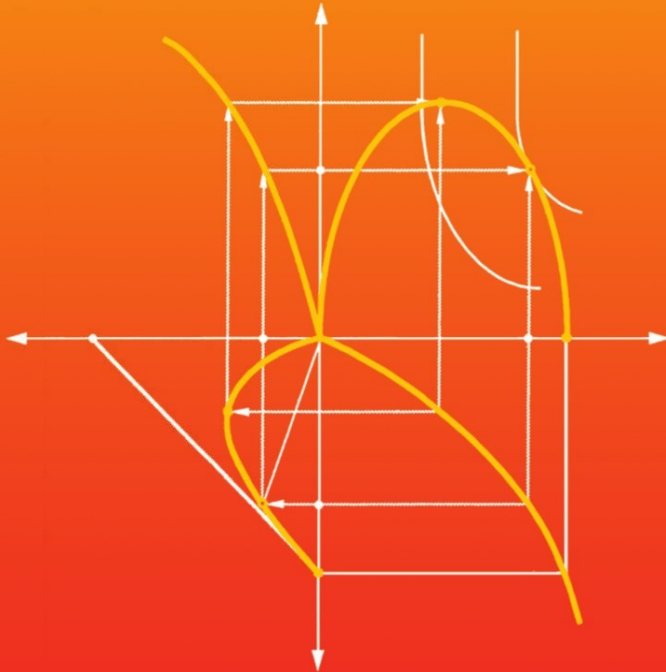PETER ZWEIFEL
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Health
Economics

Second Edition

Springer

Health Economics

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Second Edition

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Preface

Health Economics is a fascinating subject. This book provides a systematic treatment of this field of study. It is based on a German version which has been well received since 1992, resulting in five editions so far. It serves both as a textbook in university courses at the Master level and as a reference book.

The book's distinguishing feature is that it consistently builds on formal economic models that have been used in academic Health Economics journals for several decades but have not been integrated in the leading undergraduate textbooks of the field. As we are convinced that many problems in Health Economics are too complicated to be analyzed only graphically, we are now offering this text for Master level courses at universities worldwide. Our premise is that readers are familiar with basic calculus. Some knowledge of econometrics is also useful. At the same time, we have taken care to explain the reasoning in the more technical sections. In addition, we state our main results in non-technical Conclusions and in Summaries at the end of each chapter.

Zürich, Konstanz and Augsburg   *Peter Zweifel*
April 2009   *Friedrich Breyer*
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Introduction

1.1 Health – a Priceless Commodity?

When trying to connect 'health' and 'economics', one usually thinks of

(1) health being the most precious good. In order to remain in good health just about anything should be done;

(2) health care being in a crisis. If the costs of health care were to continue to increase at the current rate, then health might become unaffordable to most people.

Although the two statements seem to be contradictory, they agree that both of them assume that health is 'priceless' either in an ethical sense ('invaluable') or in a more economic sense ('very expensive').

So why should economists, presumably emphasizing the latter, deal with health-related subjects? In the eyes of most people, the answer lies in the development of health care expenditure (HCE): in all western industrialized countries, public HCE have strongly increased, during the past decades (that is from the 1960s until 2005, see Table 1.1) not only in absolute figures but also as a share of GDP (Gross Domestic Product). Given continued growth, the entire GDP of many industrialized could be consumed by HCE before the end of the twenty-first century. This so-called 'cost explosion' has led to a number of legislative measures in many industrialized countries. They all had the objective of reducing the rate of increase in public HCE.[1]

Obviously, HCE are not the only outlay that has increased strongly in the past. So have the expenditures on private transportation and on haircuts. Nonetheless no one has ever heard of a 'crisis in hair care' and the media have not drawn our attention as

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[1] In countries with public health insurance such as Germany, policymakers seek to stabilize the contribution rate which is the part of labor income that workers have to pay to their sickness funds. In other countries, such as the United States, the federal government tries to limit its ever-rising subsidies paid to Medicaid (a program for the poor) and Medicare (for the elderly).

