HOW MISLEADING ARE INCOME DISTRIBUTIONS?

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Starting from the proposition that economic welfare is better measured by the capitalized value of expected future income at age 18 than by income at a point of time, the present paper explores the bias introduced in comparisons of earnings and income distributions.

The earning distribution chosen for study is that for males in 1959 in the United States. It is shown that earnings distributions are biased and therefore can be considered highly misleading in most comparisons unless the comparison involves two groups with identical age distributions and identical distributions of earnings over the working life of earners.

Further, a most striking effect can be discerned in comparing the earnings to the present value distributions by educational level. As one moves up the educational ladder, the within-group distribution of lifetime income becomes more and more equal, in sharp contrast to the findings for the distribution of earnings at a point in time.

The results are sufficiently interesting and striking to warrant further studies of distributions of present value of lifetime expected earnings (and income).

1. INTRODUCTION

In recent times a number of economists have pointed out some of the shortcomings of income at a point in time as a measure of economic welfare, and through economic welfare as a determinant of behavior such as consumption. Burton Weisbrod has suggested the alternative measure of the capitalized value of expected future income per capita.[1] The present author has explored the implications of such a measure for the comparison of economic welfare between countries.[2]

Economic welfare of a group of individuals is not only a function of the average control of resources but also of the distribution of these resources among individuals. Here too it is important to have a reasonable measure of economic welfare. Peter Henle, after an excellent exploration of the distribution of earned income in the United States,[3] asks the important question: "Is equality to be considered solely in terms of the flow of income at a specific point in time? Or is the flow of income during a person's lifetime more relevant?"[4] Harry Johnson is much more positive in his assertion that "inequality is to be measured not by the labor incomes of individuals undifferentiated by age and education but by the

[1]Burton A. Weisbrod, "An Expected-Income Measure of Economic Welfare," *The Journal of Political Economy*, August 1962, pp. 355-67.

[2]Vladimir Stoikov, "An Empirical Estimate of the Relation Between Two Measures of Economic Welfare," *The Review of Income and Wealth*, September 1971, pp. 299-305.

[3]Peter Henle, "Exploring the Distribution of Earned Income," *Monthly Labor Review*, December 1972, pp. 16-27.

[4]*Ibid.*, p. 25.

lifetime earnings (or with greater theoretical accuracy, consumption) profiles of these individuals."[5] He also thinks that most of us would agree with him.[6]

Assuming such general agreement, it might be puzzling why investigations of inequality universally use distributions of income (or earnings). M. J. Bowman points out that the data problem in constructing distributions of life-income prospects are severe. However, she adds, "it would be possible to construct cohort approximations by schooling categories and to simulate distributions of earnings around those means for the construction of life-earnings distributions, past and projected into the future."[7]

The main purpose of the present paper is a modest exploration in line with this latter suggestion. Using easily available data, we compare distributions of the present value of expected future earnings to distributions of earnings at a point of time. The results are striking, and deserve further research. But before the results are presented, the reader is confronted with a paradox which should help make the subsequent results of comparisons more easily understandable.

II. A PARADOX

Since present values of expected future incomes or earnings are rather difficult to construct, it is reasonable to ask whether they differ in a significant way from income, and whether a significant difference implies a different interpretation of the concept of economic inequality as universally used in the income-inequality literature of today.

The following example, admittedly artificial in many respects, dramatically contrasts the equity implications of the contrasting measures. A country, that will be named Utopia for obvious reasons, has a population with the following characteristics: (a) At age eighteen every individual can look forward to an identical stream of income over his lifetime. The stream is small in the early years, but increases rapidly at the beginning, and then more slowly during middle age, and reaches a maximum around age sixty-two. To be more specific, assume the stream is the estimated annual earnings stream of white males in the occupational category of "managers, officials, and proprietors, excluding farm," with four or more years of college education, and in the experienced civilian labor force with earnings in 1959 in the U.S.A.;[8] (b) The population in Utopia being rather homogeneous in health and other relevant characteristics, individuals have the same life-expectancy; and (c) Utopia being a very fertile land, on the whole underpopulated, and composed of a lusty population, fertility is high. The result is

[5]Harry G. Johnson, "The Alternatives Before Us," *Journal of Political Economy*, No. 3, Part II, May/June 1972, p. S285. The parentheses are rather puzzling since they imply that the size of the estate left to one's children does not bring satisfaction to a planning parent.

