Income distribution and life expectancy: a critical appraisal

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In a series of papers published during the past decade Richard Wilkinson has advanced the view that income inequality is the key determinant of variations in average life expectancy at birth among developed countries. Yet a careful examination of the two sources of data on income distribution most often used by Wilkinson suggests that if they are analysed more appropriately they do not lend support to his claims. More recent data on income distribution is now available for several countries in the Organisation for Economic Development and Cooperation in the mid-1980s and for Great Britain from 1961 to 1991. The use of these data also casts doubt on the hypothesis that inequalities in the distribution of income are closely associated with variations in average life expectancy at birth among the richest nations of the world.

A paradox inherent in the scientific method is that, attached though we are to the hypotheses we formulate, we must really subject them to assault and search for circumstances that really test their resilience.[1]

Life expectancy is one of the key indicators of population health and economic development. Citizens of the poorest countries can expect to live for many decades less than those of the richest nations. Among the developed countries variations in the average expectation of life are not so great, but there are differences that cannot easily be explained by reference to economic prosperity. In 1988, for example, life expectancy at birth for men and women combined was almost five years greater in Japan than in Portugal.[2] Several reasons have been advanced to account for these differences—from dietary influences such as the consumption of olive oil or fish to cultural factors such as national perceptions of self esteem—but many of them are peculiar to one country or a small group of countries. In recent years, however, it has been suggested that the key determinant of variations in life expectancy at birth among developed societies is inequalities in the distribution of income within countries.

For almost a decade the evidence and arguments in support of this income inequality hypothesis have been most associated with a series of papers by Wilkinson.[3-10] A review of the primary sources of income distribution data used in these eight papers shows that two are used most frequently: one in six of the papers[11]; and the other in five.[12]

The aim of this paper is critically to evaluate Wilkinson's use of the two key pieces of evidence on which his analyses are based and to suggest that the strength of the relation between income inequality and average life expectancy has been exaggerated. I also use more recently published data about income distribution that cast doubts on the income inequality hypothesis.

Cross sectional comparisons

The two key sources of income distribution data used by Wilkinson to support his income inequality hypothesis examine cross sectional comparisons for one group of countries in about 1981[11] and changes over time for a slightly different selection of countries from the mid-1970s to 1984-5.[12]

The aim of the first source, produced by Bishop *et al*,[11] was to compare the degree of relative inequality in nine countries: Australia, Canada, the Netherlands, Norway, Sweden, Switzerland, West Germany, the UK, and the USA. Two main series of income distribution data were produced: one for family incomes and the other for income per head. In each case estimates were made of the proportion of income received by cumulative deciles of either families or individuals. A summary statistic of the overall shape of the income distribution in a particular country—the Gini coefficient, which rises as inequality increases—was also reported for each series.

Wilkinson shows that about three quarters of the observed variation in life expectancy among the nine countries is accounted for by differences in the proportion of family income going to the poorest 70% of families.[3 5-10] However, he gives no satisfactory explanation about why "the poorest 70%" should be chosen, and the suspicion must be that the choice is derived from the data. Moreover, Wilkinson makes no reference to the data about income per head.

The consequences of using family income rather than income per head as the indicator of economic inequality are illustrated in table I. Correlation coefficients between average life expectancy at birth and the proportion of income going to cumulative deciles as well as the respective Gini coefficients are shown for the two series. Most of the coefficients associated with measures of family income are statistically significant and positive: they appear to lend support to the income inequality hypothesis. In contrast, the measures of income per head do not. This is important because the data about family incomes are unadjusted for differences in family size between countries. Bishop *et al* warn of the need for caution when using the measure of family income because: "international differences in variations in the size of families as the level of income changes has (sic) important implications for cross country comparisons of income inequality."[11]

TABLE I—*Income distribution and life expectancy: Correlation coefficients 1979-83*[2 11]

Income decile†	Family income	Income per head
1	0·0879	−0·1989
2	0·4435	0·0285
3	0·5703	0·1172
4	0·6529*	0·1673
5	0·7366**	0·2056
6	0·8089***	0·2527
7	0·8053***	0·3116
8	0·7310**	0·3849
9	0·6310*	0·4809
Gini coefficient	−0·7737**	−0·1886

†Cumulative share of income available to successive deciles.
*P<0·1, **P<0·05, ***P<0·01.