Table 1.1. Health Care Expenditure as a Share of Gross Domestic Product (in Percent)

Year	1960	1970	1980	1990	2000	2005
Austria	4.3	5.2	7.5	8.4[a]	9.9	10.3
Canada	5.4	6.9	7.0	8.9	8.8	9.9
Federal Republic of Germany	–	6.0	8.4	8.3	10.3	10.7
France	3.8	5.4	7.0	8.4	9.6	11.2
Italy	–	–	–	7.7	8.1	8.9
Japan	3.0	4.6	6.5	6.0	7.7	8.2
Sweden	–	6.8	8.9	8.2	8.2	9.2
Switzerland	4.9	5.4	7.3	8.2	10.3	11.4
United Kingdom	3.9	4.5	5.6	6.0	7.2	8.2[b]
United States	5.1	7.0	8.7	11.9	13.2	15.2

a: break in series; b: differences in methodology.

Source: OECD (2008)

much to the risk of walking around long-haired one day, contrary to the nightmare of not being able to afford medical treatment. In looking for peculiarities of health care that have prevented such a comparison (so far), one comes mainly across the following three characteristics:

(1) *The size of the health care sector.* Health care services constitute an industry of considerable economic importance. Its share in GDP today is close to or even above ten percent in most western industrialized countries (depending on the method of measurement and the delimitation of the industry, see Table 1.1). This means that a great number of people owe their income to this industry. For economists, this is a good reason to acquire knowledge of the subject and to analyze the industry, following the example of agricultural, energy, transportation, and recently tourism and cultural economics.

(2) *Public regulation of health services.* Even more important than their sheer size is the fact that health care services are regulated by the state to a considerable extent. Just consider compulsory health insurance in many countries, the fixing of fee schedules for medical services, or even the National Health Service of the UK and similar institutions in other countries, where almost all care is provided by public employees. These departures from market forces raise the question whether an optimal allocation of scarce resources can be achieved.

(3) *Ethical significance.* Finally, health and everything related to it is an extremely emotional issue. This fact poses a particular challenge to economists, who are called upon to devise rules of allocation doing justice to the specific character of health wants. Often there is a conflict between the economic and the ethical way of looking at the allocation of scarce resources, both within health care and between health and other goods.

Nevertheless, the health care 'cost explosion' should not become an obsession. First, we are dealing with a changing group of goods over time, so that the term 'cost explosion' is not appropriate anyway and we should rather speak of a growth in expenditure instead. Second, from a welfare point of view, the problem is not so much the development of expenditures of health care, but rather their structure: the economic principle generally requires that a given degree of satisfaction of one's needs be achieved with the minimum amount of scarce resources. Thus, the demand for some particular type of goods or services may have grown – as has been the case in the services sector during recent decades – causing expenditure devoted to it to strongly increase in spite of perfect efficiency in the use of resources. Conversely, the shrinking of an industry does not imply an increase in efficiency.

> **Conclusion 1.1.** *From an economic perspective, the rules that determine the allocation of resources rather than the amount of expenditure on health are of interest. They indicate if the participants involved – both those supplying and those demanding health care services – have incentives to use scarce resources efficiently.*

1.2 The Micro- and Macroeconomic Views of Health

From the microeconomic point of view, the behavior of an insured individual, a physician, the management of a hospital or the decisions made by a pharmaceutical company are in the focus of interest. In public debate, by contrast, the macroeconomic approach dominates, with the share of health expenditure in GDP usually serving as the point of reference. Therefore it seems appropriate to connect these two approaches and to clarify why the objective of keeping the health share in GDP constant, commonly pursued by governments, is misguided.

1.2.1 A Simplified Microeconomic View of Health

For an individual, health has two functions. On the one hand, perfect health represents a value of its own, a target that is to be attained as closely as possible. On the other hand, there are other aims in life. The gourmet who prefers a foie gras to a wholesome salad justifies the presumption that health is traded off for other objectives. And who has never crossed a busy street instead of using the underground crossing, only to save a little time? These modes of behavior contradict the claim that health is a priceless commodity (see statement (1) at the beginning of Section 1.1). This contradiction rarely becomes obvious because no one sacrifices his health in an immediate sense. People only allow the probability of living healthy in the future to be a little smaller than it could be.