[6]*Ibid.*

[7]M. J. Bowman, "Comment," *Journal of Political Economy*, No. 3, Part II, May/June 1972, p. S69.

[8]Herman P. Miller and Richard A. Hornseth, *Present Value of Estimated Lifetime Earnings*, Technical Paper 16, Bureau of the Census, U.S. Dept. of Commerce, U.S. Government Printing Office, 1967, p. 22.

a very young population. Again to be more specific, assume the age distribution is that of males (between the ages of 18 and 64) in Costa Rica in the year 1960.[9]

Given the characteristics of this happy land, it is no surprise that a look at the distribution of the present value of expected future earnings at age eighteen will show a perfectly egalitarian society. Now let us send a team of expert statisticians to investigate the income distribution in Utopia. Having assumed a number of characteristics earlier, it is possible to foreshadow the results of the investigation.

Before reporting the results, it is useful to specify the manner in which inequality will be reported.[10] In what follows three numbers will be reported. These are the incomes (earnings) of the fifth, tenth and seventy fifth percentile (multiplied by one hundred) and measured from the top of the distribution, expressed as a fraction of the fiftieth percentile (the median). These numbers will be referred to henceforth as P_5, P_{10}, and P_{75} respectively.[11] P_5 and P_{10} tell us about the relative dispersion of the upper tail of the distribution, while P_{75} tells us about the relative dispersion of the lower tail. For completeness the whole range of P's could be reported, but for the present limited purpose the three P's (P_5, P_{10}, P_{75}) suffice.

Returning to Utopia, the report of the team of experts on income inequality would have included these P values:

$$P_5 = 191$$

$$P_{10} = 185$$

$$P_{75} = 64.$$

These can be compared to the same measures for a number of countries. Lydall's work greatly facilitates the task.[12] Table 1 presents a selected list for the purpose of comparison. Utopia appears now in a peculiar light. P_5 corresponds to the upper tail dispersion of egalitarian countries like Australia, Denmark, and Sweden. P_{10} for Utopia is in the range of much less egalitarian countries like Spain and France. Finally P_{75} for Utopia is in the range of highly inegalitarian societies such as Japan, India, and Mexico. Thus with the exception of the upper tail (P_5) it appears that Utopia is a country with great inequities. At least that would be the report of the statistical team.

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[9]Nathan Keyfitz and Wilhelm Flieger, *World Population: An Analysis of Vital Data*, The University of Chicago Press, 1968, p. 94. Graphic interpolation of the data was necessary to make it compatible with the earnings distribution.

[10]Helpful discussions of measures of inequality can be found in M. J. Bowman, "A Graphical Analysis of Personal Income Distribution in the United States," *American Economic Review*, September 1945, pp. 607–28; and in Harold Lydall, *The Structure of Earnings*, Clarendon Press, 1968, pp. 137–41.

[11]The nomenclature is that used by Lydall, *op. cit.*, p. 139. This makes comparison with his results easier. In the last section the three following numbers are used: P_{10}, P_{25}, P_{75}.

[12]H. Lydall, *op. cit.*, pp. 152–57.

TABLE 1
DEGREE OF DISPERSION FOR SELECTED COUNTRIES

Country and Year	P_5	P_{10}	P_{75}
New Zealand, 1960–61	178	150	83
Australia, 1959–60	185	157	84
Denmark, 1956	200	160	82
Sweden, 1959	200	165	78
United States, 1959	206	167	75
Spain, 1964	220	180	75
France, 1963	280	205	73
Japan, 1955	270	211	64
India, 1958–59	400	300	65
Mexico, 1960	450	280	65

Source: H. Lydall, *op. cit.*, Table 5.5, p. 153. (This is a selected list from Table 5.5).