REVISED DATA

In a later paper, not used by Wilkinson, Bishop *et al* deal with this problem by including data on family incomes adjusted for variations in household composition by using an appropriate equivalence scale.[13] They also report a number of revisions to the original data for various countries (Australia, Germany, the Netherlands, Switzerland, and the USA).

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Analysis of the revised data is complicated by the fact that Wilkinson has expressed concern about the accuracy of the German data.[14] Nevertheless, whether the German data are used or not, the later data supplied by Bishop *et al*[13] do not support the income inequality hypothesis. Table II shows correlation coefficients between life expectancy and Gini coefficients—probably the best single summary statistic of income inequality—for the revised original data series and equivalent family incomes, both including and excluding Germany. No statistically significant relations can be identified. Even the previously significant association between the Gini coefficient for unadjusted family incomes and life expectancy reported in table I appears now to have been a product of errors in the underlying data.

TABLE II—*Income distribution and life expectancy 1979-83*[2 13]

Gini coefficient	Correlation coefficient	
	Including Germany	Excluding Germany
Unadjusted family income	−0·1006 (P=0·797)	−0·3426 (P=0·406)
Equivalised family income	−0·0097 (P=0·980)	−0·1990 (P=0·637)
Income per head	0·0491 (P=0·900)	−0·1014 (P=0·811)

Changes over time

The second of the two data sources most used by Wilkinson was produced by O'Higgins and Jenkins.[12] They were commissioned to provide estimates of the prevalence of poverty—the proportion of both persons and households—for the 12 countries of the European Commission in 1975, 1980, and 1985.

In several papers [6-10] Wilkinson uses some of these data to compare changes in income distribution with changes in life expectancy in the belief that this provides "a more demanding test"[6] of the income inequality hypothesis. The results suggest "that among these countries a fall in the prevalence of relative poverty was significantly related to a more rapid improvement in life expectancy."[6]

There is, however, a major problem in accepting the validity of this finding because O'Higgins and Jenkins explicitly stated that any: "examination of the patterns of change within countries is hampered by the limited number of calculations for each country, *since it is not appropriate to use the estimated observations for this purpose* [my emphasis]."[12]

The scale of the problem can be gauged by the fact that, for at least one of the two years used to calculate rates of change in income inequality, relatively crude estimates—"our best guess" according to O'Higgins and Jenkins—had to be produced for eight of the 12 countries for both series of poverty data.

Thus it seems inappropriate to use O'Higgins and Jenkins's data to calculate changes over time for individual countries. If one persists nevertheless it seems advisable to use data for matching years for both life expectancy and income distribution and to use and compare the results associated with both series of poverty estimates—for families and individuals. On this basis the correlation coefficients between changes in individual and family poverty rates and life expectancy between 1973-7 and 1984-5 are −0·1287 (P=0·690) and +0·0719 (P=0·824) respectively. Neither is statistically significant. Wilkinson's result appears to be the consequence of using an incorrect poverty estimate for Portugal and not matching income and life expectancy data for the same years.

New evidence

It is difficult to see how the two studies most cited by Wilkinson[11 12] can be regarded as lending support to the income inequality hypothesis. What do more recent data reveal? I have linked income distribution data taken from two recent studies to life expectancy data as new tests of the income inequality hypothesis.

CROSS SECTIONAL COMPARISONS

The first piece of evidence draws on a study by Förster of income distribution in 13 countries of the Organisation for Economic Cooperation and Development (OECD)—Australia, Austria, Belgium, Canada, France, Germany, Ireland, Italy, Luxembourg, the Netherlands, Sweden, the UK, and the USA—during the mid-1980s (1984-7).[15] The wide range of data obtained from the *Luxembourg Income Study* provides a good opportunity to test whether the income inequality hypothesis is particularly sensitive to one or more specific measures of income distribution.

For this analysis I correlated a selection of Förster's income distribution indicators with life expectancy data obtained from the World Bank.[2] The measures chosen include the Gini coefficient for the whole population and various measures of the poverty rate based on different proportions of the population receiving less than 40% or 50% or 60% of median equivalent income. In addition, four different equivalence scales are used with one particular poverty rate: the proportion of the population with less than 50% of the median equivalent income. The rationale for this procedure is that Buhmann *et al*[16] have shown that the choice of equivalence scale can affect comparative assessments of income inequalities.

