Post TTE <sup>a</sup> Incomes (GDP/capita)	
	Estimate 1	Estimate 2	Estimate 3	Estimate 4
Income shares (%):				
Decile 1	0.58	0.41	0.62	0.44
Decile 2	0.82	0.59	0.88	0.63
Decile 3	1.23	0.90	1.35	0.96
Decile 4	1.69	1.27	1.81	1.33
Decile 5	2.35	1.75	2.50	1.91
Decile 6	3.81	2.96	4.01	3.12
Decile 7	6.41	5.84	7.74	6.49
Decile 8	11.35	10.88	13.41	13.78
Decile 9	21.01	22.01	21.19	22.48
Second 5% from top	17.30	18.28	16.46	17.38
Top 5%	33.44	35.10	30.05	31.49
Inequality measures				
Gini coefficient	0.676	0.709	0.649	0.685
Theil coefficient	0.860	0.964	0.770	0.871
Mean Log deviation	0.976	1.167	0.908	1.098
Atkinson 1	0.518	0.578	0.488	0.552
Atkinson 2	0.378	0.424	0.350	0.398
Atkinson 3	0.203	0.229	0.185	0.210
Variance log	1.901	2.330	1.848	2.292

<sup>a</sup>Taxes, transfers and expenditures.

constant the mean *per capita* income in each country or, in other words, assuming that fiscal activity had a pure redistributive function.<sup>36</sup> World inequality falls somewhat, although less than when going from the income to the consumption distribution (Table 3). It may be noticed, however, that the percent decrease in the Theil index is much larger than that of the Gini coefficient (about 10 percent instead of 3–4 percent) reflecting the fact that fiscal redistribution is much more important in developed than in developing countries and is therefore mostly within the top half of world population, more precisely within deciles 7 to 10. The income share of the 10th decile falls by 4–4.5 percentage points depending on whether we use Estimate 1 or Estimate 2 (e.g. from 53.38 to 48.87 in Estimate 2) to the benefit mainly of deciles 7 and 8. The changes are thus significant but localized.

### 3(vi) *Distribution of Lifetime Income (Consumption) Contrasted With Distribution of Current Income (Consumption)*

A widely recognized source of ambiguity or error in income distribution estimates is the fact that income varies with age. An observed point of time

<sup>36</sup>It would have been preferable to perform those computations starting from households' primary income. As these data were generally unavailable, Table 7 gives estimates derived from GDP/capita.

distribution (whether of earners, persons or families) reflects both the distribution among units (e.g. earners or family heads) of a given age category and differences in the average income across age categories, with the overall distribution showing greater inequality than that of the typical age cohort. Thus in a society where incomes are typically much lower for young people than for those in mid career, the overlife distribution among earners could be much more egalitarian than the distribution at a point of time.

Having accepted that the distribution of lifetime income (or consumption) is of greater interest than that of current income (or consumption), one must still decide (i) how to aggregate income (consumption) occurring at different points of time and (ii) for what group one wishes to assess inequality. A relatively manageable alternative is to focus on the probable over-life income (or consumption) of persons currently falling in a given age range, as best it can be judged by whatever data is available. Due to the serious additional complexities of most other alternatives, we here limit ourselves to an illustrative and partial discussion of this one.

Even in the statistically best endowed countries, estimating inequality of lifetime income among the individuals making up a cohort (e.g. a middle aged one) requires a number of arbitrary assumptions.<sup>37</sup>

A particularly difficult problem is the procedure to deal with the aggregation of over lifetime income into one figure.<sup>38</sup> Should a discount rate be used, and if so should it be the same for each person?<sup>39</sup> In the case of income earners, inequality within a typical age cohort is less than for the universe, since the age-experience related variance is removed. But when one considers all persons, not just earners, the result is more difficult to predict and there is little empirical information to guide one.

For the household income distribution, one can get some feel for the possible effects of using a lifetime income measure. Applying the decomposability property of the Theil coefficient, Morrisson reports that household income differences across age cohorts (defined by age of household head) account for only 1–3 percent of the total value of the Theil coefficient for a group of L.D.C.'s as compared to 11 percent for the U.S. (partly though not mainly because total inequality is less in the U.S., of course.)<sup>40</sup> Using these figures as a guide we have calculated the effects on the world Theil coefficient of reducing by 10 percent the Theil coefficient of each developed country and by 3 percent that of each L.D.C. to be a modest reduction of 2.5 percent.<sup>41</sup> The effect of taking account

<sup>37</sup>The guesswork must be multiplied, however, when older and younger cohorts are also included; among other things, future economic growth rates become a major determinant of the income differential between today's older and younger cohorts.

