HOUSEHOLD INCOME OR HOUSEHOLD INCOME PER CAPITA IN WELFARE COMPARISONS*

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In studies of income distribution household income is the common measure of household welfare, although household *per capita* income is better since it automatically "corrects" for household size. Perhaps the continued use of the former is a consequence of the belief that in practice the two give very similar results. This paper shows that in many cases those results differ substantially. Policy prescription based on household income rather than household per capita income can be very defective. The paper compares results according to the two income concepts for Malaysian data. U.S. data are then used in a comparison over time.

The disparity between the two Malaysian distributions is illustrated by their cross tabulation. A quarter of the households in the lowest forty percent of the household income distribution is in the upper three quintiles of household *per capita* income; and 10 percent of the same lowest forty are in the highest two quintiles of the second distribution. The paper also shows that the distribution of benefits from public education–measured as the public costs of school years—is very inegalitarian if household income is used. The reverse occurs if household *per capita* income is used. Similar reversals occur in comparisons involving partitions by occupation and sex of head of household. Women-headed households, for example, have sub-mean household incomes but their household income per capita equals the mean. The paper also examines the differences in the age-income profiles of the two distributions. It then considers whether the much discussed secular stagnation in U.S. measures of inequality is changed if household income *per capita* is used rather than the usual household income measure. Use of the *per capita* concept results in a slight decrease in U.S. inequality between 1947 and 1972. Appendix 2 explores how long term growth in per capita incomes and the associated changes in the size composition of households may affect measurements of inequality.

> "Progress against poverty over time is underestimated.... An old person who is able to afford to maintain a separate household by virtue of higher social security payments is better off than he would be in their absence—but he is counted as worse off because he is a separate household with low income rather than part of his children's household.[1]"

1. INTRODUCTION

Interest in the distribution of income derives from the fundamental interest in the distribution of human welfare. Welfare cannot be measured but we can measure income, which is generally regarded as the best proxy for welfare. Consequently size distributions of income are the focus of a great deal of analytical work.

Most of such work is based on household income, although household *per capita* income is a better measure. (The distribution of household *per capita* income can be interpreted as the *per capita* income of households or as the distribution of household *per capita* income by individuals.) This was shown by

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[1]Irwin Garfinkel from the foreword of Reynolds and Smolensky (1977), p. xxi. See also Rivlin (1975) pp. 1 and 5.

Simon Kuznets (1976) when he traced through the differences in the two concepts in great detail and concluded (p. 87):

> It makes little sense to talk about inequality in the distribution of income among families or households by income per family or household when the underlying units differ so much in size . . . before any analysis can be undertaken, size distributions of families or households by income per family or household must be converted to distributions of persons (or consumer equivalents) by size of family or household income per person (or per consumer).

Notwithstanding the work of Kuznets, apparently the lack of interest in household *per capita* income and the widespread persistence in the use of household income to measure inequality are due to the belief that the difference between household *per capita* income—however defined—and household income is unimportant.[2] Analysts also use household income because no other income data are available. Yet if there were widespread dissatisfaction with household income as the basic measuring rod, in several years data generators such as statistical offices would begin to supply data based on household per capita income.

The continued widespread use of household income suggests that there is need for the kind of exploratory analysis presented below which involves a comparison of some of the difference in results from using the two concepts. That analysis shows that the differences between the two are very substantial. It is misleading to use the one as a proxy for the other. Policy prescription based on household income rather than household *per capita* income can be very defective.

Although the argument is that household *per capita* income (PCY) is preferable to household income, it must not be inferred from this that the former is an ideal concept of income. The ideal concept is much removed from household PCY as hitherto measured in surveys. The ideal concept would adequately deal with the consequences of government tax and expenditure activity[3] as well as the valuation of the non-market activity of household members. Household PCY—as well as household income—could be so defined as to include such changes. But current practice of statistical and survey organizations is a long way from any such inclusion.

In comparing some of the differences resulting from the use of household income or household PCY, an aggregate measure of inequality is a useful vehicle for exposition. We have chosen the Gini coefficient for this purpose not because we believe that it is an ideal measure, but because its use is widespread and

[2]Most recent work on U.S. income inequality—for example—is based on household income. See Paglin (1975), Comments on Paglin (1977), Reynolds and Smolensky (1977), Browning (1979). Over 88 percent of recent studies of income distribution in 60 developing countries were based on household income or expenditure. See Shail Jain (1975).

[3]The usual income concept is "money income" before it is reduced by payment of direct personal taxes and indirect taxes, but excluding direct corporate taxes, retained profits, employer payment of social security taxes, and including government transfers; in short, a concept very close to personal income, as defined in U.S. national income accounting. This concept is inadequate. It does not measure total income as it would be before taxes are paid or government transfer payments received. The concept implicitly assumes that there are no benefits from government outlays, since no attempt is made to treat any part of them (transfers excepted) as increasing incomes.

previous work involving it provides useful material to illustrate the basic analysis.[4]

Part 2 of the paper uses Malaysian data to describe the imperfect correlation between household income and household PCY.[5] Part 3 involves comparison of incomes and educational and other benefits by groups in Malaysia in terms of the two income concepts. Part 4 uses the Malaysian data to compare the age–income profiles for the two distributions, to some degree in welfare perspective. Part 5 carries out a comparative measurement of the secular trend in U.S. income inequality contrasting the results for the two concepts. Appendix 1 shows how the U.S. Gini coefficients were calculated. Appendix 2 is an exploration of how long term growth in *per capita* incomes and the associated changes in the size composition of households may affect the value of Gini coefficients.

