HEALTH, CAPABILITIES AND FUNCTIONINGS; AN EMPIRICAL ANALYSIS FOR THE AGED IN ITALY

Sergio Destefanis*
CELPE
University of Salerno, Italy

Vania Sena[1]
LUBS,
University of Leeds, UK

This version:
28-7-03

PRELIMINARY DRAFT. COMMENTS WELCOME

Abstract

In this paper, we analyse the relationship between economic variables and health outcomes in a sample of Italian aged (above 50 years old) people. To this purpose we propose a synthetic index computed using Data Envelopment Analysis (DEA) based on Sen's approach of capabilities and functionings. The index allows one to rank individuals on the basis of their capabilities of transforming economic resources into health outcomes and lets policy-makers infer how income and economic resources in general may influence their health outcomes. The results of out empirical exercise show that socio-economic variables do affect significantly the health outcomes for aged people in Italy.

[1] Corresponding author. Address for correspondence: LUBS, University of Leeds, Leeds, LS2 9JT, United Kingdom.

1. Introduction

There is a large body of literature showing that health outcomes are associated to socio-economic variables, implying that individual's income and wealth can improve health indicators like mortality, incidence of diseases and self-reported health status. Interestingly, this relationship is strongest among the poor, while it is weaker for high levels of income and wealth. Of course, there is some considerable debate over the origin of this relationship and its causality. Some economists have argued that poor health affects labour market outcomes and therefore the income, while others have stressed the fact that different incomes and wealth may determine different health outcomes. Of course, there may be different factors at work in explaining why economic resources can impact health outcomes: psycho-social factors, job-related attributes, impact of early childhood health conditions. However, it is important to recognise that a more obvious reason for the positive correlation between health outcomes and income may be the fact that rich people have access to better quality health services (Smith, 1999). The extent to which income and wealth are important in affecting health outcomes of course conveys a lot of information on how equitable a health care system is. Indeed, this relationship may hide huge differences in the access to health care services, as rationing systems of various types may (perversely) allow only rich people to have access to health care services of a certain standard. So it is of obvious interest for the policy-maker to understand the mechanisms through which higher income implies better health.

This paper contributes to this debate by analysing the relationship between economic variables and health outcomes in a sample of Italian aged (above 50 years old) people. The focus on the elderly people is due to the fact that major health problems are concentrated in this group along with reductions of income and financial independence. The novelty of the paper is that we propose a synthetic index that allows one to rank individuals on the basis of their capabilities of transforming economic resources into health outcomes and lets policy-makers infer how income and economic resources in general may influence their health outcomes. Our interest in this idea originates with Sen (1985, 1987) who distinguishes among commodities, capabilities and functionings. Commodities (or more broadly, resources) are material goods and services that provide the individuals with the capability to achieve functionings, or living conditions. These ideas can be easily translated into a health care context, where resources refer to both socio-economic variables (like income, education, wealth) and health resources (like number of visits or days spent in hospital) that give the individual the capability of getting (and eventually enjoining) good health outcomes. So our index can be thought of as a “capability index”, ranking the individuals on their ability of transforming resources into health functionings. To derive our index analytically, we interpret resources and functionings as inputs and outputs of a production process. We assume that there is a maximum amount of functionings that can be produced by given resources and that this corresponds to a “production frontier”. Obviously, each individual differs in its capability of transforming resources into functionings; this means that they are located in different position with respect to the production frontier and their distance from the frontier allows to measure (and rank) the individuals’ proficiency with which they transform resources into capabilities. However, before computing the capability index, it is necessary to compute the production frontier. This can be computed easily by borrowing the techniques from the frontier analysis (Lovell, 1993) and therefore we use Data Envelopment Analysis (DEA) based on linear programming techniques to compute our frontier and derive the capability index. Our empirical analysis is carried out on a sample of aged people; this has been extracted from SHAW, the 2001 Survey of Health, Aging and Wealth, a joint venture of the Universities of Padua, Salerno, Venice and Tilburg. This survey contains detailed information on health status, medical expenditure, use of hospitals and other health facilities as well as detailed demographic and economic variables for a sample of about 2000 individuals older than 50. The structure of the paper is as follows. Section 2 shows how to derive analytically the capability index, while more information on the data and the variables are contained in Section 3. The results are illustrated in Section 4, while Section 5 offers some concluding remarks.

