What Difference Does the Choice of SES Make in Health Inequality Measurement?

by

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Summary

This Note explores the implications for measuring socioeconomic inequality in health of choosing one measure of SES rather than another. Three points emerge. First, whilst similar rankings in the two the SES measures will result in similar inequalities, this is a *sufficient* condition not a necessary one. What matters is whether rank differences are correlated with health—if they are not, the measured degree of inequality will be the same. Second, the statistical importance of choosing one SES measure rather than another can be assessed simply by estimating an artificial regression. Third, in the 19 countries examined here, it seems for the most part to make little difference to the measured degree of socioeconomic inequalities in malnutrition among under-five children whether one measures SES by consumption or by an asset-based wealth index.

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I. INTRODUCTION

The literature on socioeconomic health inequalities examines the distribution of health by some measure of socioeconomic status (SES), the question of interest being the degree to which persons with lower SES are more likely to suffer from ill health and die early. A variety of different measures of SES have been used, including social (or occupational) class [1], educational attainment [2], income [3], dwelling size [4], consumption [5], and ownership of certain household assets as reflected in a 'wealth' index [6]. For some purposes, it may be of interest to know whether the choice of SES indicator makes a difference to the measured degree of socioeconomic inequality in health. For example, given the relative ease with which asset data can be collected compared to consumption data [7], one might ask whether using assets rather than consumption makes much of a difference to the degree of measured socioeconomic inequalities in health.

This paper sets out a framework for comparing health inequalities measured using different measures of SES, and develops a simply implemented statistical test that enables the analyst to determine whether the difference is statistically important. The approach is illustrated in section III of this Note using anthropometric data on child malnutrition in 19 developing countries. Two measures of SES are employed—household consumption and an asset-based wealth index.

II. SOME THEORY

Suppose we have a scalar measure of health that is decreasing in good health. The measure might be the presence or absence of chronic illness, bed-days, malnutrition or even death. Suppose we have two alternative scalar measures of SES, SES_1 and SES_2, both increasing in SES. If we rank individuals by, say, SES_1, beginning with the most disadvantaged, and graph on the x-axis the cumulative proportion of individuals ranked by SES_1 and on the y-axis the cumulative proportion of ill health, we obtain the concentration curve for ill health [8, 9]. This will lie above the diagonal or 'line of equality' if the disadvantaged suffer from higher levels of ill health. If the concentration curve for SES_1 lies further from the diagonal than the curve for SES_2, then there is more health inequality by SES_1 than there is by SES_2.

Twice the area between the line of equality and the concentration curve equals the concentration index, C [8, 9], which is our measure of socioeconomic health inequality. This is negative in the case where ill health is more common among the more disadvantaged, zero if the concentration curve coincidences with the diagonal, and positive if ill health is more common among the better off. In the case of SES_1, C can be written [9]:

$$(1) \qquad C_1 = \frac{2}{n \cdot \mu} \sum_{i=1}^{n} h_i r_{1i} - 1 \ ,$$

where C_1 is the concentration index for SES_1, n is the sample size, μ is the mean of the ill health variable, h, and r_{1i} is person i's fractional rank in the SES_1 distribution (r_{1i}=1 being the fractional

rank of the person with the highest SES). A similar expression can be written down for C_2 (the concentration index for the SES_2 measure) by replacing r_1 by r_2, the fractional rank in the SES_2 distribution. By comparing C_1 and C_2 we can see how much more (or less) socioeconomic health inequality there is when we rank by SES_1 rather than by SES_2. If the difference between C_1 and C_2 is small, the choice of SES measure makes little difference to the measured degree of socioeconomic health inequality.

