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Nicolas R. Ziebarth
Joachim R. Frick

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Nicolas R. Ziebarth
DIW Berlin, SOEP

Joachim R. Frick
DIW Berlin, SOEP,
TU Berlin and IZA

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IZA

P.O. Box 7240
53072 Bonn
Germany

Phone: +49-228-3894-0
Fax: +49-228-3894-180
E-mail: iza@iza.org

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ABSTRACT

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We show that the choice of the welfare measure has a substantial impact on the degree of welfare-related health inequality. Combining various income and wealth measures with different health measures, we calculate 80 health concentration indices. The influence of the welfare measure is more pronounced when using subjective health measures than when using objective health measures.

JEL Classification: D31, I10, I12

Keywords: health inequality, concentration index, income measurement, SOEP

Corresponding author:

Nicolas R. Ziebarth
DIW Berlin
Department SOEP
Mohrenstrasse 58
10117 Berlin
Germany
E-mail: nziebarth@diw.de

1. Introduction and background

The measurement of inequality in health has become a popular topic of inquiry in the last two decades. The traditional approach is to compare health distributions against a standard-of-living measure such as education, income, or consumption. The majority of the literature investigates the question of whether poor health is more concentrated among the economic poor. The few studies that have examined whether the choice of welfare indicator makes a difference in this issue come to diverging conclusions (Wagstaff and Watanabe 2003, Lindelow 2006, Jürges 2009).

We are the first to systematically assess the sensitivity of income-related health inequalities to ten different income and wealth measures. We also vary the health measure using subjective dichotomized health measures, cardinalized self-assessed health (SAH), and objective continuous health measures to test whether the welfare sensitivity varies among these groups of health measures. The analysis uses recent and representative microdata for Germany. In contrast to previous studies, our comparative study focuses on a single country using a variety of measures of well-being and health, thus avoiding the risk of being contaminated by cultural or linguistic differences in reporting behavior.

2. Methods

The most popular health inequality indicator is the concentration index (CI). The CI measures the correlation between the rank of an individual according to a standard of living measure and the individual's health:

$$CI = \frac{2}{\mu_h}\mathrm{cov}(h_i, r_i^w) \qquad (1)$$

where h_i stands for the health status of individual i and μ_h is the mean of the health indicator. The rank of an individual in the welfare indicator distribution is expressed by r_i^w.

The CI lies between -1 and 1 and takes the value zero in the case of no welfare-related health inequality. It has negative values if ill health is more concentrated among the poor.

Whether the choice of the welfare measure has an impact on the degree of health inequality measured can be assessed as follows (Wagstaff and Watanabe 2003):

$$2\sigma^2_{\Delta r}\left(\frac{h_i}{\mu}\right) = \alpha + \rho\Delta r_i^w + \varepsilon_i \,. \qquad (2)$$

Here, Δr_i^w is the difference between the ranks of the two welfare measures and $\sigma^2_{\Delta r}$ is its variance. The estimate ρ yields whether the two health inequality indicators differ significantly from each other.

For the choice of the welfare measure to have a significant impact on welfare-related health inequality, two conditions need to be fulfilled: Firstly, depending on the welfare concept, the rankings of the population have to differ and secondly, the difference in the rankings needs to be correlated with the health measure.

3. Data

We use microdata from the German Socio-Economic Panel Study (SOEP), an annual household panel survey started in 1984 (Wagner et al. 2007). We use data from 2007, when an extra module on individual wealth holdings was included in the questionnaire above and beyond the annually surveyed income information. Similarly, while subjective health measures are surveyed every year, the objective health measures used here were collected in 2006 only.

Welfare measures

The set of welfare measures are based on flow (income) and stock (net worth) measures. An individual's own economic performance is measured using individual labor income (*indlabor*). Individual total income (*indtotal)* is the sum of income from labor, pensions, as well as public and private transfers. Net worth (*indwealth)* is the sum of housing, financial, and business assets after deduction of any outstanding debts.

To consider redistribution within private households and to effectively control for economies of scale, we assign each individual needs-adjusted income measure[3] based on all market income

[3] We apply the modified OECD equivalence scale, which assigns a value of one to the household head, 0.5 to other adults, as well as 0.3 to children up to 14 years of age.

sources in the household (*eqpre*) and a post-tax, post-transfer measure (*eqpost*). Similarly, we assign each individual a measure of per capita household net worth (*hhwealth*).

Health measures

The use of dichotomized health measures is a standard approach in the literature on health inequalities. Here, we employ three such dichotomized subjective health measures. The two lowest categories of the popular self-assessed health (SAH) measure are collapsed into *Poor health*. *Health worries* assigns a one to everyone who answered the question "Are you concerned about your health" with "very concerned" or "somewhat concerned." *Health low* is a binary indicator coded one for respondents in the lowest four categories of an eleven-category scale on health satisfaction.