The results for Utopia clearly depend on two crucial assumptions:[13] (a) the rate of increase of income over the working life of the population, and (b) the age distribution of the population which depends crucially on the birthrate.[14] It should be clear that there is no simple way of adjusting income distributions for age composition in making comparisons because the income distribution is a product

[13]In order to observe the effect of these assumptions, two further distributions were constructed for Utopia. First, a stream of income over the lifetime of the individual which increases much less steeply than the one used earlier was chosen: the estimated annual earnings stream of white males in the occupational category "Clerical and kindred workers," with four years of high school (Herman P. Miller and Richard A. Hornseth, *op. cit.*, p. 25). Second, the age distribution of the United States white male population in 1960 (Nathan Keyfitz and Wilhelm Flieger, *op. cit.*, p. 154), which may be described as "middle-aged." Given these and the previously assumed distributions, four different sets of *P* values can be obtained. The following table lists these values:

Degree of Dispersion in Income for Selected Age
Distributions and Earnings Profiles

	Flat Earnings Profile			Steep Earnings Profile		
	P_5	P_{10}	P_{75}	P_5	P_{10}	P_{75}
Medium-aged population (medium birthrate)	103	103	89	150	149	66
Young population (high birthrate)	107	107	74	191	185	64

Source: Calculated from assumed distributions. Figures are rounded to nearest whole number.

If the *P* values for the distribution of the present values of expected future earnings at age 18 had been computed under the same assumptions, the values would have been equal to 100. Assuming that these calculations are the relevant ones, one can talk about the bias introduced by measuring equality by income distributions. The following conclusions can be drawn from the table:
(a) The bias is greater, the steeper the earnings profile, and the younger the population.
(b) The size of the bias is greater in a normal range of increases of earnings profiles than in a normal range of age structures. (If instead of earnings distributions one looked at total income, the bias would be even greater since income other than earnings increases with age.)

[14]For the effect of the birthrate on age structure see Ansley J. Coale, "The Effect of Changes in Mortality and Fertility on Age Composition," *The Milbank Memorial Fund Quarterly*, January 1956, pp. 79–114.

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of age composition *and* steepness of earnings profiles. We now turn to an examination of an actual income distribution and compare it to the distribution of the present value of the lifetime income at age eighteen.

III. The Data and Assumptions

The earnings distribution chosen for study is that for males in 1959 in the United States. The reason is simple. The Bureau of the Census has published on the basis of one of its subject reports[15] estimates of the present value of expected lifetime earnings by the major occupational groups, and by three levels of education completed.[16] It thus becomes relatively simple to compare the earnings distribution of the same population to the distribution of present values of expected future earnings at age eighteen, using the same basic data. Age eighteen is the lowest age for which present values are computed.

The P_i values of a distribution are sensitive to the exact definition of the membership included and the income concept used.[17] It is therefore important to compare distributions of income and present value of expected future earnings which refer to the same concept of income and cover exactly the same classification of individuals into groups. The distribution of earnings for males derived from the subject report mentioned earlier, for example, can be described by the following P_i values:

$$P_5 = 242$$

$$P_{10} = 191$$

$$P_{75} = 76.$$

This distribution does not correspond to any of the 23 U.S. distributions for which P_i values are computed by Lydall.[18] To begin with the concept of income used is earnings which does include self-employed earnings in contrast to the wage and salary concept used in Lydall's work. But more importantly the values are computed for earners 18–64 years old, while most of the Lydall distributions include the male population of wage and salary earners above the age of fourteen. Thus direct comparison is impossible. The closest group of comparison is that given in his Table 4 (p. 358) with the following P_i values:

$$P_5 = 206$$

$$P_{10} = 168$$

$$P_{75} = 74.$$

It is clear that the differences are sizable, especially at the upper end of the distribution, although they still appear consistent enough not to raise questions of reliability of computation when compared to values for other countries.

[15]U.S. Census of Population: 1960. *Occupation by Earnings and Education*, Series PC(2)-7B.
[16]Herman P. Miller and Richard A. Hornseth, *op. cit.*
[17]Harold Lydall, *op. cit.*, pp. 357–68. Observe, for example, the difference in P_i values for the U.S. depending on exact definition of membership and income concept.
[18]*Ibid.*

The computed estimates of present value of expected lifetime earnings[19] suffer from some conceptual difficulties. First, the estimates are derived from cross-sectional data rather than actual lifetime earnings profiles. The two are very different.[20] Unlike the cross-sectional data for most occupational groups, actual age-earnings profiles never level off, and each birth cohort is higher at all points than the one before it. To some extent this difference is taken into account in the calculation of the estimates by an assumed annual increase in earnings due to rising productivity (X in f.n. 19). This is not a perfect correction, particularly since X is assumed constant over age groups and cohorts, and the results should be judged therefore with these difficulties in mind.