2. Contrast between Household and Household *Per Capita* Income

There is a strong relation between family incomes and their size: Mean family size is usually an increasing function of family income. But family size is a decreasing function of family PCY. As a consequence of this systematic relationship there is a substantial non-correlation between size distributions using household incomes and household PCY.[6] In the sample survey of 1,465 Malaysian households generated in 1974, the Spearman rank-order correlation coefficient for the two distributions was 0.77.[7] In Table 1, this point is made in detail by defining quintiles of household *per capita* income and distributing the households in each quintile across their corresponding quintiles of household income. The table dramatically illustrates the disparity in the two distributions. What may be called the diagonal of co-incidence has maximum values at the lowest and highest quintiles of 62 and 66 percent, while all other values on the diagonal are only in the 30's. Also revealing is the fact that the three lowest quintiles of household income have some households in all five of the quintiles of household PCY.[8]

In developing countries the re-ordering of families by family PCY also frequently results in a size distribution with a substantially lower Gini coefficient

[4]The Gini coefficient suffers from numerous shortcomings, as do the other summary measures of inequality. For example, the Gini coefficient is not additively decomposable, into between-group and within-group Gini coefficients for grouped data. Moreover the rank orderings of distributions by the various summary measures are not congruent. See Atkinson (1970).

[5]The comparison uses data from a Malaysian sample survey designed to provide information on the distribution of benefits from public expenditures across households. Household income was a basic reference variable and was carefully estimated through the survey. The concept used was very close to personal income as defined in the national accounts. (Meerman (1979), Chapter 3.)

[6]Throughout the paper household PCY and family PCY are used interchangeably. The concepts are very similar and refer to statistical practice in the U.S.A. (family) and Malaysia (household).

[7]The R^2 for the two was 0.66.

[8]It was not possible to generate such a table readily for the U.S. from published data of the U.S. Census Bureau. But it would be similar. For example, in 1972 the lowest family income in the interval from $15,000 to $24,000 exceeded the overall mean ($12,625) by 19 percent. Yet the family PCY of 27 percent of the families in the interval was less than the overall family PCY. Richard Groeb's article in Duncan and Morgan (1976), using data from the Panel Study of Income Dynamics of the University of Michigan, also notes the non-congruence of the ranking of family incomes with an adult equivalent measure. The R^2 obtained by him is very similar to the Malaysian results.

TABLE 1

CROSS TABULATION, QUINTILES OF HOUSEHOLD *PER CAPITA* INCOME BY QUINTILES OF HOUSEHOLD INCOME AND NUMBER OF PERSONS PER HOUSEHOLD FOR BOTH PARTITIONS SAMPLE FOR PENINSULAR MALAYSIA, 1974

Quintile of Household Income	Quintile of Household *Per Capita* Income					Number of Persons Per Household
	1	2	3	4	5	
1	62	20	12	7	1	4.09
2	31	36	20	10	2	5.41
3	7	32	32	22	11	5.77
4	1	11	29	36	20	6.69
5	—	—	6	26	66	7.11
	100	100	100	100	100	
Number of Persons Per Household	6.57	6.33	6.04	5.53	4.67	5.83

Source: Meerman (1979), Tables 3.1, 3.2, and computer file of the Malaysian Sample.

Note: Since each quintile has the same number of households, population per quintile increases in the case of the partition of household income; the reverse is true in the case of the partition of household PCY.

than the distribution obtained from the use of family income. This has been recently confirmed by Pravin Visaria who calculated Gini coefficients for eleven family income or family expenditure distributions in five countries (India, Nepal, Sri Lanka, Taiwan, and Malaysia). In all eleven cases the Gini coefficient was lower for household *per capita* income (expenditure) by individuals than for household income (expenditure).[9] In the Malaysian sample, however, the difference was not great. The Gini coefficient was 0.48 for household income and 0.46 for household PCY by individuals. And in developed countries the pattern may be reversed.

Re-ordering the size distribution by family PCY has substantial policy implications for anti-poverty programs. In the Malaysian data if the "povery group" is defined as the bottom quintile of households ranked by household income, then—as shown by Table 1—only 62 percent of the "genuinely poor" (those in the lowest *per capita* income quintile) would be included in this group. The remaining 38 percent of the poor would fall outside the target group. Conversely a substantial percentage of households from higher *per capita* income quintiles would be included in the povery group.[10]

The thinking which leads to the conclusion that household income is a poor measure of welfare can be extended to object to household PCY as well. The latter fails to consider the effect of the age composition of the family as well as economies of scale in the operation of households. The work on equivalence

[9]See Visaria (1978).