Equivalence scales are commonly used to compare the incomes of households that vary in terms of their composition on the assumption that there are economies of scale in consumption. The problem is that there is no consensus about the extent of economies of scale: numerous equivalence scales have been produced that vary "according to how great the adjustment for family size is in the range from no adjustment to per capita adjustment."[16] A common way of expressing the difference between scales is in terms of an equivalence elasticity that varies between 0 and 1. The larger the value the smaller are the economies of scale assumed by the equivalence scale.

Table III uses equivalence scales with elasticities ranging from 0·33 to 1·00 and shows the correlation coefficients between seven summary measures of income distribution and life expectancy in the 13 OECD countries for the appropriate year between 1984 and 1987. Support for the income inequality hypothesis would be provided by any reasonably large and statistically significant negative relation with life expectancy, although ideally one would like to see support from more than a single statistic. In fact, none of the measures fulfil these requirements.

Many other indicators of income distribution could be computed for this group of 13 countries and so it is not possible to rule out the possibility that one or more

TABLE III—*Life expectancy and income inequality in selected OECD countries 1984-7*[2 15]

Income inequality	Correlation coefficient‡
Gini coefficient	−0·1824
Low income rate*	
−40%	0·1023
−50%	−0·0810
−60%	−0·1710
Equivalence elasticity†	
−0·33	−0·0815
−0·72	−0·1482
−1·00	−0·1830

*The proportion of the population with less than the stated percentage of median equivalent income assuming an equivalence elasticity of 0·55.
†The proportion of the population with less than 50% of median equivalent income for various equivalence elasticities.
‡None of the coefficients are statistically significant by conventional criteria.

SPRAGUE/PANOS

Equal shares?

of them might be found to be associated with life expectancy. However, seeking for such associations would be a fruitless exercise in the absence of any theoretical rationale for selecting one indicator rather than another. Simply identifying some statistical associations that contradict those reported here would not be sufficient on their own. If support for the income inequality hypothesis turns out to depend on the choice of income distribution indicator then a clear rationale for selecting one measure rather than another is essential.

TRENDS IN THE UK

The second piece of recent evidence comes from a report prepared for the Joseph Rowntree Foundation's *Inquiry into Income and Wealth* by Goodman and Webb.[17] This study offers perhaps the best opportunity to test the income inequality hypothesis because there are a reasonably large number of observations for a single country—which significantly reduces problems of data comparability—during a period when there were substantial changes in the distribution of income.

Goodman and Webb report a number of different indicators of income distribution, but whichever is selected the trends are almost identical. Between 1961 and the early 1980s there were relatively modest fluctuations in the values of the different measures, but since about 1984 every indicator of the distribution of disposable income shows a substantial increase in inequality. For the purposes of comparison with changes in average life expectancy over time, therefore, it does not matter which indicator is chosen; the broad pattern of results is the same.

The example which has been computed here to test the income inequality hypothesis is the relation between annual percentage changes in the Gini coefficient (after adjusting for housing costs) and yearly improvements in life expectancy, using data supplied by the Government Actuary. The relation is not statistically significant ($R=-0{\cdot}2022$, $P=0{\cdot}284$).

A more plausible hypothesis might postulate a lagged relation between average life expectancy and income inequality. No clear evidence for this has yet been identified during the period 1961-91, but it may take some time for the substantial increase in inequality in the late 1980s to manifest itself in terms of reduced life expectancy.

Conclusion

One of the main reasons for taking the income inequality hypothesis so seriously is that it has influenced a wide range of authoritative reports emanating from all corners of the globe. For example, Wilkinson's findings have been used by the National Health Strategy Unit in Australia,[18] the World Bank,[19] the Canadian Program in Population Health,[20] the European region of the World Health Organisation,[21] and the Commission on Social Justice in Britain.[22] In addition, the *Social Sciences Citation Index* shows that, since Wilkinson's seminal article on the subject was published in the *BMJ* in January 1992[6] it has been cited in at least 30 articles, reviews, and editorials in 16 major journals by authors other than himself.

Despite this popular acclaim, a careful review of the evidence does not support the hypothesis that inequalities in income distribution largely explain differences in average life expectancy among rich countries. In retrospect, it seems extraordinary that a predominantly monocausal explanation of international variations in life expectancy should ever have been regarded as plausible. It is much more likely that they are the product of many influences, which probably interact over long periods of time.