Second, the estimates depend on both the assumed annual increase in earnings due to rising productivity (X) and the rate of discount used to convert future earnings to their present value (R). Since the highest rate of discount used by Miller and Hornseth is 5 percent, which appears on the low side of discount rates that are used and justified in evaluating investments in human resources,[21] we have limited the discussion to present values corresponding to the set $R = 5$ percent; $X = 0$ percent. This set is approximately equivalent to the following sets:[22]

$$R = 6 \text{ percent}, \quad X = 1 \text{ percent};$$
$$R = 7 \text{ percent}, \quad X = 2 \text{ percent};$$
$$R = 8 \text{ percent}, \quad X = 3 \text{ percent}.$$

The last two sets appear to us most realistic and defensible. Nevertheless, some of the distributions were computed also with R = 3 percent and X = 0 percent (approximately equivalent to sets R = 4 percent, X = 1 percent; R = 5 percent, X = 2 percent; and R = 6 percent, X = 3 percent). The distributions are somewhat sensitive to these variations, but not the qualitative results to be reported

[19]The following formula describes the basic method used by Miller and Hornseth (*op. cit.*, p. 2) to prepare the estimates, showing the present value of the expected earnings from age eighteen through sixty-four, which is the usual retirement age for men:

$$V_{18} = \sum_{N=18}^{64} \frac{Y_N P_N (1 + X)^{N-18+\frac{1}{2}}}{(1 + R)^{N-18+1}},$$

where Y_N = the mean annual earnings at age N. These single-year-of-age estimates were obtained by fitting a parabolic function to the age-group data shown in U.S. Census of Population: 1960, *Occupation by Earnings and Education*, Series PC(2)–7B.

P_N = the relative number of survivors at age N of those alive at age eighteen. The underlying data are presented in *Vital Statistics of the United States, 1964*, Vol. II, Section 5, Life Tables.

X = assumed annual increase in earnings due to rising productivity.

R = the rate of discount used to convert future earnings to their present value.

[20]See for instance Chapter 5 of the *1974 Economic Report of the President*, U.S. Government Printing Office, Washington, D.C., 1974, pp. 146–48.

[21]For two recent and excellent discussions, see Kenneth J. Arrow, "The Social Discount Rate," in G. G. Somers, and W. D. Wood, eds., *Cost-Benefit Analysis of Manpower Policies*, 1969, pp. 56–75; and William J. Baumol, "On the Discount Rate for Public Projects," in R. H. Haveman and J. Margolis, eds., *Public Expenditures and Policy Analysis*, 1970, pp. 273–90.

[22]This comes about because $(1 + R)^N/(1 + X)^N$ is very well approximated by $1/(1 + X - R)^N$.

later. For example, the distribution of present values for whites with the two sets can be described as follows:

		P_5	P_{10}	P_{75}
$R = 5$, $X = 0$ $[R = 7$, $X = 2]$		194	170	86
$R = 3$, $X = 0$ $[R = 5$, $X = 2]$		202	175	83

As was to be expected, lower discount rates and/or higher assumed growth rates of productivity result in somewhat more unequal distributions of expected lifetime incomes.

Third, the literature suggests that there is a considerable occupational mobility of employed workers.[23] But up to half of that mobility is accounted for by individuals under 35 years of age, and another quarter by occupational mobility within major occupational groups. Furthermore, most of the remaining mobility is across groups with similar earnings profiles. Nevertheless it is not clear to what an extent the estimated values may be biased because of occupational mobility.

It might also have been desirable to estimate the "potential" lifetime income rather than actual by using profiles estimated on the basis of the labor force fully employed, say approximately 2,000 hours per year. Such an estimate, on the other hand, would have been more difficult to interpret because of involuntary part-time work and/or involuntary unemployment.

Clearly, other conceptual issues could be raised with the suggested measure. The present estimates are presented in the spirit of a first approximation.