[10]It is noteworthy that, in carrying out government programs to assist the poor, an adult equivalent approach is usually used to ascertain who the poor are. Family income is never used to define poverty for such programs.

scales deals with these difficulties by providing a technique for converting household members of different ages to adult equivalents. Nevertheless, the distribution when using family PCY probably will be very similar to the distribution when using family income per adult equivalent. For example the R^2 between household PCY and household income per adult equivalent for the Malaysian survey data was 0.968.[11]

3. Comparison of Incomes and of Government Benefits

The discussion has proceeded in terms of disparity in the aggregate size distributions. What happens when comparisons are made for various income partitions? Using the Malaysian sample we examined three partitions (race, community size, and region) for two definitions of income (household income and households by household PCY). For the three partitions the rank ordering of the several means was identical for both distributions. For example mean household incomes of the Chinese exceeded those of the Indians, who in turn had higher mean incomes than the Malays. The same pattern carried through when the measurement was in means of household PCY. Frequently, however, the ratios of the means of the household income partition differed substantially from the corresponding ratios of the household PCY partition. As indicated in Table 2, in

TABLE 2

Relative Household Income, Relative Household *Per Capita* Income, Household Size, and Percent of Total Households, by Sex and Occupation of Head of Household

(Relative means equal 100)

	Household Income	Average Size of Household	Household *Per Capita* Income	Percent of Total Households in the Partition
Sex of head of household				
Male	105	6.1	100	83
Female	73	4.3	100	17
Selected occupations of head of household				
Landless agricultural labor	51	5.9	45	1.8
Other labor	74	6.4	68	16.9
Fishing	58	6.9	65	1.1
Study	63	2.0	171	0.8
Housekeeping	78	4.9	84	6.1
All	100	5.8	100	100

Source: Computer files from Malaysian Sample.

[11] An appendix to this paper—not included here—reviewed the empirical work on equivalence scales and then used an "average" equivalence scale to compare simple distributions for family PCY and adult-equivalent PCY. The results were very nearly the same. Musgrove (1980) reached a similar conclusion for Colombian cities: ". . . estimation of subsistence expenditures from observed behavior, whether for food only or for all categories of spending, shows an elasticity with respect to household size of between 0.9 and 1.0." (p. 251).

two additional partitions there were important differences in the rank ordering of the means.

If the interest were poverty as it distributes by sex of head of household, there would be concern with female-headed households if household income were used. But one would discover that many of the poor female-headed families were quite small, suggesting that it was not such a problem after all. And in fact mean incomes by sex of household head are identical when measured in household PCY. Again students could be classified as a poverty group since their household incomes are but 63 percent of mean household incomes. Yet this would be misleading since, in terms of household PCY, their incomes are nearly one and three quarters of the mean. Similarly, if the cut-off point for defining a group as in poverty was average income for that group of less than half the mean, landless agricultural workers would be excluded if household income is the measure; but they would be included if household PCY is used.

There are also discrepancies if the household distribution of benefits from public expenditure is being measured. In the Malaysian sample, in-patient days of hospital care were distributed in rather inegalitarian fashion when matched to household incomes. The use of household PCY changed this outcome to one in which there was little relation between income and consumption of in-patient care. There were also some startling intra-distributional changes: The second lowest income quintile had the highest number of in-patient days when the measure was in terms of household income. It dropped to the lowest number when household PCY was used.

In Table 3 we have traced through the difference between the two distributions for education. For each quintile, and at each level, the table presents

TABLE 3

MALAYSIA, SCHOOL ENROLLMENT PER HOUSEHOLD BY LEVEL, AND QUINTILES, TWO INCOME CONCEPTS, 1974

	Enrollment Data									
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	Primary			Secondary		Post-Secondary		Recurrent Costs		Norm Discrepancy
Quintile	HHY	HHPCY	Ratio	HHY	HHPCY	HHY	HHPCY	HHY	HHPCY	HHPCY
Lowest	0.68	1.37	0.85	0.18	0.36	0.004	0.003	229	450	−75
Second	0.90	1.08	0.86	0.33	0.40	0.007	0.006	356	396	−68
Third	0.94	1.06	0.93	0.38	0.48	0.022	0.018	438	454	−12
Fourth	1.23	0.89	0.99	0.53	0.38	0.025	0.017	487	380	19
Highest	0.94	0.46	0.90	0.57	0.36	0.044	0.048	473	370	88
Mean	0.94	0.94	0.90	0.40	0.40	0.021	0.021	411	411	00

HHY: Household income
HHPCY: Household *per capita* income
Ratio: Enrollment ratio for HHPCY
Source: Meerman (1979), Chapter 4; computer file from Malaysian Sample.

mean number of students enrolled per household. Column (1), for example, gives the primary enrollments from lowest to highest quintile for household income. It appears to be highly inegalitarian, in fact nearly monotonic positive with income. Column (4) has the same partition for the secondary level. The association between income and household enrollment is strongly positive. Enrollment in the highest quintile is three times that of the lowest. In column (6) the partition for the post-secondary shows that household enrollment at the highest quintile is more than tenfold that of the lowest quintile.