2. The Capability index

In this section we model formally our production process where resources appear as input and illustrate formally how the capability index can be derived. The presentation draws on Dasgupta (1990) and Lovell (1992). Consider a productive process with the following output set:

$$P(x) = \{y : x \text{ can produce } y\} \quad (2.1)$$

where $y \in \Re_+^M$ denote the functionings and $x \in \Re_+^N$ are the resources. For each *x*, the output set has an isoquant:

$$IsoqP(x) = \{y : y \in P(x), \theta y \notin P(x), \theta \in (1, \infty)\} \quad (2.2)$$

It shows the maximum combination of functionings which can be produced for given resources. Suppose now we have two different individuals A and B. They use the same vector of resources but the vector of functionings corresponding to the individual A, y^A, is different from the vector of functionings of the individual B, y^B. Obviously this difference means that the two individuals differ in their capability of transforming resources in functionings. Assume now we want to rank the two individuals' capabilities. We can do this by comparing each individual's functionings' vector to the standard given by the isoquant *IsoqP(x)*. More specifically, if y^A is radially farther from the isoquant than y^B and it needs to be expanded more than y^B so it can hit the isoquant, then this implies that the capability of A to transform resources into functionings is lower than B. So a capability index can be defined as one minus the equiproportionate expansion of all outputs for given inputs or:

$$CI = \max\{\theta : \theta y \in P(x)\} \quad (2.3)$$

The index varies between 0 and 1. If it is equal to 1, then the no expansion is possible and the individual is on the production frontier. Values smaller than 1 give the measure of how much the individual can improve on his capability. To compute (2.3), it is necessary to model and compute the production frontier with respect to which the capability index is measured. Therefore, we use the frontier techniques developed with the economic analysis of production (Fried et al., 1993). Generally speaking, a frontier production can be computed either by using parametric methods, based on the econometric estimation of the production frontier, or by using non-parametric methods based on linear programming analysis, like Data Envelopment Analysis

(DEA). For this paper, we decide to use DEA as it offers the advantage of not requiring a functional form for the production process something that in our case is very useful as the relationship between resources and functionings is naturally difficult to express in a mathematical form. DEA constructs the production frontier (with respect to which a firms' efficiency is measured) from the observed input-output ratios by linear programming techniques. The linear programming technique is expressed as follows:

$$\max \beta \qquad (2.4)$$

s.t. $$\sum_{k=1}^{K} z_k y_{km}^{t} \geq (1+\beta) y_{k'm}^{t}, \text{ where m = 1,....,M}$$

$$\sum_{k=1}^{K} z_k x_{kn}^{t} \leq x_{k'n}^{t}, \text{ where n = 1,....N}$$

$$z_k \geq 0, \text{ k = 1,....,K.}$$

where k represents each individual, z_k is an intensity variable and β is the capability index.

3. The Empirical analysis: the data and the variables

The data for our empirical exercise have been extracted from SHAW, the 2001 Survey of Health, Aging and Wealth (Fort, 2002). The survey is a joint effort of researchers of the Universities of Padua, Rome, Salerno, Sassari and Venice and it has been funded by the Italian Ministry of University and Scientific Research and the European Union under the TMR Research Network on Saving and Pensions. The survey was commissioned to the DOXA and the questionnaire and the sample design are patterned after the US Health and Retirement Survey and the English Longitudianl Study of Ageing (ELSA) project. The survey collects information on a total of 1068 households whose head is over 50 years old and 1891 individuals. Some questions refer to all households, while other questions refer to each member of the household. Our focus is on the heads of the households and therefore our sample is made by 1068 observations. A few words of description of the Italian health care system are necessary here. The Italian health system is universal and in principle covers all health risks for any amount. Health care is provided by the public sector through public and private sectors hospitals and diagnostic centers. As a result of the wide coverage offered by the public system, private health insurance is not common. Indeed, in our sample only 5.9 percent of the respondents older than 50 years were covered by private health insurance.

In the specification of our model, the functionings vector (COMBO) is a combination of two variables: the self-reported health status and the absence of illnesses. The self-reported health status variable is constructed by asking each individual to assess his or her health status on a scale ranging from 1 (excellent) to 5 (very poor). They are also asked whether they have suffered any health problem in the last 12 months. From the answer to this question, it is possible to construct a variable taking the value of 0 in absence of illness and 1 otherwise. The two variables (self-reported health status and absence of illnesses) have then been interacted so to weight the individual's perception of its own health with objective measures of health status. The resource vector contains both measures of socio-economic background and measures of health care utilisation. Among the socio-economic variables, we include the individual's educational attainment (EDUC) and the monthly average expenditure on food (FOOD). Education is an important variable in affecting individual's health outcomes as better-educated individuals pay more attention to health conditions and have less unhealthy jobs. In our sample, educational attainment is a dummy variable …Expenditure on food is used as a proxy for income. It is a well-known fact that the variable income in survey data is not very reliable because of the high numbers of missing values and a tendency to understate the real income value. Therefore we decided to avoid these problems and use expenditure on food. Among the measures of health care utilisation, we include a variable controlling whether the individual had any check-up in the previous year (CHK_UP_1) and whether he has spent any day in hospital (either public or private) in the previous year (HOSP_1). Both variables are categorical, taking the value of 1 if the individual has made no check-up or has spent no day in hospital. In addition to the resources variables, we also introduce a set of control variables that are deemed to be important in affecting the health outcomes. These are the individual's age (BIRTH), its sex (GENDER) and whether the individual suffers from any chronic disease (CHRONIC). Indeed, it is well-known that poor health status is positively related to age and that women tend to have better health than their male counterparts. In addition, the presence of a chronic disease is obviously important in determining the individual's health status and therefore his health self-assessment. Table 1 shows some descriptive statistics for the variables:

Table 1: Sample Means for selected variables

Variables	**Sample Means**
Age	63.51
Male	0.47
Less than primary education	9.54
Primary School	40.83
Lower Secondary school	25.03
Upper secondary school	18.77
University	5.83

Source: 2001 SHAW

Table 2 reports the percentage of respondents falling into every type of health indicators we use for our analysis.