<sup>38</sup>There seems to be no strong conceptual reason to discount at all, nor even any powerful arguments for discounting to one point in the life cycle as opposed to another. It seems that both ex-ante distributions which take into account uncertainty and ex-post ones which do not are of interest. Length of life, which is taken account of in any aggregation procedure, is likely to be a significant source of inequality of welfare.

<sup>39</sup>This and other issues related to the matter of lifetime incomes are discussed in Milton Moss, "Income Distribution Issues Viewed in a Lifetime Income Perspective", *Review of Income and Wealth*, Series 24, No. 2, June, 1978.

<sup>40</sup>See the discussion in Christian Morrisson, "Income Distribution. . .", *op. cit.*, pp. 244–249.

<sup>41</sup>The calculation is based on the elasticities of the world Theil with respect to the intra-country inequalities.

of the life cycle in the most relevant way could be rather different from this. First, even for the household income distribution to which these figures refer, they provide a weighted average level of intra age-cohort inequality, which would not necessarily be equal to over lifetime inequality of a cohort.<sup>42</sup> Second, they refer to households rather than individuals; we have little information on life cycle income of persons but it would not be surprising if it varies less with age than that of households does with age of household heads. A final consideration involves length of lifetime. If it were taken into account along with average income over lifetime to give a measure of total lifetime welfare, lifetime inequality could be higher than point of time inequality for a given cohort, since average length of life is greater for rich people than for poorer ones.<sup>43</sup> An adequate treatment of the issue would require some information on people's preferences as between higher income and longer life.<sup>44</sup> Estimates of the impact of allowing for life expectancy have been made by Morrisson for four L.D.C.s by estimating average life expectancy of different income cohorts and summing lifetime income; the Gini coefficients rose by 0.046 to 0.059 (or by 3.8 to 8.2 percent of their bases). These calculations implicitly assumed no change in the income ranking of persons over the life span, so in this sense they tend to provide an upper limit estimate of the increase in inequality as one shifts to this sort of over lifetime calculation. They also assumed a unit elasticity of the welfare index with respect to length of life. The effects of this factor on world inequality would reflect also the greater average life expectancy in the richer countries.

To summarize, the net effect of the adjustments necessary to move from a point of time distribution to a lifetime distribution is negative but probably of modest proportions as long as length of life is not taken into account, i.e. as long as the welfare measure reflects average annual income (or consumption) but not years of life. Perhaps the Theil coefficient would be reduced by 5 percent

<sup>42</sup>It may be surmised that lifetime distribution would be less equal than an average of the observed age specific distributions since for the two to be equal there would have to be no change over time in the relative ranking of different individuals. Yet some changes of rank are sure to happen because of changing relative incomes for earners, of shifts between the earner category and the non-earner category, and of changes in the income position of the family to which one is attached (for non-earners), e.g. when a non-participating woman marries and moves from her parents' household to her husband's. But there is very little evidence to help one to guess the extent of the needed adjustment. Virtually all of the evidence on the over time age-income relationships seems to refer to earners. (A useful recent study is the simulation made by I. Irvine for Canada. The age-corrected cross-sectional Theil coefficient in that country is approximately 0.18 whereas Irvine found that the corresponding figure for the discounted life-time incomes of a middle-aged cohort in an economy growing at an annual rate of 3 percent was of the order of magnitude of 0.10. ("On the Use of Cross-Section Microdata in Life Cycle Models: An Application to Inequality Theory in Nonstationary Economies", *Quarterly Journal of Economics*, Vol. XCVI, No. 2, May 1981.

<sup>43</sup>See the discussion in Morrisson, "Income Distribution. . .", *op. cit.*, pp. 249-254. He notes that in France life expectancy at 30 for unskilled workers is 34 years while that of executives is 40 years. This would imply a difference of somewhat more than 6 years for total life expectancy. Comparisons across occupational groups or regions in L.D.C.s frequently seem to indicate differentials of 10-15 years (e.g. rural areas of Algeria vs. Algiers, poorer districts of Argentina vs. Buenos Aires).