Average recurrent costs to the government of a student year in 1974 were as follows (Malaysian dollars):

primary	$ 238
secondary	299
post-secondary	3,197

The total of these government costs per household—as implied by the enrollment data—by income quintile are given in column (8). The conclusion: Malaysia's educational system is inegalitarian. The richest fifth receives an average subsidy over twice as large as the poorest.[12] If the process is repeated using household PCY, a different picture evolves as indicated in columns (2), (5), (7), and (9). The conclusion then is that primary education is highly egalitarian; secondary education is on balance egalitarian; and post-secondary education is clearly pro-rich. Measured in terms of costs, the overall impact clearly favors the lowest three quintiles, and the lowest quintile most of all.

The reason for this outcome is that household enrollment is a function of the number of school-age children in the household. Children per household increases with household income but decreases with household PCY. Table 4 shows this for the elementary-school population. As explained earlier, household PCY is inherently a better measure of welfare than household income.

TABLE 4

MALAYSIA, ELEMENTARY SCHOOL COHORT PER HOUSEHOLD BY INCOME QUINTILES, TWO INCOME CONCEPTS. 1974

Quintile	Household Income	Household *Per Capita* Income
Lowest	0.81	1.63
Second	1.06	1.26
Third	1.09	1.16
Fourth	1.28	0.91
Highest	1.01	0.50
Mean	1.05	1.05

The cohort is defined as the number of children aged 7 to 12.
Source: Computer file from Malaysian Sample.

[12]However, the subsidies as a percentage of household income range from 14.8 percent in the lowest quintile to 13.3 percent in the second, 11.6 percent in the third, 8.8 percent in the fourth and 3.8 percent in the highest quintile.

Consequently the egalitarian conclusion suggested by column (9) is more meaningful than the opposite as suggested by column (8).

The results in Table 3 can be taken a step further which modifies the conclusion that the educational system is pro-poor. Taking off on the notion of each according to his needs, define distributive neutrality (or the norm) as equal benefits per school-aged person by level. For example, a household with three school-aged children should have three times the enrollment (and public spending) as the household with only one school-aged child. At the primary level the mean enrollment *ratio* is 90 percent (column (3) in Table 3). If all households had 90 percent of their primary-aged children in school, there would be considerable increase in enrollments in the lowest and second quintiles as shown in column (3). In contrast, the fourth quintile is over-enrolled (99 percent) relative to the norm. For each level we calculated the implicit financial shortfall or excess that is implied by over- and under-enrollment.[13] These were then summed by quintile across the three levels. The totals which resulted are presented in column (10) of Table 3. Again the outcome is somewhat pro-rich: The shortfall steadily decreases from the lowest through the third quintile, becomes an excess in the fourth quintile and increases to an excess of $88 per household in the highest quintile.

4. Income Inequality and the Life Cycle

In the analysis of the size distribution of income, the relation of age of household head to income or to the life cycle of earnings has achieved considerable prominence. Paglin (1975), for instance, defined equality in income distribution as consisting of equal incomes for all families at the same stage of their life cycle. In his view, normative equality is consistent with different incomes for households with heads in different age classes. Such age-related income differences are held to be "functional" since they arise from differences in productivity due to differences in length of work experience, and to the life cycle pattern of investment and returns to that investment in human capital.[14] Measures of income inequality should include only "nonfunctional" differences, that is differences not explained by differences in age of head of household. Paglin's commentators (1977) had many problems with this approach. As discussed below, the introduction of *per capita* income as the empirical income measure creates additional problems with it.

The age–income profile for household incomes generally takes the form of an inverted U, and similar to the life-cycle pattern of earnings for the individuals. Initially low, they increase with experience, peak and then fall on retirement. The

[13]For example at the lowest quintile of the primary, the average number of children of primary school age per household was 1.63. Since the normal enrollment ratio was 90 percent, the mean enrollment per household would have been 1.45. The actual enrollment was 1.37 and the per household discrepancy was therefore $(1.45 - 1.37)(\$238) = \$19$, in which $238 is the mean cost of a primary school-year.

[14]Paglin's equality means equal incomes for households at the same stage in the life cycle as measured by the age of the household head. His proxy for equal incomes at the same stage in the life cycle is mean household income for data grouped by age of family head.

reason why the relation is more peaked for the household than the individual may be because of wives and adolescents moving into outside employment as the family matures, and then retiring or moving out in the final years of the cycle. This pattern is reflected in Table 5 and in Figure 1 which shows relative household

TABLE 5

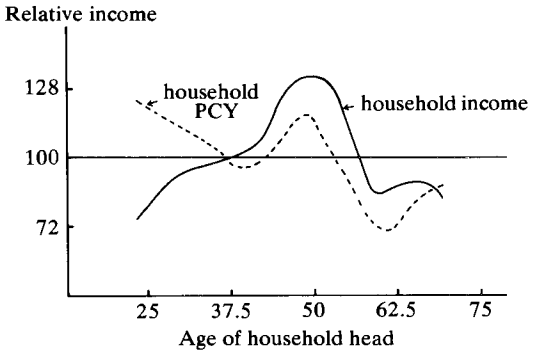
RELATIVE MEAN HOUSEHOLD INCOME AND MEAN HOUSEHOLD *PER CAPITA* INCOME PARTITIONED BY AGE OF HEAD OF HOUSEHOLD MALAYSIAN SAMPLE

Age of Household Head	Mean Income as a Percent of Overall Mean Income	Mean *Per Capita* Income as a Percent of Overall *Per Capita* Mean Income	Number of Households
1. 25 or less	71.8	126.0	82
2. Over 25–31	92.5	111.7	154
3. Over 31–37	91.0	97.0	221
4. Over 37–43	102.1	96.8	241
5. Over 43–49	128.4	113.5	223
6. Over 49–55	126.9	106.7	187
7. Over 55–61	79.2	71.0	142
8. Over 61–67	86.0	83.7	86
9. Over 67	81.1	86.1	127

Source: Computer file from Malaysian sample.

income by age of head of household for the 1,465 households of the Malaysian sample.