In Chapter 3, we analyze individual health behavior in detail. For a beginning, we present a model by WAGSTAFF (1986a) which is a simplified version of the model by GROSSMAN (1972b) (see Section 3.3). It is based on the fact that individuals implicitly trade off 'health' (H) against all other aims, which for simplicity will be aggregated into 'consumption' (C). This weighing-up of objectives is, as usual in microeconomics, symbolized by a set of indifference curves (see quadrant I of Figure 1.1).

There are two characteristics, however, which make health particularly important to most people:

(1) The consumptive benefit that one can derive from one's income depends on one's state of health. Depression for instance, the most widespread mental illness, makes it just about impossible for the person affected to enjoy the nice things in life. Similarly, in the event of a disease of the digestive tract, a foie gras is not a pleasure even to the gourmet.

   This characteristic can be reproduced in quadrant I of Figure 1.1 by the shape of the indifference curves. As soon as the ratio of health to consumption becomes small, additional consumption does not have positive marginal utility any longer, causing the indifference curve in the northwest area of quadrant I to run vertical rather than negatively sloped.

(2) Only someone who is in good health can earn an income on the labor market. This feature is represented in quadrant III of Figure 1.1 showing how individuals can divide their budget (disposable income, Y) between medical care (M) and consumer goods (X). The prices for medical care (net price q after deduction of insurance benefits) and consumer goods (p) are exogenous. The peculiarity of the budget constraint,

$$Y(H) = pX + qM \tag{1.1}$$

   lies in the fact that disposable income Y depends on the state of health H. If income did not depend on the state of health, i.e., if H were fixed to $\overline{H}$, the budget constraint would be linear, as shown by the dashed line $A'B$. Point B indicates where the entire income is spent on medical care.

If, starting at point B, the expenditure on medical care is reduced, the state of health H deteriorates according to the function $H(M)$ shown in quadrant IV. This decrease results in a reduction of income $Y(H)$ in the third quadrant.[2] Consequently, the quantity of consumer goods rises at a decreasing rate up to point A. At this turning point, a further reduction of medical care lets health deteriorate so much that the associated drop in income neutralizes the savings in health expenditure. Beyond point A, a further reduction of M would result in a loss of income to such an extent as to require a reduction of consumption. And finally, at $M = 0$, income would drop to $Y = 0$ and with it purchases of consumer goods ($X = 0$).

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[2] We assume that the functions $H(M)$ and $Y(H)$ are both strictly concave.
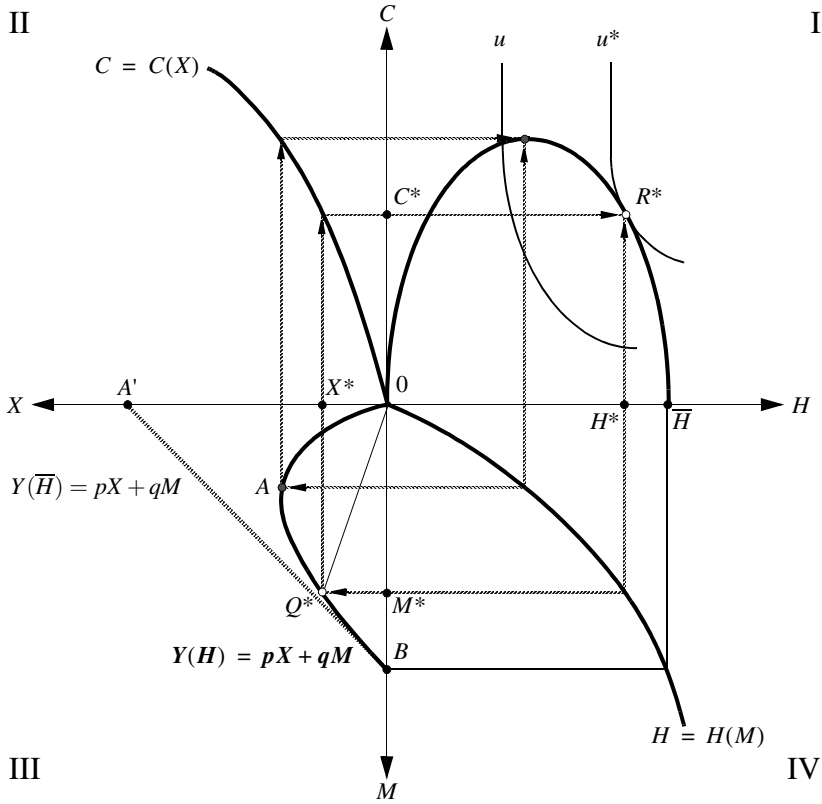
Fig. 1.1. Health, Consumption, and Optimum Share of Income Devoted to Health