<sup>44</sup>A. B. Atkinson and F. Bourguignon consider precisely that issue in "The Comparison of Multi-dimensional Distributions of Economic Status", Document No. 33, Paris, Ecole Normale Supérieure, Nov. 1980.

Another treatment of this issue is by Dan Usher in *The Measurement of Economic Growth*, Oxford, Basil Blackwell, 1980. He considers the effect of allowing for increases in life expectancy on the rate of growth of welfare, by assuming a tradeoff between longer life and higher consumption.

or thereabouts.<sup>45</sup> When length of life is allowed for an upward adjustment is necessary, one whose extent cannot be gauged even approximately without specification of how length of life enters the utility function, but whose magnitude could be comparable to the downward adjustments. Thus much more information is needed on expected lifetime inequality of persons and on preferences with respect to length of life before any firm conclusions can be reached about world inequality of lifetime income or consumption. For the moment, there is no reason to believe it differs much from point of time distribution.

### 3(vii) *Possible Misreporting of Relative Incomes (Intra-Country)*

The income data used to estimate levels of inequality are quite deficient in many countries, especially L.D.C.s. But misreporting is only a serious problem when the degree varies across groups. Biases which may exist in the data of most countries, especially in L.D.C.s, are a relative underestimation of the real incomes of persons in rural areas or small towns, and of the highest income people.

One source of relative underestimation of rural income is a systematic tendency for prices to be lower in rural areas.<sup>46</sup> If to this price differential is added the probably greater average underreporting of many independent farm families, the potential overestimation of inequality becomes greater. Further, a difference in relative prices between rural and urban areas may work in the same direction; it is the essentials, food and housing, which usually cost less in rural areas. Finally, number of children is usually higher in rural than in urban areas, so that the ratio of persons per adult equivalent is higher and the inequality of income among persons exaggerates that among adult equivalents.

Some feel for the possible upward bias in the estimates of internal inequality due to these sources of relative underestimation of rural incomes is provided by estimates we have made for Colombia and the Philippines. A 1971 household survey implies a Gini coefficient of 0.512 for the household income distribution in Colombia; if the incomes of all rural families were raised by 50 percent the Gini coefficient would instead be 0.478, or 6.7 percent lower. At this time 37 percent of Colombia's households were rural and the urban/rural average household income ratio was 2.5 : 1. In the Philippines (also 1971), the same adjustment reduces the Gini coefficient from 0.49 to 0.45, a drop of 8.2 percent. Here 70 percent of families were rural and the urban to rural income differential was 2.1 : 1. The effect of the adjustment would be greatest in countries with a large rural-urban income differential and with a substantial share of the population in both rural and urban areas. The two countries cited are probably fairly typical.

<sup>45</sup>The estimated reduction of 2.5 percent cited above refers to only one of two needed adjustments, and is based on data on the household distribution rather than the personal distribution.

<sup>46</sup>The issue has received little empirical study; calculations of the cost of specific consumption baskets often indicate differences of 10–25 percent between rural and urban areas (For a discussion see our "How Unequal..."). A number of factors complicate this issue. Evidently some items are cheaper in rural areas (notably agricultural products of the area) and others in urban areas (manufactured goods, imports, etc.). Access to some items, including important services such as education and medical care, is often much more limited in rural areas. We have seen no studies which, taking account of this aspect, have estimated rural/urban cost of living differences.

Relative underestimation of upper incomes is widely believed to exist in the data of most countries. Greater underreporting of capital income (including capital gains) than of labour income would contribute to this,<sup>47</sup> as would the general failure of samples to include the highest income families. If 10 percent of national income were to accrue unreported to the very top income families, the effect on the Gini coefficient would in many countries be very similar in magnitude (but of the opposite sign) to the adjustment for relative underestimation of rural incomes, i.e. the two would tend to cancel each other. The same would not necessarily be true of other indicators, nor would the relative importance of these two biases be similar across all countries. But in our world distribution there seems a considerable likelihood that they would in large part cancel each other out.

#### 4. LEVEL OF WORLD INEQUALITY: SUMMARY

Among our benchmark estimates, the combination of assumptions which generates the lowest level of inequality (Est. 1 for consumption, see Table 2) produces Gini and Theil coefficients of 0.61 and 0.685 respectively for the world distribution, while Est. 2 for GDP embodying the assumptions which generate the highest level of inequality produces Gini and Theil coefficients of 0.69 and 0.92 respectively.