As also indicated in Figure 1, when we move to household PCY (by household), the inverted U takes a more complicated form. The profile for household PCY depends to a greater degree on the life-cycle in household size.



Source: Table 5.

Figure 1. The Age–Income Profile in Malaysia, 1974, using Household Income and Household PCY

We can speculate that households with very young heads are single individuals or childless couples in the labour force. These units would tend to have high *per capita* incomes, even though individual earnings are low. Subsequently, although the income of the head of household grows, the departure of women from the labour force in their child-bearing years together with a growth in the number of non-earning dependents leads to a decline in *per capita* incomes. As family size stabilizes, and income continues to grow—perhaps, due in part to labour force entrance of secondary earner(s)—this decline is reversed and *per capita* incomes peak. Finally, the effect of age on income and declining family size leads to a substantial decline in incomes (due to retirement) and *per capita* incomes follow suit, although with a rise in the highest age categories.

As a consequence of the life-cycle, in Malaysia at least, mean household PCY of households whose heads are under their mid-thirties is above average in contrast to the sub-mean magnitude for the corresponding household income distribution. (See Figure 1.) After the mid-thirties, however, the age–income profiles for the two distributions are similar: They both rise, then peak in the later forties and finally fall. But the peak is considerably higher for household income than for household PCY.

In developed countries such as the U.S., a similar ordering using incomes after considering government effects[15] may result in a flatter relation between age and household PCY, because of the combined effects of progressive taxes and pro-poor government transfers and other benefits. The fact that a much larger share of household heads under the age of thirty are students in the U.S.A.—with low earnings the consequence—would tend to reinforce this conclusion. It is possible that the age–income profile for U.S. household PCY—after considering the effects of government—would be something close to a more or less horizontal line or would show only a weak relation so that the notion of adjusting the income distribution for age would be superfluous. Such flatness in the age–income profile would in part be the result of household incomes—after considering government budget effects—and household size moving in tandem over the life cycle; that is first increasing together, peaking and then as the retirement years approach, contracting together. It would also indicate the success of the welfare policy of the U.S. federal government since in effect one of its goals is the reduction of per head income disparity due to variation in age and family size.

These results also suggest an additional reason for using household PCY in measuring inequality. An important aspect of correction for the effects of the life cycle in measuring inequality is the effect of the cycle on household size, and therefore on the *per capita* welfare within a household which is generated by a given amount of income. Accordingly a measure which automatically adjusts for size of household, by that same token, also eliminates part of the "error" in the measurement of welfare resulting from failure to consider the effects of the life-cycle. Household PCY does precisely this. In other words the adjustment of income by family size (or possibly by family size measured in adult equivalents) may be better than an adjustment based on age if the purpose of the exercise is to

[15] After payment of taxes and including transfers as well as benefits in kind. This is clearly the best measure of income if household economic welfare is the focus.

obtain an income distribution in which differences in incomes primarily reflect differences in welfare.

5. Application to Times Series

The re-ordering from family income to family PCY may also result in Gini coefficients which are affected by alterations in average family size over time. The importance of such trends is apparent on examining U.S. data. Table 6 illustrates the considerable change in average U.S. family size by tabulating the percentage of families in each size class for the two years 1972 and 1947.[16] (In the table "unrelated individuals", which the Bureau of the Census excludes from its distribution of families, are considered single person families.[17]) The proportion of one and two person U.S. families has risen considerably between 1947 and 1972, while the proportion of families in all larger sizes has declined. This would be caused by some combination of families having fewer children or extended families evolving into smaller nuclear units or adults forming households jointly without changing their single marital status.[18] As suggested by Garfinkel's prefatory statement, social changes of the kind mentioned above and the growth of the social security system may imply substantial reduction in economic inequality. However, the use of household income as the relevant welfare measure together with the exclusion of single individuals from the analysis means that such effects are in part not considered. Or if considered in full or in part (single persons excluded), they may cause an increase in measured inequality when in reality

TABLE 6

Percentage of Families in Each Size Class, United States, 1947 and 1972

Number of Persons in Families	1972	1947
1	23.6	17.7
2	28.0	25.8
3	16.3	21.1
4	14.9	16.3
5	8.9	9.2
6	4.5	4.8
7 or more	3.8	5.1
Mean	2.9	3.1

Sources: U.S. Government Bureau of the Census (1967) and (1975).

[16]Kuznets (1976), p. 48, provides similar data for a five-country sample in which the percentage of one-person households ranges from 1.8 (Philippines) to 22.6 (Germany).

[17]The institutional population is excluded.