Since present values of expected future income are available by educational level for only those who had completed (a) eight years of elementary school, (b) four years of high school, and (c) four years or more of college, the remaining discussion will limit itself to that group.[24]

We proceed by first comparing the distribution of earnings and present values of expected lifetime earnings by race, and then by race and educational level. Before the comparisons are presented a few words on the present values chosen for the comparison are necessary. First, it is clear that the present values at an early age are necessary in order to have measures of lifetime prospects or lifetime economic welfare, but it is not clear what this early age should be. We have chosen to use eighteen, the earliest age for which the Bureau of the Census has computed present values. In order to compute the distribution of these values it is necessary to know how the eighteen-year-old males will distribute themselves among the major occupational groups. Their distribution among occupations at age eighteen is not a good indication of their distribution over most of their lives since a great number have not yet finished their schooling. In order to better approximate that latter distribution we have assumed, somewhat arbitrarily, that they will distribute

[23]Samuel Saben, "Occupational Mobility of Employed Workers," *Monthly Labor Review*, June 1967, pp. 31–38.

[24]Highest grade of school completed represents the combination of (a) grade attended and completed and (b) next higher grade attended but not completed. The three levels discussed above comprise 50.1 percent of the white males 18 to 64 years old with earnings in 1959, and only 30.6 percent of the non-white males. The remainder are dropouts from any of these educational levels (dropouts are therefore individuals who have completed at least one grade or year of the three educational categories).

themselves among occupations as the thirty-year-old earners have distributed themselves in 1959.

IV. FINDINGS

Comparisons by Race

Table 2 presents a comparison of inequality, as measured by P_i values, for the distribution of earnings and that of present values of expected lifetime earnings for white and non-white males in 1959 in the United States. For whites the distribution of present values is considerably more equal than the distribution of earnings. For non-whites that comparison is less clear-cut. The distribution of present values appears more equal at the lower end of the distribution, and less equal at the upper end.

The distribution of earnings for non-whites is considerably more egalitarian than for whites, especially at the upper end. Finally the distributions of present values for whites and non-whites appear to be equally unequal. In terms of the discussion in the previous section, the explanation must lie in the higher increase in earnings over their lifetime for whites.[25]

The important conclusion to draw from Table 2 is that although two distributions in present value terms (our accepted standard) may be very similar, the underlying earnings distribution may be dramatically different (in this case at the upper end of the distribution), and therefore very misleading.

TABLE 2

COMPARISONS OF DISTRIBUTIONS OF EARNINGS AND PRESENT VALUE OF EXPECTED FUTURE EARNINGS BY RACE. (P VALUES EXPRESSED IN TERMS OF EACH GROUP'S MEDIAN)

	Earnings Distribution			Distribution of Present Values		
	P_5	P_{10}	P_{75}	P_5	P_{10}	P_{75}
Whites	233	197	80	194	170	86
Non-whites*	159	136	81	**	170	89

Source: Computations described in text.

*The P_i values for non-whites are particularly affected by limiting oneself to the three educational levels completed. The corresponding values for the earnings distribution for all educational groups are: $P_5 = 191$, $P_{10} = 163$, $P_{75} = 83$.

**This value is difficult to estimate due to the character of the distribution. Rather than guess, we prefer not to report it.

A point of interest to statisticians and theoreticians alike, the distributions of present value appear, on graphical examination, to fit reasonably well a log-normal distribution over the whole range, something that cannot be said about

[25] "... the whole notion of a career with steady advancement is relevant only for white males, whose wages rise through ages 45 to 54. Black males, and women of both races, make progress only through ages 20 to 24. From ages 25 to 34 onward, their wage profiles are practically flat." Robert E. Hall, "Why is the Unemployment Rate so High at Full Employment?," *Brookings Papers on Economic Activity*, No. 3, 1970, p. 393.

earnings distributions.[26] This "fact" deserves further investigation, and if generally confirmed will need an explanation.

Comparisons by Race and Educational Level Completed

Table 3 presents a comparison of measures of inequality for the distribution of earnings and of present values of expected lifetime incomes, broken down this time by race and educational level completed.[27] The results are more striking than those reported above and can be summarized as follows:

(a) For both whites and non-whites the distribution of present value is more equal than the distribution of income, except for whites with an elementary education only, and that only at the upper end of the distribution.

(b) Comparing earnings distributions alone, by level of educational attainment, there is no evidence that the distributions differ very significantly. This contrasts with the finding by race not disaggregated by educational level attained.

(c) Comparing present value distributions alone, by level of educational attainment, there appears to be a significantly more equal distribution for non-whites than for whites with elementary level attainment, but no difference for high school graduates. This again contrasts with the finding by race not disaggregated by educational level. This difference appears to be due to the very equal present value distribution of whites with a college degree.