The measured level of world inequality depends, naturally, on the variable one is considering. It is less for post-TTE (tax, transfer and public expenditure) income (including benefits of government expenditures) than for pre-TTE income and less still for consumption (see Table 8 which summarizes our key estimates). From a welfare point of view, the consumption and post-TTE distribution are the more relevant measures, and they differ little. We choose the distribution of world consumption, perhaps the most interesting of the three cited above, to bring out the implications of the earlier sections of this paper.

Most of the uncertainty with respect to the level of world inequality results from the impossibility of specifying a single appropriate conversion rate between incomes expressed in two currencies, and from other statistical and conceptual problems, some of them discussed above. The correction for age structure decreases measured inequality a little, while the implications of various data errors and of using lifetime consumption rather than current consumption are not clear. The switch to lifetime consumption is likely to decrease measured inequality as long as one does not take account of length of life; if one does, the effect could be the opposite.

It is of course not possible to attach precise confidence levels to ranges for the Gini or Theil coefficients. But the sense of our discussion is that, in the absence of other sources of uncertainty than that regarding the appropriate rates of conversion among currencies, the Gini coefficient would very probably (e.g. with 90 percent likelihood or so) fall between 0.594 and 0.646 (last row of Table 8) and the Theil coefficient between 0.652 and 0.780. Allowing for the other

<sup>47</sup>Income distribution figures are almost always limited to the national accounts concept of income and therefore exclude capital gains. But from the perspective of distribution, this is inappropriate. Inclusion of capital gains (and losses) would presumably increase inequality.

TABLE 8  
GINI AND THEIL COEFFICIENTS OF VARIOUS WORLD DISTRIBUTIONS, UNDER VARYING ASSUMPTIONS

	124 Socialist & Non-Socialist Countries		115 Non-Socialist Countries	
	Conversion at Kravis <i>et al.</i> International Prices <sup>a</sup>	Conversion to U.S. \$ at Own Country Prices <sup>b</sup>	Conversion at Kravis <i>et al.</i> International Prices <sup>a</sup>	Conversion to U.S. \$ at Own Country Prices <sup>b</sup>
1. Personal distribution of current <sup>c</sup> pre-TTE income	$G = 0.649$ $T = 0.797$	$G = 0.693$ $T = 0.923$	$G = 0.676$ $T = 0.860$	$G = 0.709$ $T = 0.964$
2. Personal distribution of current <sup>c</sup> income after taxes, transfers and Government expenditures			$G = 0.649$ $T = 0.770$	$G = 0.685$ $T = 0.871$
3. (a) Personal distribution of current <sup>c</sup> private consumption expenditures	$G = 0.609$ $T = 0.685$	$G = 0.659$ $T = 0.814$	$G = 0.635$ $T = 0.739$	$G = 0.675$ $T = 0.850$
(b) Row 3(a) corrected for differences among countries in age structure	$G = 0.594$ $T = 0.652$	$G = 0.646$ $T = 0.780$		

<sup>a</sup>Corresponds to Estimate 1 of earlier tables.

<sup>b</sup>Corresponds to Estimate 2 of earlier tables.

<sup>c</sup>As contrasted with lifetime income or consumption.

sources of uncertainty considered above clearly widens the range, though probably not a great deal.<sup>48</sup> A parallel discussion for the distribution of pre-tax income would produce a similar conclusion, with the range of the Gini being say 0.64 to 0.68.

Are these ranges wide or narrow? The answer depends very much on the context of the question. They are narrow in the important sense that they leave no room for doubt that inequality at the world level is extreme. The relative consumption per adult equivalent for the top 5 percent compared to the bottom 20 percent would range between 44-fold and 65-fold. Between the more unequal distribution and the less unequal the top decile loses 10 percent of its income while the bottom 3 deciles gain on average 35 percent. While both distributions involve extreme inequality, the difference between them is also striking. If one wishes to draw finer distinctions, as would for example be necessary to assess trends over time in world distribution, this level of uncertainty becomes significant.