[18]Since, by definition, a family includes only people related by blood, marriage or adoption, unrelated adults living together are counted as single individuals in the U.S. data. (This was the case through 1972.)

inequality has decreased. The household PCY concept in contrast avoids these difficulties.[19]

Nevertheless, recent measurement of U.S. income inequality has usually been based on the household income concept. A common interpretation of such measurement has been that the very substantial increases in government in-kind programs and cash transfers designed to reduce inequality since the Second World War have had little effect. Measurements of inequality have very nearly identical values for the late 1940's and the early 1970's.[20] As suggested above, the income concept may be defective. What are the results if household PCY rather than household income is used to measure the secular trend in U.S. inequality?

Table 7 answers this question by setting out the Gini coefficients for the size distribution of income in the U.S. in recent years using three measures. Section (1) is the conventional estimate using family income as provided by the U.S. Bureau of the Census. The Gini coefficients are as calculated by Mortimer Paglin in his 1975 article on U.S. income inequality. (The same household income concept and data were used by the five critics of Paglin whose comments appeared in 1977.) The estimates of column (1) use an income concept which excludes in-kind transfers (public housing, rent supplements, food stamps, medicaid) and includes income taxed away. Reynolds and Smolensky consequently calculated an after-government income distribution as shown in section (2). In section (3) we have reworked the data of section (1) using household PCY. We did not have the data to do the same for the material of Reynolds and Smolensky. In both (1) and (2) the reduction in inequality is low for the recent quarter of a century.

In section (3), between 1947 and 1972 a decline in the Gini coefficients of 15.4 percent is the result when the measure is family PCY. This contrasts to the little changed Gini coefficients for the same years if the Gini coefficients are based on family income as in sections (1) and (2). Were we able to present the results for family PCY based on family income reduced by taxes and increased by government benefits, perhaps a similar decrease would be recorded but beginning from a lower Gini coefficient in 1947. If, however, the distribution of family PCY over individuals is used then the decline in inequality is far less. The Gini coefficient for household PCY by individuals declined 6.7 percent over the 1947–72 period.

The distribution for individuals gives each person the same weight. And since it is based on family PCY and includes the entire non-institutional population, it appears to be the best measure. As noted it gives a lower decline in inequality (6.7 percent) than household PCY although more than measures used hitherto. These results suggest that the paradox of an apparently unchanged degree of statistical

[19]There are some good reasons for compiling statistics on single-person units separately from multi-person families. Typically single-person units include a large fraction of "people on the move" and information on their economic characteristics is less reliable, stable or complete compared with that for larger units. Again the institutional populations of most societies generally contain a disproportionately large number of single-person units, and the usual omission of institutional inmates from sample surveys implies that a biased sub-sample of single-person units would be included in random samples. Consequently single-person units are often left out of the analysis. However, by 1972, nearly a quarter of consumer units in the U.S. were of single individuals. Precisely because their share in the total was a rapidly increasing one, they should not be ignored.

[20]See Paglin (1975) and Comments on Paglin's Paper (1977). Even if there were no measurement problems, the conclusion that government programs were ineffective would not necessarily follow, since what equality would have been without such government intervention is not known.

TABLE 7

GINI COEFFICIENTS IN RECENT YEARS FOR THE SIZE DISTRIBUTION OF INCOME IN THE UNITED STATES: THREE DIFFERENT APPROACHES

	(1) Usual Estimate (Household Income)	(2) Reynolds and Smolensky (Household Income)		(3) Datta and Meerman (Household PCY)			
				Families		Individuals	
	Family Income	Before Government	After Government	Families and Individuals	Families	Families and Individuals	Families
1947	0.378			0.352	0.338	0.418	0.404
1950	0.375	0.391	0.334				
1970	0.355	0.400	0.322				
1972	0.359			0.297	0.296	0.390	0.376
% Change 1947–72	5.0	2.3[a]	4.6[a]	15.4	12.4	6.7	6.9

[a]1950 to 1970.

Notes and Sources

(1) Paglin (1975) p. 604. These coefficients are based on data of the U.S. Bureau of the Census. They are based solely on family incomes. Single individuals are excluded. All families receive equal weight in the Gini calculation. The income concept approximates personal income consisting primarily of factor earnings and transfer payments.

(2) Reynolds and Smolensky (1977) p. 71. Household incomes for families and single individuals are constructed using money NNP as the aggregate. Budget incidence is based on their standard incidence assumptions, except that general expenditures are allocated in proportion to household incomes. Reynolds and Smolensky also reviewed ten other studies of U.S. inequality. All were based on household income and all households received the same weight. In all of these, the Gini coefficients were little changed in 1970 from 1950. See Reynolds and Smolensky (1977) p. 35.