(d) Finally, a most striking effect can be discerned in comparing, by race, the earnings to the present value distributions by educational level. For whites the effect is more clear-cut. As one moves up the educational ladder, the earnings distribution becomes less and less equal. In contrast as one moves up the educational ladder, the present value distribution becomes more and more equal. This effect is especially discernible in Table 4 which presents the interquartile range divided by the median as a measure of inequality.[28] This reversal also holds for non-whites in the upper end of the distribution (Table 3), but not at the lower end, and the comparison for non-whites in Table 4 is thereby obscured.[29]

This reversal of the measures of inequality is the result of the following characteristics of the different groups. For simplicity contrast the group of college graduates to elementary school graduates. These groups differ very significantly in the distribution of their earnings over their lifetime. College graduates receive relatively low earnings early in life, especially while going to college, but rapidly increasing earnings over most of their working life. In contrast the earnings of elementary school graduates do not vary very much over their lifetime. But the variance of the *level* of these latter earnings is greater than the variance of the "average" earnings of the college graduates. These differences lead to the reversal of measures of inequality obtained above.

[26]Harold Lydall, *op. cit.*, pp. 64–65.

[27]Note that Table 4 gives P_{10}, P_{25}, P_{75} values in contrast to the earlier P_5, P_{10}, P_{75} value. P_5 values are difficult to estimate for distributions with few observations. Furthermore, an alternative measure of inequality, to be presented in Table 4, depends on P_{25} and P_{75} values.

[28]The interquartile range divided by the median is also equal to $P_{25} - P_{75}/100$ in the terminology adopted earlier. Because of rounding of P_i's, the values in Table 4 may not be exactly derivable from Table 3.

[29]Nevertheless, the differential in inequality is considerably reduced by using present value distributions rather than the earnings distribution.

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TABLE 3

COMPARISON OF P_i'S OF DISTRIBUTIONS OF EARNINGS AND PRESENT VALUE OF EXPECTED FUTURE EARNINGS BY RACE AND LEVEL OF EDUCATION COMPLETED

		Earnings Distribution			Distribution of Present Value		
		P_{10}	P_{25}	P_{75}	P_{10}	P_{25}	P_{75}
Whites	Elementary	114	107	76	129	120	80
	High School	143	114	79	124	108	86
	College	139	121	66	125	115	98
Non-whites	Elementary	121	117	89	123	109	91
	High School	129	115	77	115	105	84

Source: Computations described in text.

TABLE 4

COMPARISON OF $(P_{25} - P_{75})/100$ VALUES OF DISTRIBUTIONS OF EARNINGS AND PRESENT VALUE OF LIFETIME EARNINGS BY RACE AND LEVEL OF EDUCATION COMPLETED

		Earnings Distribution	Distribution of Present Value
Whites	Elementary	0.316	0.400
	High School	0.357	0.226
	College	0.552	0.165
Non-whites	Elementary	0.275	0.172
	High School	0.378	0.214

Source: Computations described in text.

The earlier tentative conclusion is strongly reinforced. Earnings distributions are biased and therefore can be considered highly misleading in most comparisons (unless the comparison involves two groups with identical age distributions and identical distributions of earnings over the working life of earners).[30]

Education and Economic Equality

Recently considerable doubt has arisen that more education will lead to greater economic equality. Among others, Thurow[31] concludes that, since education has been becoming more equally distributed yet income has not, education cannot be looked upon as a means of equalizing economic welfare. One may well inquire whether using a biased measure of economic welfare has not contributed to the conclusion.

[30]Of course, for some purposes earnings distributions may be better. They are biased only to the extent that the expected lifetime income measure is accepted as the conceptually better one.

[31]Lester C. Thurow and Robert E. B. Lucas, *The American Distribution of Income: A Structural Problem*, Joint Economic Committee Print, 92d Congress, 2d Session, U.S. Government Printing Office, March 17, 1972. See also Lester C. Thurow, "Education and Economic Equality," *The Public Interest*, Summer 1972, pp. 66–81.

