

Health, knowledge and the demand for medical care : an econometric analysis

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Chapter 8. General summary and conclusions

"Great theories are rarely simple in the ordinary sense of the term. Both quantum mechanisms and relativity theory are very difficult to understand; it takes only a few minutes to memorize the facts accounted for by relativity, but years of study may not suffice to master the theory and to see these facts in its context." (Polanyi, 1958, p. 16)

In the introduction to this thesis, we stated the central research question as follows: How, and to what extent, does the knowledge capital of individuals affect their behaviour with respect to health and with respect to their demand for medical care? Because the explicit intention was to approach this problem from an economic point of view, we first reviewed the theoretical models that had been used in the health economics literature in the (distant and recent) past in Chapter 2. The demand models that were discussed were classified according to whether or not:

1. the demand for medical care was derived from the more fundamental demand for 'good health',
2. health was regarded as a human capital stock which depreciates over time but can be augmented by health investment,
3. health depreciation was considered as uncertain, thereby causing a demand for insurance and the need to distinguish between preventive and curative care, and
4. consumer information on the effectiveness of medical care was imperfect, leading to a derived demand for (professional) advice.

Although undoubtedly each of these model characteristics is important, and therefore ought to be incorporated in any attempt to construct a comprehensive theoretical model of health (care) demand behaviour, such an exercise was not our ambition. Because we mainly wanted to use the theoretical models as the basis for our empirical analysis, we chose to tackle the problem in two stages for pragmatic reasons. A static but stochastic model was chosen to study the relationship between consumer information or knowledge and the demand for medical

care in Part I. The empirical analysis in the second part is based on a dynamic but deterministic theoretical model of the demand for health. Abstracting from intertemporal considerations in the first part, and from uncertainty in the second part, reduced the research problem to manageable proportions without, in our view, running the risk of oversimplification.

Part I: Consumer information and the demand for medical care

In Chapter 3 basically Kihlstrom's (1974a) Bayesian approach to the demand for information when product quality is uncertain, is adopted to describe demand behaviour in the health care market. The essence of the idea is that consumers are uncertain about the quality of medical care in terms of what it can contribute to their health status. It is assumed that they do possess some prior knowledge which is characterized by an a priori (normal) distribution of their belief about the effectiveness of medical care. The larger the variance around the mean of this distribution (or the more diffuse the prior), the more uncertain they are and the more valuable the availability of additional information. Information can be obtained from experience but it can also be bought in the 'medical advice' market. Basically, diagnostic and therapeutic information is precisely what is being purchased in most (primary care) physician-patient encounters.

It is further assumed that patients act as Bayesian decision makers in combining their prior knowledge and the advice received (the sample information) to arrive at a posterior knowledge (in the form of an a posteriori distribution) on which to base their decisions in order to maximize expected utility. In such a framework, the degree of consumer ignorance (and thus sovereignty) varies continuously with the degree of uncertainty expressed by the prior and posterior distributions. It is then shown that the expected utility gains of extra information (obtained from a doctor-expert or elsewhere) and treatment will be weighted against the cost of information. Some comparative static results can be derived for the effects of income, prices, prior uncertainty and the perceived informativeness of medical advice on the demand for diagnostic and therapeutic information.

Additional problems arise in health care because a doctor visit very often is a joint product consisting of both information and care. The Bayesian decision making assumption provides a key to the issue of how suppliers of medical care may be able to induce additional demand for their services: by altering the accuracy of their advice and overstating the marginal effect of an intervention. The consumer's prior knowledge and his perception of the accuracy of such advice provide limits to this discretionary power of the physician. How effective these limits are is an empirical matter.

This brings us to Chapter 4 in which a (LISREL) structural equation model is specified in order to test some of the theoretical model predictions. The dependent variables are two patient-initiated demands for primary medical care (self-medication and GP contacts) and two physician-initiated utilization rates (referred GP contacts and prescription drugs). A sample of nearly a thousand adults was analyzed drawn from the general Flemish population.

Special attention was paid to the measurement of health and knowledge. Individual health status was measured as a latent vector consisting of two components: a permanent stock of health and a transitory flow of healthy time. In a similar way, two Bayesian components of consumer information were distinguished: a MIMIC index for medical knowledge-ability was constructed to measure the prior information, and by means of principal components analysis a scale was derived to measure the respondents' perception of the accuracy of GP advice. The reliability of the various indicators we used and the validity of the constructs we developed was analyzed extensively in the measurement submodels. The results of these health and information 'modules' proved to be very robust when they were integrated into the full structural model. This indicates that it was justified to adopt the stepwise strategy of sorting out the measurement problems before performing any hypothesis testing in the total model.