Under what circumstances will C_1 and C_2 be the same? Using eqn (1) and the analogue for SES_2, we can write:

$$\begin{aligned} C_1 - C_2 &= \frac{2}{n\mu}\sum\nolimits_i h_i r_{1i} - 1 - \frac{2}{n\mu}\sum\nolimits_i h_i r_{2i} + 1 \\ &= \frac{2}{n\mu}\sum\nolimits_i h_i \Delta r_i \\ &= \frac{2}{\mu}\mathrm{cov}(h, \Delta r), \end{aligned} \tag{2}$$

where $\Delta r_i = r_{1i} - r_{2i}$ is the difference between the two fractional rank variables, which has a zero mean. So, C_1 and C_2 will be equal if the rankings in the two distributions coincide (i.e. $\Delta r_i = 0$ for all i). But this is a *sufficient* condition, not a necessary one. C_1 and C_2 will be equal if health and the rank difference do not covary—in other words, people may not occupy the same position in the two SES distributions, and yet if the rank differences are not correlated with health, socioeconomic inequalities in health will be the same.

Eqn (2) also provides the basis for a simple statistical test to see whether the difference between C_1 and C_2 is important statistically. In much the same way as the concentration index itself can be computed easily by means of a convenient regression of health on the fractional rank [9], so too can the concentration index *difference* be computed by means of a simple artificial regression:

$$\frac{2 \cdot \mathrm{var}(\Delta r)}{\mu}\ h_i = \alpha + \beta\ \Delta r_i + \varepsilon_i\ . \tag{3}$$

The left-hand side is individual i's ill-health score, multiplied by twice the variance of the rank difference variable and divided through by the mean of the ill-health variable. The coefficient β is equal to C_1-C_2, and the standard error of β allows one to test the significance of the difference between the two concentration indices. This is valid for small *and* large samples. Strictly-speaking, the expression for C_j (j=1,2) has an additional term on the right-hand side, equal to 1/n, where n is the sample size [10]. This tends to zero as n increases and in any case cancels out in the difference in eqn (2). The testing procedure lends itself to a comparison of two alternative measures of SES. Where more than one measure of SES is being explored, one could use a sequential testing procedure, but it is possible that there may be no significant differences between *any* of the measures, and it seems possible that the results may not even be transitive.

III. **EMPIRICAL ILLUSTRATION**

The literature to date on socioeconomic inequalities in health in the developing world focused for the most part on maternal and child health, in part because of the wealth of data in this area, but also because of the objectiveness of data on child mortality and anthropometrics (malnutrition measures based on weight, height and age measurements). A key source of data has been USAID's Demographic and Health Survey (DHS), which has been fielded in over 50 countries. The DHS, unlike the World Bank's Living Standards Measurement Survey (LSMS), does not have a measure of household consumption [11], and in its absence an asset-based wealth index has been developed [12, 13] and has been by the World Bank to date to generate data on health inequalities in 42 countries from the DHS [6]. One issue that has arisen—and which is explored below—is whether it makes a difference whether child health inequalities are measured across consumption groups or across wealth groups.

Data

Our data are from the 19 multipurpose LSMS-type household surveys listed in Table 1—for further details see [14]. Not all are nationally representative. We included only children under the age of five years. The sample size is after deletion of cases with missing values for any of the variables used in the analysis. We measure child health by two binary variables indicating whether the child is underweight (low weight for age) or stunted (low height for age). These are obtained, as is common practice in anthropometry [15], by comparing the child's weight-for-age and height-for-age with a hypothetical population of well-nourished children assembled by the US National Center for Health Statistics (NCHS). Children with a z-score below –2 (using the NCHS mean and standard deviation as references) are classified as underweight and stunted.

Our two measures of SES are equivalent household consumption and an asset-based wealth index. Consumption is a better measure of living standards than income or expenditure, since it captures what households consume whether or not they purchase it or produce it themselves, and whether they finance it through current, future or past income [11]. We used pre-computed consumption aggregates except in the cases of Guatemala, the Philippines and Zambia, where we computed our own using as, far as possible, standard LSMS methodology [11, 16]. In the case of Guatemala, the consumption data were somewhat limited, and in the case of China we had to make do with income data. We took into account household size using an equivalence scale equal to the square root of household size. This is equivalent to raising household size to an elasticity power (e) equal to 0.5, this being an intermediate position between the assumption that there are no economies of scale in household consumption (it costs two people twice as much to live as one, or e=1) and the assumption that two can live as cheaply as one (e=0) [16, 17]. Our asset-based wealth index is a linear combination of a variety of indicators of household living standards, such as ownership of various household durables (e.g. radio, refrigerator, TV, and motorcycle), whether the household has electricity, the number of rooms per person, whether the floor is finished, the type of drinking water and sanitation, and so on. The weights used are the first component from a principal components analysis of the wealth indicator data [12, 13], this being the linear combination that maximizes the variance in the observed indicators.