The finding of the present paper that as one moves up the educational ladder, the distribution of the present value of expected future earnings at age eighteen within each educational group becomes very significantly more and more equal may tempt one to infer that for all groups as a whole economic inequality decreases as individuals move up the educational ladder. Such an inference would be incorrect because overall inequality depends not only upon inequality within groups but also on the proportions of each group in the total. Only when the proportion of the group in the upper end becomes very large can one make safely the intuitive inference.

The $(P_{25} - P_{75})/100$ value of the distribution of present values for the three educational classes of whites together, in Table 4, given their 1959 proportions, is 0.50. The same value computed on the assumption of changing the relative proportions to correspond roughly to the proportions twenty years earlier[32] is 0.40. Thus, even measuring economic welfare with the preferred measure has led to a slight increase in economic inequality for the group as a whole.

On the other hand the equalization of the distribution of education over the last twenty years has been rather small. Although large shifts in the proportions of the three educational groups have taken place the resulting equalization is from 0.27 to 0.23 as measured by the coefficient of variation.[33]

Finally, it is possible to raise the question whether perceived economic equality is best measured by a measure of equality of the population as a whole alone. To some extent perceived equality is a function of the relative equality among peers. A relevant peer group is the individual's educational attainment class. If that is accepted, perceived equality will increase partially to the extent that individuals move up from one educational attainment group to another. In that sense there has been some equalization of economic welfare over the last twenty years.

V. CONCLUDING REMARKS

This paper presents results of an investigation of a single earnings distribution and its implied distribution of lifetime economic welfare. For that reason alone it has to be considered very exploratory in nature. The results are sufficiently interesting and striking to warrant further studies of distributions of present value of lifetime expected earnings (and income).

As was shown in Section II, current earnings distributions are a function of the age composition of the population and the distribution of earnings over the

[32]The proportion of elementary school graduates was assumed to double, that of secondary school graduates to be reduced by two-thirds, and that of college graduates to one-half of their 1959 values.

[33]Computed on the assumption of eight years of schooling for those with a grade school education, twelve years of schooling for those with a high school education, and sixteen years of schooling for those with a college education. The distributions of the white labor force used are:

	1949	1969
Grade school education	47%	20%
High school education	38%	51%
College education	15%	28%

The figures come from Thurow and Lucas, *op. cit.*, p. 34.

lifetime of the individuals making up the population. There is no feasible way in which one can construct earnings distributions standardized for these factors because they interact in a multiplicative manner. The more unequal is the distribution of earnings over the lifetime of individuals, the more important becomes the age composition in determining the earnings distribution. As Lydall has remarked, "neglecting the age structure becomes entirely unsatisfactory and completely misleading if the distribution is compared over periods in which the number of old or young people has greatly increased."[34] And yet the literature continues to describe, analyze, and compare earnings and income distributions. It is our contention that this procedure introduces so much noise (information irrelevant to judging lifetime economic welfare) that the resulting information becomes almost impossible to interpret.

The alternative of constructing distributions of the present values of lifetime earnings and income involves difficult empirical work, and many possible conceptual pitfalls not discussed in this paper, but appears at this point considerably more attractive. The results presented here, clearly needing further checks, would have gone unnoticed unless such distributions were constructed. For example, the important finding that as one moves up the educational ladder, the distribution of lifetime economic welfare within educational groups become very significantly more equal—in sharp contrast to the finding when earnings distributions are explored—does appear to throw some cold water on the recent skepticism about the effect of education on economic equality.

At some point in the factual investigation of distributions of lifetime incomes a theory of the determinants of such distributions will be required. The logical place to look for a beginning is the theory of human capital. A valiant and partially successful attempt in this line is the work of Lydall.[35] Unfortunately the theory is used to explain earnings distributions while it is better fitted to explain lifetime earnings distributions. The fact that the distributions of present value appear to fit reasonably well a log-normal distribution over the whole range suggests that a number of human competencies interact multiplicatively to produce the capacity to earn an income.

A final remark deserves to be aired. The fact that the suggested measure of economic welfare turns out to be more equally distributed than earnings or incomes is absolutely no reason to become complacent about the distribution of economic welfare in any nation. We have become accustomed to certain absolute numbers and will have to get accustomed to another set. What is important is their change over time, and their comparison with such sets in other countries.

[34]Harold Lydall, op. cit., p. 34.
[35]Ibid., chapter 4 entitled "Proposals for a New Theory," pp. 68–136.

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