Quadrant IV shows the amount of medical care M required to guarantee a given state of health. The more medical care (of curative nature), the better the state of health. The individual's own efforts at preserving his good health (prevention) are not taken into consideration here (in Chapter 3 the model will be extended to preventive efforts).

Finally, quadrant II shows the positive relationship between consumer goods (X) and consumable services ('consumption', C) according to the equation $C = C(X)$. This relationship is assumed to depend on household characteristics, e.g., the ability to use technology. Combined with the equation $H = H(M)$ pictured in the fourth quadrant, we can assign to each point on the budget curve in quadrant III a point in the (C, H)-space of quadrant I (see the dashed arrows in Figure 1.1). The set of all these points indicates the individual's production frontier. It differs from the usual production frontiers known in microeconomics by running through the origin. That is because, as explained above, a very poor physical constitution ($H = 0$) is associated with an income of zero and consequently also with a consumption of $C = 0$. At first,

it slopes upward with an increasing value of H. This means that, initially, better health enables one to consume more, not less (detailed reasons for this will be given in Chapter 3).

The tangency point of the highest attainable indifference curve and the production frontier defines the combination of consumption and health (C^*, H^*) yielding maximum utility. Quadrant IV shows the corresponding optimal expenditure on medical care M^* and quadrant II the optimal purchase of consumption goods X^*. Point Q^* on the budget curve in quadrant III finally indicates the individual's optimal budget allocation. Connecting Q^* with the origin, one can interpret the slope of this line as the 'optimal health share': the steeper the line the bigger the optimal share of income spent on medical care. These reflections can be summed up in

> **Conclusion 1.2.** *The trade-off between the objectives 'consumption' and 'health' can be illustrated as a conventional microeconomic optimization problem. When solving this, one has to consider that health serves as an input into the generation of income, which in turn is necessary to buy consumer goods.*

1.2.2 Health Care at the Macroeconomic Level

In principle, the functions shown in Figure 1.1 can be aggregated over all individuals. They are therefore valid at a macroeconomic level as well. The problem is their limited observability. Precisely the two quantities of utmost importance to the individual, state of health H and consumption C, are captured only rudimentarily by official statistics. However, the quantity of medical treatment (M^* or its monetary value qM^*) and purchases of consumer goods (X^* and pX^*, respectively) are well known. As a consequence, attempts at controlling health care usually focus on these quantities.

Why should there be a need for controlling HCE? Chapter 5 deals with this question. It will be shown that subsidies for health insurance, possibly even compulsory insurance for individuals combined with open enrollment by insurers can be justified. But more far-reaching interventions such as stabilizing the share of health expenditure in the Gross Domestic Product (GDP), limiting the increase in costs to a specified percentage, or stabilizing contributions as a share of wage income are difficult to justify.[3] In the following, we will show that fixing the share of HCE in GDP or in wage income easily results in efficiency losses which accumulate over time.