Table 2: Health Indicators

Health Indicators	**Percentages**
Self-reported health status	Very good: 9.36% Good: 48.99% Fair: 27.23% Poor: 11.32% Very Poor: 3.10%
Presence of chronic disease	34.51%
Health problems in the past 12 months	36%
Health care utilisation	11.50%

Source: 2001 SHAW

The distribution of self-reported health status indicates that 9 percent view their health as excellent, 49 percent as good, 27 percent as fair, 11 percent as poor and 3 percent as very poor. Chronic diseases affect a third of the sample and respondents use health care services at least once a month.

4. The results

Different DEA models have been run with different specifications of the production set. The first model is our baseline model (Model A): its main feature is that all the resources and control variables have been included in the input vector. All the other models will be compared against Model A. The descriptive statistics for the resulting capability index are in Table 3.

Table 3: Descriptive statistics of capability indexes

	Model A	**Model B**	**Model C**
Mean	0.65	0.63	0.63
Standard Deviation	0.352	0.354	0.357
T-test		*Model B vs. Model A*: 0.09	*Model C vs. Model A*: 0.18

As we can see, the average value of the capability index is relatively high indicating that individuals in our sample are good at transforming the resources they have into (perceived) good health condition. The standard deviation is low and we can see that a good number of observations get the highest capability index, i.e. they are on the frontier. A second model (Model B) has been computed where this time FOOD has not been introduced among the resources. The idea is to check whether on average the capability of the individuals to produce functionings is statistically the same as in Model A once the proxy for income is not in the model any longer. The descriptive statistics for Model B are in Table 3 and we can see that on average the scores are close to the ones from Model A. A formal t-test shows that on average the two sets of capability scores are not significantly different at 5% significance level. This is an important result because it shows that for aged people both higher income/consumption does not prevent them from being proficient at transforming resources in health functioning. This result is not surprising: as we mentioned in Section 3, the Italian health care system is universal in the sense that it covers all the possible risks and so income does not matter in determining access to health services. Therefore, each individual's perception of its own health status is independent from his income. Model C is the same as Model A where this time it is EDUC that has not been introduced as a resource. The average capability index is not very different from the average capability index from Model A. Indeed again the t-test shows that the two capability indices series are not significantly different on average and so suggests that the educational background does not matter in this type of context. This result can again to be attributed to the fact that in the Italian National Health Service individuals are not discriminated in their access to health services on the basis of socio-economic variables.

5. Concluding remarks

The purpose of this paper was twofold: on one hand, we have analysed the relationship between socio-economic variables and health outcomes on a sample of Italian aged individuals, using a new microeconomic survey, the 2001 Survey on Health, Aging and Wealth. This survey is a representative sample of 2000 individuals over 50 and elicits detailed information on health outcomes and their possible determinants like health risk indicators, demographics, income and wealth. On the other hand, we have proposed a new index that measures the proficiency with which individuals transform their economic resources into functionings. This way, we have tried to make operational in a health care context Sen's paradigm on commodities, capabilities, and functionings. Therefore we have assumed there exists a frontier production process that describes the maximum output (the functionings) that can be produced with the existing resources (the inputs); then the distance of an individual from the frontier measures the capability of an individual to transform resources into functionings. We have computed this capability index on our sample of aged people and we have found that socio-economic variables do not matter in affecting health outcomes among aged people in Italy; this is not unexpected as the Italian health service does not have rationing mechanisms based on income for elderly people and so health functionings are not influenced by individual's socio-economic background. Of course, it is necessary to explain why individuals differ in their capabilities of transforming the existing health resources into functionings and this has to be the object of future research.

References

Fort, M. (2002), *The 2001 Survey on Health, Aging and Retirement*, University of Padua, mimeo.

Fried, H.O., Lovell, C.A.K., Schmidt, S., eds. (1993), *The measurement of productive efficiency: techniques and applications*, Oxford University Press, New York.

Sen, A. (1985), *Commodities and Capabilities*, Amsterdam: North Holland.

Sen, A. (1987), *The Standard of Living*, Cambridge: CUP.

Smith, J.P. (1999), Health bodies and thick wallets: the dual relation between health and economic status, *Journal of Economic Perspectives* 13, n.2, 145-66.