(3) Uses the same data sources as (1). However, the income concept is family *per capita* income. The distribution by families gives each family or household equal weight. The distribution by individuals is equivalent to the household distribution weighted by family size. The columns headed "Families" exclude one-person households. The latter are included in the columns headed "Family and Individuals".

inequality, notwithstanding very large increases in public expenditure to reduce poverty, may be explained in small part by moving to a more adequate measure of income. Using family PCY does indicate a somewhat larger decrease in statistical inequality.[21]

An interesting question is how has the increase in single person households affected the measurement of inequality in the U.S.A. (In the quarter century from 1947 through 1972, the share of single person families in total families rose from 18 to 24 percent. See Table 6.) If the income measure is family income per household, and if all households receive equal weight, then increasing the share of one person units with sub-mean household incomes will necessarily increase the

[21]See also Reynolds and Smolensky (1977): "Why has the redistributive 'bang per buck' apparently diminished in the postwar period? Although net government output is distributed in a proper fashion each year, the growth of government since 1950 failed to produce a more compact distribution." (p. 77). Browning (1976, 1979) concluded, however, that recently there has been very substantial reduction in inequality by including public expenditure benefits, adjustments for leisure, capital gains and unreported income. Smeeding (1979) takes issue with Browning. Both authors rely on household income.

measure of inequality—as noted in Mr Garfinkel's introductory quotation. However, if the concept is family PCY, either outcome is possible depending on how individual incomes relate to mean household PCY. As indicated in Table 7, the addition of single member households to the household PCY measure slightly increases the Gini coefficient. In the case of the distribution of household PCY by individuals—the preferred distribution—the increase is 3.7 percent in 1972. But in the temporal comparison—using the same distribution—the decrease in the Gini coefficients from 1947 through 1972 is very slightly larger for families than for families and individuals.[22]

Appendix 1

Calculation of Gini Coefficients for the U.S.A.

The U.S. data are from the U.S. Government Bureau of the Census (1967) and (1975). Both publications present their data only by family incomes, and for the various family income brackets, by a partitioning according to size of family. Consequently family incomes were divided by the number of persons in the family in order to obtain family PCY. Families were then re-ranked according to PCY. Families with seven or more members are assumed to have seven members for the computation of *per capita* incomes.[23] The Gini coefficients, calculated from the new distributions generated in this manner, are presented in Table 7 of the text. These are trapezoidal Gini's computed according to the formula

$$\text{Gini coefficient} = 1 - \sum_i (f_{i+1} - f_i)(Y_i + Y_{i+1})$$

where f_i = cumulated percent of families and Y_i = cumulated percent of incomes. The data for 1947 are grouped in ten brackets, while the 1972 data are grouped in thirteen brackets. The distribution of income within each bracket is assumed to be uniform.

[22]Kurien (1977) suggested that income inequality can be decomposed into choice-related and opportunity-related inequality. Choice-related inequality involves individual decisions on level and type of education as well as occupational choice. Hence differences in occupations and their associated wages reflect differences in tastes as well as in opportunities. The number of earners per household, particularly the degree of female participation, is usually a matter of choice. In the U.S.A. the number of hours to work per year, the size of the family, and household location are all matters of choice. All of these variables will affect measures of income inequality. There is no reason, however, to expect that the net impact of such measures will remain constant over time. There remains the ominous inequality due to elements which the individual is powerless to affect: genetic endowment; environmental influences including the intrauterine, the family, the school, the peer group and the neighborhood; endowment of non-human capital; and interactions among these variables; "acts of God" or bad luck such as sickness or refugee status or maiming due to warfare. Much of the value of the Gini coefficient for the United States may be due to choice-related inequality. Implicit in much of the policy oriented thought about economic inequality is the ideal of complete normative equality. As suggested above, the U.S. may already be at the point where a good deal of statistical inequality really reflects welfare equality—insofar as welfare is a function of economic variables. This suggests that we should be more wary on the meaning we attach to aggregate measures of inequality. It may be more useful to de-emphasize aggregate measures in favor of a focus on clearly disadvantaged groups, such as the extremely poor.

[23]This bracket contained four and five percent of total families in 1972 and 1947. See Table 2.

Besides these general assumptions, some specific assumptions are made regarding the data for each year. These are, for 1947:

(i) The assumption that the unknown mean family income in each income bracket is the middle point of that bracket. The error arising from this procedure is likely to be negligible, since for later years, when the mean family income in each bracket is available, the data show the means to lie very close to the mid-points of the brackets.

(ii) Households with negative incomes are considered as having no income, which is what is required for the calculation of Gini coefficients. Consequently in the lowest income bracket, \$1,000 and below, mean incomes are assumed to be zero.

(iii) For the upper open-ended income interval, \$10,000 and above, the assumed mean family income is \$15,600. This value is obtained by applying the Pareto formula[24] $\bar{X} = X[V/(V-1)]$ where $V = (c-d)/(b-a)$, $\bar{X}$ = the estimated mean in the open end interval, X = lower limit of open end interval, a = logarithm of lower limit of interval preceding open end, b = logarithm of lower limit of open end interval, c = logarithm of the sum of the frequencies in the open end interval and the one preceding it, and d = logarithm of the frequency in the open end interval.

For 1972 the only specific assumption employed is the attribution of zero mean income to the lowest income bracket (incomes of \$1,000 and below).

Appendix 2

Gini Coefficients and Income Concepts

An interesting question is whether there is any necessary pattern in the Gini coefficients generated for a given population from households distributed first by household income, then by household PCY for each household and finally by household PCY for individuals. We noted that in Visaria's work (see Part 2) all of the results were of a single pattern. For every distribution the Gini coefficient for household incomes was higher than for household PCY by individuals. And as noted earlier it is also true that in all of the distributions which have come to our attention:

$$M = f(Y), \qquad f' > 0 \tag{1}$$

and

$$M = g(Y/n), \qquad g' < 0 \tag{2}$$

where M = mean number per household, Y = household income, and n = number in the household.