The continuous SF12 is a generic health measure that is claimed to be objective. The answers to twelve health questions are weighted and aggregated into a physical health (*pcs*) and a mental health (*mcs*) summary scale by a specific algorithm (Andersen et al. 2007). We also use the average of both scores as an overall health measure (*sf12index*). Since we intend to measure ill health, we normalize the values to a zero-one interval and employ a measure of one minus the according indices. We use the distribution of the SF12 across SAH categories to cardinalize SAH by means of the van Doorslaer-Jones' method (van Doorslaer and Jones 2003).

Finally, grip strength as an objective physical health indicator was surveyed by means of a hand dynamometer from 4,277 respondents in 2006 (Hank et al. 2009). Again, we take one minus the normalized zero-one index as a measure of ill health (*grip strength*).

Other variables

We gender-age standardize all health measures by the method of indirect standardization as described in O'Donnell et al. (2008). We standardize the health measures with respect to ten gender-age groups (<35, 35-44, 45-64, 65-74, >74), conditional on the height and weight of the respondents. We also control for labor force participation, family status, and education.

4. Results

Table 1 shows a total of 80 CIs, each arising from a combination of a health measure (row) and a welfare income concept (column). All but two (B-3, E-3) CIs show a negative sign indicating that poor health is more concentrated among the poor.

The results for the dichotomized subjective health measures indicate that the size of the inequality strongly depends on the welfare measure used. The variation in size is clearly larger across the six income measures than across the three subjective health measures.

When using individual labor income (*indlabor)*, the point estimate for the CI is always very close to zero. This finding may be an artifact of the large share of rather heterogeneous individuals entering this estimation with zero income (such as unemployed, non-working housewives, retirees, individuals not able to work due to health impairments). By contrast, health inequalities are many times larger when employing equivalent pre-government household income (*eqpre*).

Interestingly, for all three subjective measures, we find a consistent ranking in terms of how the underlying income concept is related to the degree of inequality. An increasing degree of inequality is reflected by the following ordering: *indlabor* <*indwealth* <*hhwealth* < *eqpost* < *indtotal* < *eqpre*. This ranking also holds when SAH is cardinalized by SF12.

Dichotomizing health measures is associated with a loss of information, and it has been shown that the resulting health inequality measures are much larger than those based on continuous health measures (Ziebarth, 2009). This finding is clearly confirmed by the results presented here.

As for objective health measures, the mental health component of the SF12 (*mcs*) is strikingly robust to the underlying income concept. Except for one outlier in (E-3), all CIs lie between [-0.0085; -0.0125]. For almost all other health measures, testing the CIs against each other reveals that the choice of the income measure has a significant impact on the degree of inequality measured.[4] This is not the case for *mcs* (except for *indlabor).* When using the physical health component of the SF12 (*pcs*), indices vary much more widely. For example, health inequality is fourfold higher when employing *eqpre* instead of *indlabor*. Interestingly, inequalities increase according to the same ranking as above.

[4] For each row of Table 1, i.e., for each health measure, we performed tests according to equation (2). Results are available upon request.

Income-related health inequalities based on the objective grip strength measure are likewise sensitive to the underlying income concept. *Indtotal* yields a standardized concentration index that is about four times larger than the one obtained from *indwealth*.

While *indlabor* takes on the value zero for any non-employed person, *indtotal* is zero for anyone living on household-based resources only. Both wealth measures, *indwealth* and *hhwealth,* might even take on negative values in case of indebtedness. However, often only welfare measures with positive values are available. To simulate the effects of censoring for measures that include a substantial number of zeros and negative values, columns (4), (6), (8), and (10) provide the CIs for these four measures being artificially censored on the population holding positive income and wealth. While we find only small differences for *indtotal*, *indwealth*, and *hhwealth*, suggesting that censoring would not matter much for these measures in this specific setting, large differences appear for *indlabor*. This finding is strongly related to the degree to which the various measures compensate for selection into employment. *Indlabor* straightforwardly selects on contemporaneous employment, while *indtotal* considers redistribution effects in case of non-employment. *hhwealth* considers contemporaneous within-household redistribution and both wealth measures incorporate an intertemporal redistributive component, thus shifting the measure of well-being away from the contemporary health status.

5. Conclusion

This paper shows how the choice of the welfare indicator determines the size of welfare-related health inequality. Welfare measures have a particularly large impact when dichotomized subjective health measures are used to calculate welfare-related health inequalities. While there is not much empirical support for mental health inequalities being affected differently by the underlying income or wealth measures, income-related physical health inequalities are sensitive to the choice of income concept. Overall, comparative analyses across space and time require great caution when welfare measures have been surveyed inconsistently.