As soon as the government is involved in the financing of health care, its budget is affected by individual decisions with regard to health care. The more people rely on medical treatment, the larger is public HCE (at least in the long run) due to

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[3] In Germany, the premiums for public health insurance are tied to income from salaried employment, in contrast to, e.g., Dutch and Swiss public health insurance where premiums are quoted in absolute terms. An important objective of a series of reform laws in the German health care system is to stabilize the contribution rate.

additional subsidies for medical students and for investments of hospitals. Furthermore, the operating deficits of hospitals are covered by the state in many countries and higher payments for the medical treatment of senior citizens arise in countries such as the United States and Germany (to name just a few of the lagged influences on the budget).

On the other hand, public expenditure secures votes, helping to secure re-election to politicians. Chapter 13 will focus on this issue; here we would simply like to point out that politicians prefer a specific division of the budget to any other division, just as the individual of Figure 1.1 prefers the division of his budget according to Q^* to other solutions. But by pushing through its preferences regarding the budget, the government more or less fixes the share of health in GDP. The consequences of this policy will be highlighted in the following section.

1.2.3 A Critique of Global Budgeting

In their struggle against the 'cost explosion' in health care, governments refer to the figures of Table 1.1 arguing that the share of health in the Gross National Product is rising too fast. Assuming that one could succeed in stabilizing this share at a certain percentage of GDP, what could be gained?

To answer this question, the transition from the micro- to the macroeconomic level is made in the simplest possible way by applying the features of Figure 1.1 to all individuals of a society, who are assumed to be identical. Accordingly H becomes the number of person-years spent in good health, qM the national health expenditure, and pX the aggregate consumption expenditure. The allocation of GDP between these two categories is given by point Q^* in the third quadrant, symbolizing the aggregate outcome of individual decisions. For the sake of simplicity, the health share set by the government is assumed to coincide with the optimal Q^* in the initial situation.

This equality may now be disturbed by an exogenous shock, e.g., an improvement in medical technology. This causes the function $H(M)$ to shift to $H'(M)$ in the fourth quadrant of Figure 1.2, implying that a given supply of medical services now guarantees a better health status than before. This leads to an outward shift of the budget curve in quadrant III. Consequently, the production possibility frontier shown in the first quadrant shifts outward. Society evidently can reach new (C, H)-combinations, lying to the right and above the old optimum R^* in quadrant I.

Let us now assume that the government learns about the improved medical technology but wants the share of GDP devoted to health to remain unchanged. This means that it is trying to keep the global allocation between consumption and health expenditure the same, which requires the new point Q' to lie on the same ray through the origin as Q^*. Thereby a new (C, H)-combination would be reached, symbolized by R' in the first quadrant (see the solid arrows in Figure 1.2).
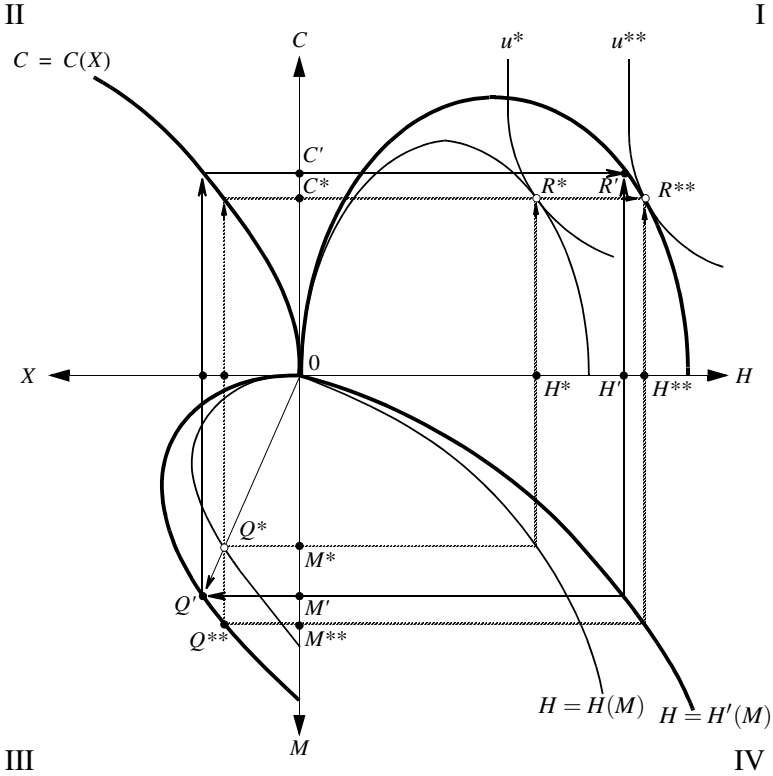
Fig. 1.2. Change in Medical Technology and Adjustment of Optimal Health Share