Consequently one might suspect that if the elasticity of household income to household size exceeds zero but is less than one—as implied by equations (1) and (2)—then the Gini coefficient is necessarily lower for household *per capita* income than for household income.[25] Yet simple examples show that the conclusion is

[24]See U.S. Government, Bureau of the Census (1967), p. 34.

[25]There is at least one published instance of this conclusion; see I.Z. Bhatty in "Inequality and Poverty in Rural India" in Srinivasan and Bardhan (1974).

invalid. Consider two income distributions (A) and (B) as shown in Table 9. In both cases equations (1) and (2) apply. Each has two families.[26] In the case of distribution (A) we have the Visaria pattern with respect to the order of the Gini coefficients: the Gini coefficient is lower for household PCY (for both definitions) than for household income. Distribution (B), however, does not exhibit these results. Rather the Gini coefficient is lowest for household income. The ordering of the values of Gini coefficients in developing countries using the three income concepts is, therefore, as depicted in example (A). But this ordering is not necessary if the only restrictions are those of equations (1) and (2).

Anand (1978) has shown that if the elasticity of household income to household size exceeds unity, then the Visaria pattern of higher Gini coefficients for household incomes would be always observed. But equation (2) would have to be invalid, if the elasticity were to exceed one.

TABLE 8

THREE INCOME CONCEPTS FOR HYPOTHETICAL INCOME DISTRIBUTIONS (A) AND (B) AND THEIR CORRESPONDING GINI COEFFICIENTS

Income Distribution	(A)			(B)			
Family	I	II	Gini C.	III	IV	Gini C.	Discrepancy
Household income	500	900	0.143	500	600	0.045	50
Household size	1	2		1	3		
PCY of households	500	450	0.024	500	200	0.214	150
Household PCY by individuals	500	450	0.026	500	200	0.205	112.5

If we interpret the Gini coefficient in a manner similar to Pyatt (1976) or Bhattacharya and Mahalanobis (1967) we can make these results more intuitive. In their interpretation the Gini coefficient equals one half the mean difference between any two incomes taken at random divided by mean income. For household income the equation is therefore:

$$G = \left[\tfrac{1}{2}\sum_{i=1}^{N}\sum_{j=1}^{N}|Y_i - Y_j|\Big/N^2\right] \div \bar{Y}. \tag{3}$$

And for household PCY—with each household receiving equal weight— it is

$$G = \left[\tfrac{1}{2}\sum_{i=1}^{N}\sum_{j=1}^{N}|(Y_i/n_i) - (Y_j/n_j)|\Big/N^2\right] \div (\overline{Y/n}) \tag{3'}$$

where i and j = households, G = Gini coefficient, Y_i = household income of household i, n_i = number in household i, N = number of households, and $\bar{Y}$ = mean household income.

$$(\overline{Y/n}) = (\sum Y_i/n_i)/N.$$

[26]Or each distribution is of indefinite size with shares of income and households in proportion to those of the table.

In terms of equation (3), in distribution (B), the mean of $|Y_i - Y_j|$ is 50 for household income, 150 for PCY of households, and 112.5 for household PCY by individuals.[27] The corresponding mean incomes are 550, 350 and 275. And the Gini coefficients are half of the resulting ratios of mean difference to mean income.

Mean income must always decrease in moving from household income to household PCY, because household PCY is defined as household income divided by household size. Consequently, if the Gini coefficient is to fall the mean difference between any two incomes must decrease to a greater degree than mean income, because the mean difference is divided by the mean income. As shown in example (B), however, it is possible for the mean difference to actually increase if the elasticity of income to family size is very low, although still exceeding zero.

Example (B) suggests an interpretation of the recent U.S. pattern. As shown in Table 7, in recent decades the U.S. Gini coefficient for household PCY by individuals (0.390) is much larger than for household income (0.359). and as in example (B), in the U.S. there is weak progression in mean income with family size, a progression which is reversed for family size exceeding five persons. Because of this low elasticity of household income to household size many of the high income families perhaps consist of low income individuals if the household PCY distribution is used. If the U.S. results are typical for a developed country, it may be that as countries develop, changes associated with increasing incomes and smaller families eventually bring a reversal from the pattern Visaria found for his five countries.

The U.S. result—in which household income (Y) is an increasing function of size only through 5 persons—has no necessary implication for equation (1), in which family size is the dependent variable, because both dependent variables, that is Y in the U.S. example and M in equation (1), are means with variances and probability densities which change as their corresponding independent variables take on increasing values. As a consequence equation (1) need not imply $\bar{Y} = h(M)$, $h' > 0$, for all values of M. Specifically while U.S. data for 1972 show a distinct peak for mean income at the size class five persons, the relation of mean family size is positive for nearly all household income levels, being only marginally departed from for the few incomes in the brackets of $1,000 to $4,000 and for incomes greater than $50,000.

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[27] Set i and j to refer to individuals and equation (3′) becomes applicable to the distribution by individuals.

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