Tab. 1: The impact of income and wealth measures on the concentration index

		Welfare concept used to calculate health inequality (Concentration Index)									
		eqpost	*eqpre*	*indlabor*		*indtotal*		*indwealth*		*hhwealth*	
Health measures				all values	positive	all values	positive	all values	positive	all values	positive
		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Subjective measures											
(A)	*healthpoor*	-0.1177	-0.1955	-0.0059	-0.1242	-0.1336	-0.1538	-0.0825	-0.0649	-0.1023	-0.0695
		(0.008)	*(0.008)*	*(0.007)*	*(0.011)*	*(0.008)*	*(0.008)*	*(0.008)*	*(0.009)*	*(0.008)*	*(0.009)*
(B)	*healthlow*	-0.1113	-0.1951	0.0196	-0.1439	-0.1367	-0.1614	-0.0875	-0.0857	-0.1090	-0.0890
		(0.011)	*(0.011)*	*(0.009)*	*(0.017)*	*(0.011)*	*(0.011)*	*(0.011)*	*(0.014)*	*(0.011)*	*(0.013)*
(C)	*healthworries*	-0.1381	-0.1933	-0.0004	-0.1487	-0.1335	-0.1597	-0.110	-0.1051	-0.1369	-0.1169
		(0.008)	*(0.008)*	*(0.007)*	*(0.011)*	*(0.008)*	*(0.008)*	*(0.008)*	*(0.010)*	*(0.008)*	*(0.009)*
(D)	SAH scaled by SF12	-0.0098	-0.0155	-0.0027	-0.0087	-0.0102	-0.0123	-0.0067	-0.0047	-0.0087	-0.0058
		(0.000)	*(0.000)*	*(0.000)*	*(0.001)*	*(0.000)*	*(0.001)*	*(0.000)*	*(0.001)*	*(0.000)*	*(0.001)*
	N	**19,063**	**19,063**	**19,063**	**12,053**	**19,063**	**17,329**	**19,063**	**14,840**	**19,063**	**16,139**
Objective measures											
(E)	*mcs*	-0.0119	-0.0119	0.0088	-0.0085	-0.0102	-0.0122	-0.0103	-0.0100	-0.0125	-0.0104
		(0.001)	*(0.001)*	*(0.001)*	*(0.001)*	*(0.001)*	*(0.001)*	*(0.001)*	*(0.001)*	*(0.001)*	*(0.001)*
(F)	*pcs*	-0.0141	-0.0224	-0.0044	-0.0110	-0.0133	-0.0161	-0.0067	-0.0051	-0.0096	-0.0074
		(0.001)	*(0.001)*	*(0.001)*	*(0.001)*	*(0.001)*	*(0.001)*	*(0.001)*	*(0.001)*	*(0.001)*	*(0.001)*
(G)	*sf12index*	-0.0130	-0.0173	-0.0022	-0.0099	-0.0120	-0.0142	-0.0094	-0.0076	-0.0114	-0.0089
		(0.000)	*(0.000)*	*(0.000)*	*(0.001)*	*(0.000)*	*(0.001)*	*(0.000)*	*(0.001)*	*(0.000)*	*(0.001)*
	N	**18,437**	**18,437**	**18,437**	**11,748**	**18,437**	**16,844**	**18,437**	**14,432**	**18,437**	**15,622**
(H)	*Grip strength*	-0.0132	-0.0243	-0.0124	-0.0267	-0.0309	-0.0314	-0.0077	-0.0057	-0.0082	-0.0026
		(0.002)	*(0.002)*	*(0.002)*	*(0.003)*	*(0.002)*	*(0.002)*	*(0.002)*	*(0.002)*	*(0.002)*	*(0.002)*
	N	**4,277**	**4,277**	**4,277**	**2,598**	**4,277**	**3,877**	**4,277**	**3,591**	**4,277**	**3,915**

Each cell displays the concentration index (CI); standard errors are in parentheses. All CIs are weighted by SOEP sample weights. All health measures are indirectly standardized as described in O'Donnell et al. (2008). Differences in sample size arise from subjective health measures being sampled in 2007 together with all income and wealth measures (n=19,063), whereas the SF12 was sampled in 2006 (n=18,437). The grip strength measure was only taken from a representative subsample in 2006 (n=4,277). Columns (4), (6), (8), and (10) are based on smaller samples due to exclusion of individuals with non-positive income and wealth measures.
Source: SOEP 2006-2007, own calculations.

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