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	FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS	
	ORGANISATION DES NATIONS UNIES POUR L'ALIMENTATION ET L'AGRICULTURE	
	ORGANIZACION DE LAS NACIONES UNIDAS PARA LA AGRICULTURA Y LA ALIMENTACION	

**Item II of the  
Provisional Agenda**

**COMMITTEE ON WORLD FOOD SECURITY**

**Eighteenth Session**

**Rome, 29 March - 1 April 1993**

**PROGRESS REPORT ON THE DEVELOPMENT OF A  
HOUSEHOLD FOOD SECURITY INDEX**

**I. BACKGROUND**

1. This Committee at its Seventeenth Session reviewed approaches to monitor access to food and household food security on the basis of document CFS: 92/3<sup>1</sup>. That document reviewed approaches and associated indicators for monitoring household food security based on widely available data at the international level, and concluded that it was appropriate to combine such indicators into a composite index. This conclusion was based on the observation that since household food security is a multi-dimensional concept influenced by more than one factor, a single indicator in isolation may not be effective for its monitoring. The document further noted that some progress towards the construction of a composite index can be made with national-level data that are largely available with the international community. Finally, the document also emphasized that the primary role of the index is to monitor household food security at the international level, and not so much for its monitoring at a country level, where indicators need to be based on much more disaggregated, sub-national data.

2. The Committee broadly endorsed the work plan proposed by the Secretariat in the above document, namely desk work on the construction of the composite index, the review of the index, and, following this initial evaluation, some country-level work aimed at further

<sup>1</sup> *FAO Approaches to Monitoring Access to Food and Household Food Security, CFS: 92/3, 1992.*

improving the precision of the index. This document reports on the progress made to date. The bulk of the report (Section II) is technical in order to maximize transparency regarding the procedures followed and to facilitate comments and advice by national experts in index construction. Some results are also highlighted in this section. The paper ends with some concluding remarks in Section III.

## II. CONSTRUCTION OF A COMPOSITE HOUSEHOLD FOOD SECURITY INDEX

### 2.1 Selection of Individual Indicators for the Composite Index

3. The document referred to earlier (CFS: 92/3) had listed a set of eight variables for consideration for the composite index. They were: per caput food production, per caput export earnings, a measure of inter-market price differentials, degree of deviation of per caput agricultural production from trend, per caput GDP in local currency or purchasing power parity units, a measure of income distribution in the country, public expenditure on targeted income transfers and food subsidies, and an index of food price inflation relevant for low-income households. In addition, other possible indicators had been suggested during the CFS debate, including wage to food price ratio and the proportion of total expenditure on food.

4. In the first stage of this work, a review was made of the statistics covering the above-listed set of indicators for their ultimate selection and incorporation in the composite index. The two indicators, per caput food production and per caput export earnings, were meant to represent average food supply in a country through production and imports. While these data are widely available, it was found during the review that, in order to have a more precise representation of food supply, the food items ultimately selected need to be country-specific as there is a wide inter-country variation in the composition of the national diet. Hence there was a need for considering a all-encompassing indicator of food supply, such as the per caput daily dietary energy supply (DES).

5. In the case of two other variables listed above, namely public expenditure on targeted income transfers and food subsidies and inter-market price differentials, no data was available in a form that could be used for the composite index. These are important factors impacting upon household food security and therefore efforts need to be made at the country level to compile these statistics. On food prices, while some data were available at the international level, these referred to general food prices and are not specific to low-income households as desired for this work, and, moreover, country coverage was small. This shortcoming was to some extent overcome by expressing per caput GNP in real terms, for which following a common practice an overall measure of inflation, the GNP deflator, was used.

6. On wage to price ratio as an indicator, two problems were noted. First, as discussed in the conceptual paper on this work (document CFS 92/3), the extent to which available data on wage rates are representative of both the rural areas and the informal urban sectors, where a majority of the low-income households are found, is largely unknown. Second, even if this representation were adequate, the country coverage of these statistics at present is inadequate. The other indicator suggested for consideration, namely the proportion

of a household's total expenditure on food, requires information first on these proportions for a base year, and second, on a year to year basis, of at least total household expenditure (or income) and food prices. There were serious statistical gaps in both of these accounts.

7. In view of these limitations, the composite index was finally based on the following three variables: per caput DES, per caput GNP in Purchasing Power Parity (PPP) units, and the coefficient of variation in income distribution. As noted above, per caput DES has been used as an indicator of aggregate average food availability for human consumption in a country. Similarly, per caput GNP in real terms has been used as a proxy for overall real purchasing power of an average person. The third variable, the coefficient of variation of income distribution, indicates the degree of equality or inequality in inter-household income distribution.