Table 1. Survey details

Country	Survey name	Survey year	N	Comments on survey
Bangladesh	Matlab Health and Socioeconomic Survey	1996	1506	Covers only a rural region of Matlab, located to south of Dakha.
Brazil	Presquisa sobre Padrões de Vida	1995-96	1693	Covers only south-east and north-east.
China	China Health and Nutrition Survey	1991	861	Eight provinces covered including urban and rural areas.
Côte d'Ivoire	LSMS	1988	1090	
Egypt	Egypt Integrated Household Survey	1997	1426	
Ghana	LSMS	1987-88	2349	
Guatemala	Guatemalan Survey of Family Health	1995	2794	Covers 4 departments (out of 22).
Guyana	LSMS	1992-93	589	
Indonesia	Indonesian Family Life Survey	1993	1236	Covers 13 provinces, representing 83 % of the population.
Morocco	LSMS	1990-91	2121	
Nepal	LSMS	1996	1596	
Nicaragua	LSMS	1993	3284	
Pakistan	LSMS	1991	3773	
Peru	LSMS	1994	2093	
Philippines	Cebu Longitudinal Health and Nutrition Survey	1991	2031	Survey area is city of Cebu and surrounding area—the regional center of Central Visayas region.
Romania	LSMS	1996	3740	
South Africa	LSMS	1993	3961	
Vietnam	LSMS	1992-93	2622	
Zambia	Living Conditions Monitoring Survey I	1996	4483	

Methods

The concentration indices C_1 and C_2 were computed by means of an artificial regression of the malnutrition variable (multiplied by twice the variance of the fractional rank variable divided by mean malnutrition) on the fractional rank variable [9]. The Newey-West [18] estimator was used to correct standard errors for the autocorrelation induced by the fractional rank variable [9]. Estimates of C_1-C_2 and their standard errors were obtained directly by using OLS to estimate eqn (3).

Results

The concentration indices and their t-statistics in Table 2 indicate that however SES is measured inequalities in both underweight and stunting significantly disfavor poor children in almost all countries (the indices are negative and are mostly significantly different from zero). The exceptions are Egypt in the case where children are ranked by equivalent consumption and China in the case where they are ranked by the wealth index. With the exception of Morocco, it

is in the Latin American countries where socioeconomic inequalities in malnutrition are most pronounced.

Of more interest in the present context are the differences between the consumption-based and wealth-based concentration indices. On average, inequalities in malnutrition are larger (in absolute size) by equivalent consumption than by wealth, but the difference between C_1 and C_2 is, on average, reasonably small—12-14% of the average concentration index. Furthermore, of the 38 differences between C_1 and C_2, fewer than one quarter are significant at the 95% level. Thus in this particular application, and for this particular set of countries (or at least surveys), the balance of probability is that it does *not* make a significant difference to the estimated magnitude of socioeconomic inequalities in health whether one uses one measure of SES (consumption) or the other (wealth).

IV. **CONCLUSIONS**

The aim of this Note has been to explore the implications for measured socioeconomic inequalities in health of choosing one measure of SES rather than another. Three points seem worth emphasizing. First, whilst similar rankings in the two the SES measures will result in similar inequalities, this is a sufficient condition not a necessary one. What matters is whether rank differences are correlated with health—if they are not, the measured degree of inequality will be the same. Second, the statistical importance of choosing one SES measure rather than another can be assessed simply by an artificial regression along the lines discussed in the paper. Third, in the 19 countries examined here, it seems *for the most part* to make little difference to the measured degree of socioeconomic inequalities in malnutrition among under-five children whether one measures SES by consumption or by an asset-based wealth index.