Still, it may be surprising that the ranges are not wider, especially in the light of the well known uncertainty of data from L.D.C.s. This is due to the fact that world inequality, as measured here, results much more from differences

<sup>48</sup>The mid point of the range could also be shifted if the expected effect of these factors were positive or negative but such an argument could not be persuasively made at this time.

in average income (or consumption) between countries than from intra-country inequality.<sup>49</sup>

In Table 9, we compare the highest and lowest inequality benchmark distributions (Est. 2 of income and Est. 1 of consumption) with the distributions which would result were distribution in each country perfectly equal, all other

TABLE 9  
THE EFFECTS OF INTRA-COUNTRY INEQUALITY ON WORLD DISTRIBUTIONS  
AMONG PERSONS

	GDP (Est. 2)		Consumption (Est. 1)	
	World Distribution	World Distribution without Intra-Country Inequality	World Distribution	World Distribution without Intra-Country Inequality
<i>Inequality measures</i>				
Gini	0.693	0.600	0.609	0.499
Theil	0.923	0.643	0.685	0.431
Mean log deviation	1.043	0.751	0.702	0.447
Atkinson 1 ( $\epsilon = 0.75$ )	0.543	0.430	0.413	0.288
Atkinson 2 ( $\epsilon = 0.50$ )	0.399	0.305	0.299	0.202
Atkinson 3 ( $\epsilon = 0.25$ )	0.217	0.158	0.161	0.105
Variance log	1.985	1.447	1.296	0.828

assumptions unchanged.<sup>50</sup> World inequality would be high even in the absence of any intra-country inequality, much higher than were average income equal in all countries but inequality at an average level, however plausibly defined; the mean value of the intra-country Theil coefficient is 0.278 using GDP (Est. 2) weights. If distinct regions within some very large countries like China and to a lesser extent India and Brazil were to be treated as different countries (with substantially different average income levels) the role of differences in averages across substantially separated economic regions would be seen to be even greater.

Another reflection of the same point is the fact that world inequality results largely from the income gap between the developed or industrialized countries and the less developed countries. If one accepts as dividing line a *per capita* income of 1,700 dollars of 1970, then inequality within the developed countries as a group (i.e. inequality between and within those countries) accounts for 29 percent of the Theil index of 0.80, that within the less developed countries

<sup>49</sup>Note that the country figures on inequality may suffer some systematic downward biases but, as discussed in section 3, there is no clear presumption at present that this is the case. If it does turn out to be true, the statement in the text might require modification.

<sup>50</sup>A similar experiment was performed by Whalley. (See John Whalley, "The Worldwide Income Distribution".) His estimates refer to about the same point of time (1972), in that the average income figures come from that year, and make use of income distribution figures compiled by Jain (S. Jain, *Size Distribution of Income: A Compilation of Data*, Washington, World Bank, 1975), together with estimates of distribution for the other countries obtained by assuming for such countries the same distribution as observed in "similar" countries. Whalley's world Gini coefficient was almost identical to our Est. 1 (0.65) as was his estimate of the Gini in the absence of intra-country inequality, 0.54 (see p. 274).

TABLE 10  
THEIL COEFFICIENT FOR VARIOUS GROUPS OF COUNTRIES AND THE SHARE OF INTER-GROUP MEAN INCOME DIFFERENCES IN TOTAL INEQUALITY<sup>a</sup>

Group A \ Group B	Non-Socialist Developing Countries (Theil = 0.717)	Non-Socialist Developing Countries and China (Theil = 0.565)		
Non-Socialist developed countries (Theil = 0.322)	Overall Theil (A + B):	0.861	Overall Theil (A + B):	0.892
	Share of intergroup inequality (A/B):	51.3%	Share of intergroup inequality (A/B):	51.4%
	Share of inequality in Group A:	28.2%	Share of inequality in group A:	24.7%
	Share of inequality in group B:	20.5%	Share of inequality in group B:	19.9%
Non-Socialist developed and Socialist East-European countries (Theil = 0.374)	Overall Theil (A + B):	0.725	Overall Theil (A + B):	0.797
	Share of intergroup inequality (A/B):	48.6%	Share of intergroup inequality (A/B):	52.7%
	Share of inequality in group A:	31.8%	Share of inequality in group A:	28.8%
	Share of inequality in group B:	19.6%	Share of inequality in group B:	18.5%

<sup>a</sup>To show how this table reads, the upper left hand quadrant may be explained as follows. The total inequality in non-socialist developed countries and non-socialist developing countries is 0.861, of which the difference between mean incomes in developed and developing non-socialist countries accounts for 51.3%.

accounts for 18 percent and the difference in average income between the two groups accounts for 53 percent (see Table 10). Average *per capita* income is 7.6 times higher in the developed countries and average consumption *per capita* 5.5 times higher.<sup>51,52</sup>

The importance of inter-country differences in world inequality would be reduced if the costs of poverty to an individual are significantly associated with his income relative to those around him. If sufficiently strong, that effect could make intra-country inequality a more serious problem than inter-country inequality.