## 2.2 Methodology

### (a) The Data Base Used for the Composite Index

8. The per caput DES, as a measure of average total food availability in a country for human consumption during a year, is largely understood and is widely used as a proxy for average per caput consumption. FAO Food Balance Sheets were used as the source of per caput DES estimates. These estimates are based on aggregate food items available for human consumption in a country within a year, converted into calorie units, and divided by the population. Total supplies include production, net imports and changes in stocks.

9. The incorporation of per caput GNP in the composite index involved the following steps. Using GNP data for 1985 published in the 1992 World Bank's World Tables, in current US\$ units, and the rates of change in per caput real GNP over time published in the 1992 UNCTAD's Handbook of International Trade and Development Statistics, per caput real GNP in US\$ units were estimated for the years 1985 to 1990. In the next step, these incomes were expressed in PPP units by using country-specific PPP adjustment factors from the statistics reported in the 1992 Human Development Report of the UNDP. The PPP units have been used here, rather than the US\$ units, because they reflect more precisely the real purchasing power of currencies in the developing countries. Second, following the reasoning made on a similar exercise by UNDP on human development index, a cap, or an upper limit, was put on per caput GNP. Thus, it is assumed that income level beyond a certain (high) threshold has no significance to improving household food security. In line with the 1992 Human Development Report, the per caput GNP ceiling was set at PPP\$4,850 for 1990 and at slightly lower levels for the earlier years. Some six to eight countries in the sample had per caput GNP above this threshold in which case their income was truncated at this threshold level.

10. Statistics on income distribution used here have been compiled by the Statistics Division of FAO based on available household income or expenditure surveys. These data on inter-household income distribution were available for this work for 49 developing countries. Income distribution has been expressed in terms of the variance of the (logarithm of) income or expenditure, whatever was available. A larger variance implies greater skewness, and so on. Before incorporating the income distribution variable in the composite index, it was transformed into an indicator of equality, so that, as with per caput DES and GNP, the

larger the value of this indicator, the greater the equality and hence the greater the probability of achieving food security.

(b) Aggregation of Individual Indicators into a Composite Index

11. This involved two steps: the construction of unit-free normalised indicators for each of the three components of the composite index, and the selection of a set of relative weights for their aggregation. The procedures followed are outlined next.

12. Construction of Normalised Indicators: Normalised indicators in general are obtained by establishing a standard or normal value for the indicator and expressing the value of the indicator for each country in a sample with respect to its distance from the standard. Often, this is done by using the average or the maximum value for the sample as the standard. Since the main use of the composite index under discussion here is to assess progress made by each country towards the reduction of household food insecurity, it is essential that the normalisation procedure be valid over time. Second, in order to assess if a country is making progress over a period, some notion of a goal to be attained needs also to be built-in within the procedure. However, reduction in household food insecurity is a dynamic process and, therefore, it would be inappropriate to associate its achievement with specific normative values. In view of these considerations, the maximum values of the three variables for the sample countries and over the review period (1985 to 1990) have been used for normalising the raw data. These maximum values were: PPP\$4,850 for per caput GNP, 3,300 kcal for per caput DES, and (the inverse) of 0.20 for income distribution (see para. 10 above).

13. In order to facilitate the exposition of the normalisation procedure used, define

$X_{ijt}$  = the value of the raw (not normalised) indicator  $i$  in country  $j$  in year  $t$ ;  
where

- $i = 1$  refers to per caput GNP in PPP units,
- $i = 2$  refers to per caput DES, and
- $i = 3$  refers to the income equality indicator.

Thus, for country  $j$  in year  $t$ , the normalised indicators were defined as:

$$\begin{aligned} NX_{ijt} &= 1 - \{\text{Max}(X_i) - X_{ijt}\} / \text{Max}(X_i) \\ &= X_{ijt} / \text{Max}(X_i) \end{aligned}$$

where  $\text{Max}(X_i)$  refer to the maximum values of the  $i^{\text{th}}$  variable. As an example, for per caput GNP, where the value of  $\text{Max}(X_i)$  is PPP\$4,800, the normalised indicator for a country with per caput GNP of PPP\$1,200 would be 0.25 as against 0.83 for a country with per caput GNP of PPP\$ 4,000.