According to the estimation results of the basic model specification reported in table 7.13, the following conclusions can be drawn with respect to the tested model predictions. First of all, individuals with better medical information do not initiate fewer visits to their GP. On the contrary, *ceteris paribus*, they report significantly more of such contacts but the effect is quite small. Its total (positive) effect is even smaller than the direct effect, mainly because knowledge has also a positive influence on the use of non-prescribed medicines. Because this acts as a substitute for GP contacts, the indirect effect is negative.

Distinguishing between the initiator of consumption turned out to be important because the opposite effect was found for physician-initiated GP contacts. People with more medical knowledge had significantly less GP contacts on referral. It was argued that this finding, in combination with the consistently positive, though non-significant effect of GP availability, could be interpreted as evidence in favour of Pauly's (1980) hypothesis that prior information effectively constrains the providers' ability to induce demand for their services. It does not, however, rule out other possible explanations.

No influence was found of prior medical knowledge on the use of prescription drugs and not one of the demands we considered was significantly affected by our measure of the (in)accuracy perception of GP diagnostic and therapeutic information. Education only showed a positive influence on the use of self-medication.

In the discussion of these results in Chapter 4 we pointed out that their inconsistency with some of the major theoretical predictions stands in sharp contrast to their consistency with earlier findings in the literature. Either no or a small positive effect was found of medical knowledge on physician visits. However, with our structural model approach it was possible to show that some of the interpretations which other researchers had given to this result were incorrect. In addition, we could show that the opposite result holds for physician-initiated contacts.

Our general conclusion of Part One is therefore that the Bayesian approach to the demand for information, despite its theoretical appeal, contributes little to a better empirical explanation of the demand for primary care. Even if the power of the tests could be raised by analyzing a larger sample or measuring more accurately than we did, some effects may become statistically more significant but it is unlikely that they will be much larger. The institutional requirement to buy professional information, in the form of a prescription, for the majority of health care may be one of the reasons why the effect of prior information is so small. In fact, such requirements may always cause a downward bias in the information effect, even when in future research efforts it is attempted to distinguish between more and less appropriate medical consumption.

Finally, also the estimated partial direct effects of medical knowledge and education on health status were very small and often non-significant. This finding is inconsistent with the strong partial correlations between the level of schooling and health which are often found also in individual cross-section studies. This relationship is explored in more detail in the second part of this study.

Part II: Education and health

The second part of the study does not (only) deal with the specific mechanism through which knowledge might affect medical consumption but takes a broader view to investigate the overall effect of one type of human capital (education) on the other type of human capital (health). The theoretical and empirical problems associated with an analysis of the schooling-health relationship are discussed in Chapter 5. It was argued that, for our purposes, education effects on the health of a general adult population could better be examined by means of production functions rather than demand functions. By estimating an essentially technical relationship like a production function, a number of specific problems inherent to the demand for health approach can be avoided. At the same time, however, most of the characteristics of the economic approach to health behaviour are neglected.

Through a review of earlier empirical studies of the schooling-health

link, we identified mainly four methodological problems: (a) omitted variable bias, (b) measurement error, (c) direct versus indirect effects, and (d) non-linearity and interaction. With respect to the issue of omitted variable bias, it was shown that longitudinal data might provide an acceptable solution if the objective is not so much to identify the "omitted third factor(s)" but rather to control for possible spurious correlation. The problem of errors in health measurement can be reduced by using several indicators of the unobservable variable and combining them into one index. This procedure has hitherto only been used in (non-longitudinal) cross-section studies. Investigations of intervening factors in the linkage between schooling and health sometimes reported important indirect effects through allocation decisions. But the problem with these estimates is that possibly the total effect is substantially over-estimated due to lack of control for omitted variables. Finally, few studies allowed for the possibility of non-linear and/or non-additive effects of education.

For our own analysis of education effects in health production, we had two datasets available, none of which allowed us to tackle all of these methodological problems simultaneously. However, each of the two had strengths and weaknesses compared to the other. Therefore, we could not discard any of them a priori and analyzed both separately.