##### 5. COUNTRY COMPOSITION OF THE WORLD'S POOR AND THE WORLD'S RICH: THE ROLE OF INTRA-COUNTRY INEQUALITY IN POVERTY

Finally, it is of interest to note the country composition of the world's poorest people and of its richest. Applying an (arbitrary) poverty line of 200 dollars (U.S.) consumption per year, we find that 26.6 percent of the world's population fell in this category in 1970. The relative incidence of poverty is shown by the share of the population falling below this line in the various

<sup>51</sup>Both figures refer to Est. 1 and include East-European socialist countries in the group of developed countries. When socialist countries are excluded the preceding figures are respectively 8.7 and 6.7. These ratios would be roughly 30 percent higher if Est. 2 GDP figures were used.

<sup>52</sup>The same type of calculation permits evaluation of the re-distribution impact of a proportional transfer of 1 percent of developed countries' income to less developed countries; it would reduce the overall Theil coefficient by less than 2 percent.

TABLE 11

INCIDENCE OF POVERTY BY COUNTRY, AND COUNTRY COMPOSITION OF THE WORLD'S POOR<sup>a</sup> AND RICH<sup>b</sup>, 1970

	Percent of World's Population	Percent of World's Poor	Percent of Population in Poverty	Percent of World's Rich
	(1)	(2)	(3)	(4)
India	15.05	34.4	60.9	0
China	23.69	17.8	30.0	0
Indonesia	3.23	7.3	69.7	0
Bangladesh	1.98	5.9	81.1	0
Nigeria	1.85	4.2	68.6	0
Pakistan	1.75	3.9	60.4	0
Brazil	2.59	2.0	31.0	3.0
Ethiopia	0.69	2.1	82.2	0
Burma	0.77	1.7	74.9	0
Philippines	1.03	1.6	44.5	0
Thailand	1.00	1.5	48.4	0
Afghanistan	0.40	1.2	84.7	0
Tanzania	0.36	1.1	80.6	0
Zaire	0.51	1.1	63.6	0
Nepal	0.31	1.0	94.5	0
Sudan	0.44	1.0	65.7	0
All LDC's (including China)	70.10	100.0	37.9	7.9
Developed Socialist Countries (East Europe and USSR)	10.25	0	0	23.8
Developed Non-Socialist Countries	19.65	0	0	68.3
World	100.00	100.0	26.6	100.0

<sup>a</sup>Consumption below 200 U.S. dollars of 1970.<sup>b</sup>Consumption above 4800 U.S. dollars of 1970, and constituting the top 5% of the world's population.*Note:* Due to the use of linear interpolation in the estimation of Col. (3), the figures are not fully consistent with those of Col. (1) and (2).

countries. (See Table 11.) Comparable figures for income tell roughly the same story.

It follows from our earlier discussion that the low levels of average income in the poorer countries play a major role as the cause of poverty, but are by no means the sole cause. This can be seen by considering the results of a redistribution within all countries now having "poor people" according to the above definition (\$200 consumption *per capita*) to a low level of inequality corresponding to a Gini coefficient of 0.23 or a Theil of 0.10.<sup>53</sup> World poverty would fall from 950 to 340 million people and at the country level the change would be that presented in Table 12. As the table indicates, all existing poverty in such middle income countries as Brazil can be attributed to the level of inequality,<sup>54</sup> whereas in Bangladesh or China the share which can be so attributed is much less.

<sup>53</sup>Those figures correspond to the reported income distribution of Bulgaria.<sup>54</sup>In this obviously arbitrary sense of a distribution of consumption more unequal than that which corresponds to the "relatively equal distribution" we have assumed here.