14. Selection of the Weights and Aggregation of the Normalised Indicators: The following formula was used to aggregate the normalised indicators into a household food security index (HFSI):

$$\text{HFSL}_{jt} = \sum_{i=1}^3 w_i \text{NX}_{ijt}$$

where the weights  $w_i$  ( $w_1 + w_2 + w_3 = 1$ ) were obtained empirically (see below), and  $\text{NX}_{ijt}$  refer to the normalised indicators as defined earlier. Some statistical analysis was required to determine these relative weights. The criterion used was to select a set of weights so that the resulting composite index explained the largest proportion of variations in an independently-obtained measure of household food security across the sample countries. This measure of household food security has been represented here by the proportion of a country's population with inadequate food consumption<sup>2</sup>. These estimates were made by following a method similar to one used by FAO for its Fifth World Food Survey<sup>3</sup>. In this method, the standard deviation of per caput DES, obtained from household consumption or food budget surveys, is used to determine the proportions of a country's population consuming different calorie levels. The threshold calorie level is the cut-off point below which consumption is considered inadequate. This was set at 1.54 times the base metabolic rate (BMR). The BMR is determined by demographic characteristics of a country. The proportion of the population with per caput DES below that level is assumed to be food insecure. This independent measure of food security, while appropriate for the validation process, as used here, is not appropriate for monitoring progress in household food security since one of the two parameters that determine its level is not amenable to more frequent measurement in practice.

15. The weights that were finally retained were as follows: 0.15 for per caput GNP, 0.65 for per caput DES, and 0.20 for income equality. With these weights, the composite index explained about 80 per cent of the inter-country variations in the above measure of household food security. The distribution of the household food security indices with respect to the proportion of food insecure population in the sample countries is shown in Figure 1.

### 2.3 The Results

16. The estimated composite indices of household food security for the 49 countries and the progress made in terms of household food security over a 1985-1990 period are shown in Annex 1. Some key observations on these results are highlighted below.

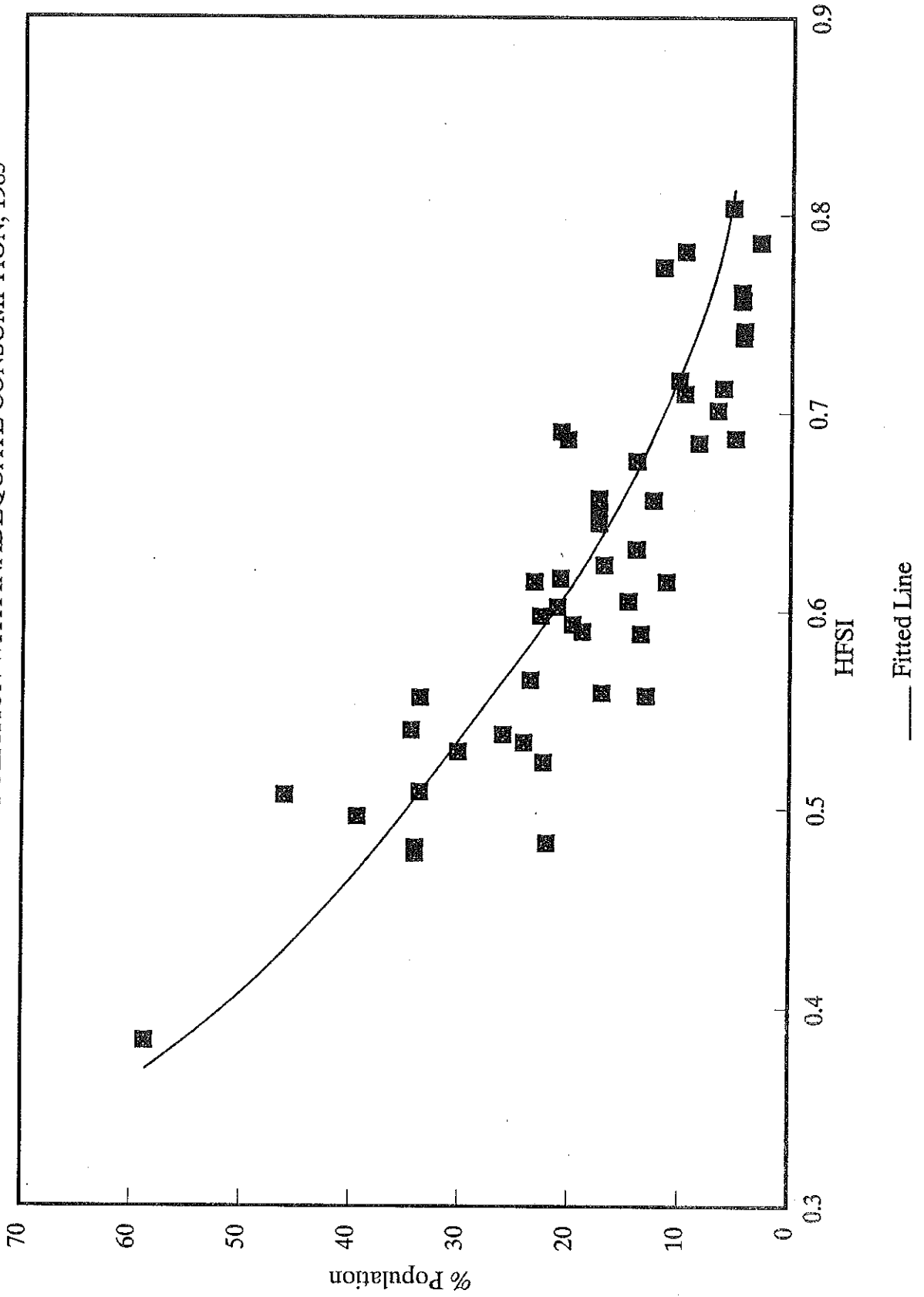
17. By design, the closer the value of the index to 1, the greater is the degree of household food security. The actual values of the indices for 1985 range from 0.38 to 0.80. Among the sample countries, Argentina ranked top with an index of 0.80, and Ethiopia at the