These critical observations, however, should not be interpreted as challenging the view that inequalities in living standards are associated with health differences within countries, as distinct from average levels between nations. For example, many international studies indicate that the poorest people have the worst health.[18 23 24] Similarly, Mackenbach and Looman have argued that regional differences in European living standards are associated with indicators of population health.[25] They make the point, however, that a statistically significant relation can be identified only "after taking into account potential confounders."

This point suggests that any future exploration of the relation between income distribution and life expectancy should use more sophisticated multivariate methods. It is certainly possible that a significant relation could be found after adjusting for other factors. Nevertheless, one recent attempt to do this "failed to support the hypothesis that an egalitarian distribution of income is related to higher levels of health."[26]

More generally, it is important that any future attempt to investigate the income inequality hypothesis should specify a priori what measures of income distribution might be expected to be associated with life expectancy and why. Considerable progress has been made recently in making available internationally comparable data about income distribution, but considerable traps remain for the unwary. Despite the very substantial efforts made by the *Luxembourg Income Study*, for example, unavoidable differences in population coverage and non-response rates across countries can influence judgments about the extent of economic inequality, especially for particular subgroups of the population.[27]

This paper does not claim to have taken account of all of these factors. What it has tried to do is to examine a reasonably representative range of indicators of income inequality and to show that these are not statistically significantly related to average life expectancy at birth among rich countries.

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Commentary: A reply to Ken Judge: mistaken criticisms ignore overwhelming evidence

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Despite Judge's highly personal focus, mine is far from being the only evidence of an association between national mortality rates and income distribution. The criticisms that Judge directs at two of my five demonstrations of the relation would therefore, even if they had been accurate, leave the bulk of the evidence unscathed. As well as summarising the evidence which Judge ignores, I shall also show why we should not be surprised at a relation between mortality and income distribution, and then deal with methodological problems that he inadvertently raises.

Additional evidence

The association between mortality and income distribution was first reported by Rodgers using data from around 1965 from 56 developed and less developed countries.[1] Since then it has been found by many others. Flegg found that income distribution was related to national infant mortality among a group of 59 developing countries,[2] and Le Grand reported that it was related to average age of death in a group of 17 developed countries.[3] Analysing data from 70 rich and poor countries, Waldmann found that, if the real incomes of the poorest 20% were statistically held constant, increases in the incomes of the richest 5% were associated with rising rates of infant mortality.[4] Among developed countries Wennemo has shown close relations between infant mortality and measures of income distribution and relative poverty.[5] I have shown relations in developed countries between income distribution and life expectancy on two sets of cross sectional data and three sets of data on changes over time.[6-8] Most recently, Kaplan *et al* at Berkeley and Kennedy *et al* at Harvard have independently found income distribution and life expectancy to be closely associated in 50 states of the United States.[9,10] Lastly, using mid-century data for 20 countries at different stages of development, Steckel reported that height (which is closely related to health) is related to income distribution.[11,12]

Leaving height aside, a total of at least eight different research workers or groups have reported statistically significant relations between income distribution and measures of mortality using 10 separate sets of data. Of these eight, one has used data exclusively on developing countries,[2] two on a mixture of developed and developing countries,[1,4] and five exclusively on developed countries.[3,5-10] The association has been found to be independent of fertility, maternal literacy, and education in developing countries and of average incomes, absolute levels of poverty, smoking, racial differences, and various measures of the provision of medical services in developed countries.[1-4,7,9,10]

Plausibility

Such an association is to be expected. By raising death rates among deprived people, relative deprivation will raise national mortality rates unless the excess mortality is mysteriously offset by improvements in mortality elsewhere. But if health were to suffer as a result of an increase in unemployment where would the balancing improvement come from? Is the rest of New York really healthier because Harlem has death rates as high as Bangladesh?[13] The existence of deprived areas with high levels of crime, drug use, and violence is likely to harm health more widely. National mortality rates would then be raised by poorer health in deprived areas as well as by some wider knock on effects.

The larger part of this relation probably reflects an association between inequalities in income and in health within societies. Using linked data for individuals in nine European countries, van Doorslaer *et al* found a close association between the extent of differences in income and in self reported morbidity within these countries.[14] (Coupled with the effects of income distribution, this implies that health inequalities may be significant determinants of average health.)

If, as Judge suggests, income were a monocausal explanation it would not be so difficult to unpack what it means. It is, of course, a determinant and indicator of a wide range of material factors, covering all aspects of the standard of living, as well as having a crucial impact on psychosocial factors such as sense of control, security, status, prestige, social distance, and cohesion.

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