Table 2. Inequalities in malnutrition by consumption and wealth

	Underweight						Stunting					
	Equivalent consumption		Wealth index		Difference		Equivalent consumption		Wealth index		Difference	
Country	C_1	t-value	C_2	t-value	C_1-C_2	t-value	C_1	t-value	C_2	t-value	C_1-C_2	t-value
Bangladesh	-0.067	-4.91	-0.037	-2.72	-0.031	-1.68	-0.049	-3.40	-0.035	-2.44	-0.014	-0.72
Brazil	-0.245	-4.58	-0.218	-3.52	-0.027	-0.48	-0.193	-5.80	-0.150	-4.05	-0.043	-1.27
China	-0.151	-3.41	-0.043	-1.07	-0.107	-2.03	-0.140	-5.05	-0.035	-1.29	-0.106	-3.03
Cote d'Ivoire	-0.099	-2.52	-0.061	-1.65	-0.043	-1.05	-0.106	-2.89	-0.027	-0.81	-0.090	-2.36
Egypt	-0.034	-0.78	-0.101	-2.17	0.069	1.42	-0.039	-1.10	-0.102	-2.91	0.066	1.79
Ghana	-0.105	-5.19	-0.054	-2.63	-0.051	-1.94	-0.094	-5.24	-0.082	-4.70	-0.013	-0.56
Guatemala	-0.106	-6.78	-0.050	-3.18	-0.053	-2.39	-0.079	-8.84	-0.041	-4.70	-0.036	-2.95
Guyana	-0.201	-4.26	-0.055	-1.04	-0.145	-2.48	-0.146	-2.20	-0.125	-1.85	-0.022	-0.27
Indonesia	-0.062	-3.14	-0.071	-3.58	0.009	0.42	-0.076	-4.32	-0.071	-4.03	-0.005	-0.28
Morocco	-0.251	-8.39	-0.259	-8.82	0.008	0.27	-0.185	-9.23	-0.211	-10.88	0.027	1.41
Nepal	-0.121	-8.29	-0.107	-7.17	-0.015	-0.84	-0.065	-4.45	-0.062	-4.13	-0.004	-0.22
Nicaragua	-0.245	-8.27	-0.255	-9.08	0.010	0.41	-0.227	-12.83	-0.267	-15.80	0.039	2.59
Pakistan	-0.066	-6.00	-0.066	-5.96	-0.001	-0.13	-0.077	-6.74	-0.084	-7.42	0.007	0.61
Peru	-0.308	-8.72	-0.299	-8.40	-0.008	-0.27	-0.281	-16.10	-0.254	-14.30	-0.025	-1.50
Philippines	-0.107	-4.31	-0.158	-6.35	0.052	2.39	-0.191	-6.07	-0.181	-5.98	-0.005	-0.18
Romania	-0.088	-2.43	-0.067	-1.94	-0.021	-0.46	-0.051	-3.01	-0.038	-2.26	-0.013	-0.62
South Africa	-0.141	-7.19	-0.139	-7.14	-0.002	-0.09	-0.199	-12.97	-0.170	-11.22	-0.028	-2.18
Vietnam	-0.068	-5.24	-0.067	-5.09	-0.002	-0.11	-0.088	-8.23	-0.073	-6.68	-0.015	-1.24
Zambia	-0.155	-9.44	-0.168	-10.24	0.012	0.86	-0.101	-11.42	-0.103	-11.60	0.002	0.27

Notes: C_1 and C_2 are concentration indices for the consumption and wealth SES measures respectively. The t-values for the indices are relevant to testing the hypothesis that the indices are zero and are derived from Newey-West standard errors that correct for the serial correlation induced by the fractional rank variable in the artificial regressions. The difference C_1-C_2 is estimated using eqn (3), the t-value in this cases relevant to testing the hypothesis that C_1 and C_2 are the equal to one another.

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