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<sup>2</sup> The size of a country's population with inadequate food consumption is a head-count measure and an important indicator of household food security. While this measure indicates the width of the problem in terms of the population affected, it does not show the depth of food insecurity, that is the extent to which food consumption of the food insecure sub-population lies below a threshold requirement. This is also an important dimension of household food insecurity and needs to be addressed as necessary data become available.

<sup>3</sup> FAO The Fifth World Food Survey, 1987, Rome, and FAO World Food Supplies and Prevalence of Chronic Undernutrition in Developing Regions as Assessed in 1992, 1992, Rome.

Figure 1: RELATIONSHIP BETWEEN HOUSEHOLD FOOD SECURITY INDEX (HFSI) AND THE PROPORTION OF POPULATION WITH INADEQUATE CONSUMPTION, 1985



other extreme with an index of 0.38. As explained above, the overall value of the index is a weighted aggregation of three separate normalised values, each of which in isolation may rank a country differently. For example, Egypt, ranked second in terms of the composite index, ranked first in terms of per caput DES, 13th in income equality, and 29th in per caput GNP.

18. The results show improvements for 28 of the 49 countries, including those with the largest populations. Of these 28 countries, 13 experienced improvements of over 5 percent. These include both the initially low-food secure countries, such as Ethiopia, Philippines, Uganda and Nepal, as well as others, such as Turkey, China, Republic of Korea and Tunisia, who were initially high-food secure. At the other end of the distribution, four countries, namely Trinidad and Tobago, Ghana, Panama and Cote d'Ivoire, experienced drops in the index of 5 percent or more. These include, as above, both high-food secure and low-food secure countries. No change in HFSI was recorded for Egypt and Mexico. While both these countries made gains in per caput GNP, per caput DES did not change in Egypt while it dropped by almost 5 percent in Mexico.

19. For eight countries, there was a deterioration in both per caput GNP and per caput DES, and hence in the composite index too. The reverse was true for 20 other countries. In several cases, a positive change in one component of the index more than compensated for the negative change in the other, and thus the overall progress remained positive. This was particularly so where per caput DES increased, which, in view of the larger weight attached to it in the composite index, more than compensated for a proportionate drop in per caput GNP. As no separate income distribution statistics for the two periods were available, it was not possible to review how changes in income distribution impacted on the index. It is widely held that many developing countries experienced income concentration over the 1985-90 period. In that case, progress would appear smaller.

### III. CONCLUDING REMARKS

20. The primary purpose of this work was to develop an indicator that could be used at the international level, with wide country coverage, to monitor trends in access to food at household level, and to identify situations where chronic food insecurity appeared to be deteriorating over time and where international action might be called for. Hence the composite index reviewed above had to be based on a uniform conceptual framework and on a uniform set of statistics. The index, as it stands now, is fairly simple in terms of the underlying concept, the design, and in its use of readily available statistics. In spite of this simplicity, the index was fairly precise in explaining the variations in the head-count measure of household food security. This work also identified, through a review of related statistics, some gaps in data and thus some areas where further work would be useful. Finally, the results substantiated an anticipated conclusion that household food security, as it is a multi-dimensional concept, may be measured more precisely with a composite index rather than with any individual indicator in isolation.

21. An important result of this work was that none of the three indicators in isolation was as good an indicator of household food security as the composite index. Using data for the entire 49 countries under review, the validation exercise (para. 15) attached much more weight to per caput DES than to the other two components of the composite index. However, our preliminary exercise suggests that the relative importance of the three indicators will not be uniform for all countries but will vary with per caput DES. One area for further work in the composite index should be directed towards the determination of these weights at different levels of per caput DES.