In Chapter 6 a longitudinal latent variable model is estimated with data taken from the two waves of the Nederland Oké Panel Survey. The health status of the 895 individuals in the sample in 1981 and 1983 is measured as a latent variable with three observable indicators: self-rated general health status, the presence of a chronic condition or handicap and a 21-item psycho-somatic complaints score. By allowing for intertemporal correlation between the error terms of two of these indicators, a measurement model was obtained that fitted these data. A recursive structural equation model is then specified to estimate the cumulative effects of education and other exogenous variables on 1981 health status and the dynamic effects on 1983 health status. The main conclusion is that schooling appears to have no marginal impact on health changes, i.e. on current health when the health status of two years earlier is controlled for. Both education and most of the other health determinants show a clear "cumulative" effect but insignificant "dynamic" effects. Notable exceptions are the influence of the two health inputs, i.e. a healthy lifestyle and the number of doctor visits, but these channel negative indirect effects of education on health. However, a decomposition into direct and indirect effects of education is hampered by the absence of any significant total (dynamic) effects. This would imply that the health lifecycle profiles of the more educated have a higher intercept but identical slopes, i.e. they are parallel. However, we have some doubt about the generalizability of this finding because the results also indicate that age does not have a dynamic effect on health, i.e. that health depreciation does not rise with age. Even though the sample only

includes persons between the age limits of 21 and 65, one would expect some age impact on health change.

We therefore conclude that the absence of a marginal health productivity effect of schooling (and other variables) may be due to a lack of discriminating power of the test. By far the largest part of the high percentage (84%) of explained variance in 1983 latent health status is accounted for by the health status two years earlier. Both the limited variation of the latent health variable over a period of two years and the limited size of the sample may prevent the detection of significant dynamic effects. This hypothesis could be tested in Chapter 7 with the other dataset.

More recently another Dutch dataset has become available with which the dynamic relationship between health and education could be examined. The 1984 CBS Health Interview Survey is not a panel but it includes a retrospective health question. Respondents were asked to rate both their current and past health status (five years ago) by means of an appreciation mark between 1 and 10. This was found to be a fairly reliable and sufficiently sensitive measure to analyze longitudinal changes in health. The longer reference period (five years), the larger sample size ($n = 7158$) and the better subdivision of education categories increased the power of the test substantially.

By means of an analysis of covariance of the health changes over time, we found that lifecycle profiles of health are not parallel across groups of people with different levels of schooling. In particular, the health depreciation rate of those who did not attend more than primary education is higher than that of the other classes (except university level), even when income, age, sex and initial health are controlled for. Although no intervening factors could be examined in detail, an explanation based on working conditions seems unlikely because this education effect did not differ between those who did and those who did not have a paid job. Further investigation is needed of the specific mechanisms through which this effect materializes. People with a low education level do seem to continue to be a high health risk group deserving the attention of health policy makers. Our analysis indicates that differences in education levels increase health inequalities, thereby amplifying the initial inequality.

Not only the direct main effect of education on health change but also the interaction effect with initial health status was statistically significant. Both indicated a substantial health gain between the lowest and the second level of education but little health returns to additional education beyond vocational training. When both types of effects were introduced simultaneously, the interaction effect became negative. This result suggests that the positive overall effect of education would conceal two opposite effects rather than two complementary influences, as one would expect. It certainly contradicts the use-related depreciation hypothesis about the effect

of education which could not be rejected when the interaction effects were estimated separately (without the main effects). The marginal productivity hypothesis could not be tested adequately due to the lack of a good measure of health investment. This will be a necessity in future work if one wants to discriminate more adequately between the two competing hypotheses.

With respect to the effects of the other background characteristics, a non-linear age influence was found: health deterioration only starts beyond the age of 30 but increases at an increasing rate thereafter. Male health profiles are slightly higher but parallel with female health profiles: the initial sex difference remains constant over the lifecycle. In all estimates, household income showed a strongly positive partial effect on health which again indicates that initial socio-economic inequalities grow as people grow older.

The main general conclusion which emerges from the various analyses presented in the second part of this book is that the correlation between health and education is not spurious. More schooling does seem to have a beneficial causal effect on health or, formulated negatively, a lack of education adversely affects the expected time path of individual health status. Future research will have to concentrate on more specific causal mechanisms which may channel this influence. In order to identify how much of this effect can be attributed to working conditions, lifestyle, use of medical care or other intervening variables, preferably panel data should be used but according to our analysis, also retrospective questions in cross-section surveys provide a useful and less expensive alternative source of longitudinal information.