TABLE 12  
INCIDENCE OF POVERTY BY COUNTRY AND COMPOSITION OF THE WORLD'S POOR<sup>a</sup> AND RICH<sup>b</sup>, IF ALL COUNTRIES HAD LOW INTERNAL INEQUALITY, 1970

Country	Percent of World's Population	Percent of World's Poor	Percent of Population in Poverty	Percent of World's Rich
	(1)	(2)	(3)	(4)
India	15.05	31.6	35.4	
China	23.69	0	0	0
Indonesia	3.23	13.6	51.0	0
Bangladesh	1.98	12.5	74.9	0
Nigeria	1.85	7.8	43.1	0
Pakistan	1.75	3.7	33.9	0
Brazil	2.59	0	0	0
Ethiopia	0.69	4.3	75.5	0
Burma	0.77	4.9	66.5	0
Philippines	1.03	0	0	0
Thailand	1.00	0	0	0
Afghanistan	0.40	3.4	81.9	0
Tanzania	0.36	1.5	47.0	0
Zaire	0.51	1.1	33.7	0
Nepal	0.31	3.1	96.3	0
Sudan	0.44	0.9	38.4	0

<sup>a</sup>Consuming below 200 U.S. dollars of 1970.

<sup>b</sup>Consuming above 4,800 U.S. dollars of 1970.

*Note:* Due to the use of linear interpolation in the estimation of Col. 3, the figures are not fully consistent with those of Col. 1 and 2.

At the other end of the spectrum, the richest 5 percent of persons (with incomes above 4800 in 1970 U.S. dollars)—a group with 34 percent of world income in that year—were distributed as shown in Col. 4 of Table 11.

## 6. CONCLUDING COMMENTS

A number of empirical and conceptual problems stand as barriers to meaningful estimates of the extent of inequality in living standards of the world's population. A number of these have been reviewed above, with a view to assessing the sensitivity to them of various indicators of world inequality. From the standpoint of the absolute level of world inequality, it is clear that considerable uncertainty still exists; an accurate estimate of the distribution of the conceptually most appropriate variable to measure inequality<sup>55</sup> could at the low end produce a Gini coefficient of 0.55 and a Theil coefficient of about the same value, or at the high end a Gini of 0.70 or more and a Theil of 0.95 or more.<sup>56</sup> It will be important in future to reduce this certainty through the use of better data and more sophisticated analysis. At the same time two points seem clear: the level of world inequality is extreme—probably more so than that of the most

<sup>55</sup>Lifetime consumption, for example, or lifetime income.

<sup>56</sup>Based on the figures of Table 8 and our judgement of the possible impact of other sources of uncertainty discussed in the paper.

inegalitarian country in the world, and world inequality is due primarily to differences in average incomes across countries rather than to intra-country inequality.

Among the major sources of uncertainty as to the level of world inequality are the relative purchasing powers of different currencies (though the uncertainty has been greatly reduced by the work of Kravis *et al.*), the absence of information on lifetime personal consumption (or income, for that matter), the lack of information on intra-family distribution of welfare, and the weakness of intra-country income distribution statistics, especially in the LDCs.

#### APPENDIX: LIST OF COUNTRIES USED IN THE ANALYSIS

Afghanistan	Finland	Madagascar	Senegal
Argentina	France	Malawi	Sierra Leone
Australia	Gabon	Malaysia	Singapore
Austria	Gambia	Mali	Somaliland
Bangladesh	Ghana	Malta	South Africa
Barbados	Greece	Mauritania	Spain
Belgium	Guatemala	Mauritius	Sri Lanka
Bolivia	Guinea	Mexico	Sudan
Botswana	Guyana	Morocco	Syria
Brazil	Honduras	Nepal	Swaziland
Bulgaria	Hong Kong	Netherlands	Sweden
Burma	Hungary	New Zealand	Switzerland
Burundi	Ireland	Nicaragua	Taiwan
Cambodia	India	Niger	Tanzania
Cameroon	Indonesia	Nigeria	Thailand
Canada	Iran	Norway	Togo
Chad	Iraq	Oman	Trinidad
Chile	Ireland	Pakistan	Tunisia
China	Israel	Panama	Turkey
Central Africa	Italy	Papua New Guinea	Uganda
Colombia	Ivory Coast	Paraguay	U.S.S.R.
Costa Rica	Jamaica	Peru	United Kingdom
Cyprus	Japan	Philippines	U.S.A.
Czechoslovakia	Jordan	Poland	Upper Volta
Denmark	Kenya	Portugal	Uruguay
Dominican Republic	Korea	Qatar	Venezuela
East Germany	Kuwait	Rhodesia	West Germany
Ecuador	Lebanon	Rumania	Yugoslavia
Egypt	Lesotho	Rwanda	Zaire
Ethiopia	Liberia	Salvador	Zambia
Fiji	Libya	Saudi Arabia	