22. Statistics on inter-household income distribution are generated through large-scale household surveys, which tend to be relatively expensive, and are therefore conducted only occasionally in most developing countries. However, lack of more frequent estimates of income distribution need not be a constraint for this type of work if income distribution does not undergo rapid change over a short period. Further, even if recent data are lacking, sensitivity tests can be made to show the effect on household food security if it is thought there has been a significant change in income distribution relative to the base survey year. However, availability of data on income distribution for recent years limited the country coverage in this work to 49. As it is well established, including from the results reviewed here, that the distribution of income is a key factor in determining household food security, efforts need to be made at country level to collect and review these statistics periodically.

23. The composite index approach outlined here will be further reviewed based on the results obtained from two related country level studies currently under way at the FAO. First, the identification of the socio-economic indicators for monitoring access to food of the vulnerable groups is being addressed under the 1992/93 Andre Mayer Research Fellowship Programme of FAO. The Andre Mayer Fellow was selected towards the end of 1992 and research work initiated recently. Second, risk-maps are being developed by GIEWS, with support from EEC and Save-the-Children Fund for identifying the vulnerable areas in a country and for monitoring the food security situation in those areas. This study will help identify relevant indicators of access to food at national and sub-national level. The findings of these activities will be reported to the Committee.

24. The Secretariat looks forward to the observations of this Committee on the composite index presented here and to the suggestions for further work in this area.



## Annex 1: The Household Food Security Index (HFSI)

The data base used for computing 1985 HFSI

Country	HFSI value 1985	Change in HFSI 1985 to 1990 (1985=100)	Per caput GNP in PPP unit (1985)	Per caput DES (1985)	Variance of the log of income (1980s)
Argentina	0.80	99	4000 1/	3105	0.54
Egypt	0.79	100	1843	3318	0.49
Mexico	0.78	100	4000 1/	3133	0.86
Trinidad and Tobago	0.77	95	4000 1/	3038	0.70
China	0.76	106	2352	2596	0.22
Korea, Rep. of	0.76	106	2989	2822	0.35
Turkey	0.76	108	3155	3043	0.61
Algeria	0.74	105	3531	2754	0.42
Tunisia	0.74	107	3144	2925	0.57
Uruguay	0.72	102	3656	2691	0.51
Indonesia	0.71	104	2156	2578	0.28
Malaysia	0.71	104	4000 1/	2688	0.65
Jordan	0.70	99	2297	2661	0.36
Panama	0.69	90	3855	2526	0.51
Morocco	0.69	104	1462	2916	0.55
Venezuela	0.69	98	4000 1/	2600	0.72
Mauritius	0.68	108	2944	2762	0.73
Costa Rica	0.68	101	3223	2716	0.87
Chile	0.66	105	4000 1/	2450	0.73
Paraguay	0.66	99	2289	2678	0.64
Colombia	0.65	106	4000 1/	2414	0.75
Brazil	0.64	104	3197	2626	1.21
Jamaica	0.63	101	2079	2532	0.55
Cote d'Ivoire	0.62	90	1154	2700	0.66
Ecuador	0.62	101	3425	2376	0.85
Pakistan	0.61	109	1837	2128	0.28
Guatemala	0.61	101	3477	2234	0.56
Nepal	0.61	110	796	1950	0.20
Bangladesh	0.60	105	683	1953	0.20
Dominican Republic	0.60	98	2537	2344	0.65
Sri Lanka	0.59	97	1991	2423	0.68
Thailand	0.59	105	2340	2286	0.56
Swaziland	0.59	106	1790	2495	0.86
El Salvador	0.56	97	1454	2399	0.77
India	0.56	103	723	2179	0.36
Philippines	0.56	110	1854	2182	0.54
Ghana	0.56	95	979	2141	0.37
Rwanda	0.54	96	595	2050	0.33
Tanzania, Rep. of	0.54	96	1243	2288	0.76
Botswana	0.53	104	1670	2244	0.91
Kenya	0.53	97	824	2143	0.47
Honduras	0.52	106	1203	2091	0.51
Lesotho	0.51	99	1646	2179	1.24
Peru	0.51	98	2731	1871	0.70
Bolivia	0.50	96	1161	2077	0.73
Uganda	0.48	108	459	2014	0.53
Zambia	0.48	98	767	2068	0.75
Malawi	0.48	96	586	2130	0.91
Ethiopia	0.38	109	359	1523	0.53

Note: 1/ These countries had per caput GNP (in PPP unit) in excess of 4,000.