If the (identical) members of this society value their health as highly as the relative steepness of their indifference curves in the first quadrant indicates, they would opt for R^{**} rather than R', implying the following outcome:

(1) By assumption, the extension of the choice set will be used exclusively for an improvement of the health status (see the transition from R^* to R^{**}).[4]

(2) This is achieved by an increasing use of medical care (new value: M^{**}) not only in comparison to the initial optimum M^* but also in comparison to M' as fixed by the government.

(3) Due to the improved state of health, there is a rise in labor income and therefore in financial means available, so that this increase of M is possible without changing consumption expenditure $X^{**} = X^*$.

(4) The new optimal budget allocation Q^{**} (in quadrant III) of society calls for an increase of the optimal health share. This is shown by the rotation of the ray from the origin to $0Q^{**}$, which is steeper than the original ray $0Q'$.

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[4] This is assumed for simplicity. The same conclusions can be drawn from a predominant tendency toward improved health.

Now if politicians hold on to the existing allocation of the public budget, they force individuals as a group to settle with Q' and R', respectively. This means, e.g., that medical services are not available because of restricted access to medical schools or that hospital treatments cannot be performed due to a lack of investment in equipment. Thus, individuals reach a lower level of utility in quadrant I than the highest possible value at point R^{**}.

The example of technological change in medicine stands for just one of many possible changes which can lead to discrepancies between the optimal health share in income from the perspective of the individual and a politically established health share in the GDP. Going through the four quadrants of Figure 1.2, one comes across the following changes:

(a) The preferences between health and consumption may change, e.g., in the course of a fitness wave.

(b) The relationship between consumer goods and consumption services may be modified by innovations in household technology (e.g., time-saving devices) or improved education (e.g., permitting more informed choices of consumer goods). In both instances, this enables individuals to extract more consumption services from a given quantity of consumer goods, resulting in an upward shift of the $C(X)$ function in quadrant II.

(c) The budget constraint is subject to continuous change. Increasing incomes shift it away from the origin whereas its slope becomes steeper if the relative price of consumer goods increases.

(d) The connection between the use of medical care and the state of health is not only modified by technological change in medicine but also by environmental factors or an increase or decrease of health-enhancing efforts on the individuals' part, the latter especially as a result of insurance coverage (see Chapter 6 for a detailed discussion). Besides, the performance of physicians and hospitals generally falls short of their efficient levels as a consequence of the remuneration system. Therefore, the location of the function $H = H(M)$ also reflects the system of remuneration (see Chapter 10).

This clearly shows that there are a number of reasons for the politically determined health share to differ from its optimal value.

Conclusion 1.3. *There are several arguments against fixing the share of health expenditure in the GDP at a certain level. This policy is likely to cause losses in efficiency which tend to accumulate over time.*

This insight is reflected in the general approach of this book. We will emphasize the microeconomic view of health and concentrate on how patients, physicians, the management of a hospital or of a pharmaceutical company behave and how they interact.

1.3 'Economics of Health' vs. 'Economics of Health Care'

Up to this point, reasons for the existence of health economics as a discipline were given and the relationship between macroeconomic and microeconomic ways of looking at health and health care was examined. To classify issues, we propose a distinction between 'economics of health' and 'economics of health care'.

1.3.1 Economics of Health

In their titles, some publications in the field (textbooks and edited volumes) talk of 'economics of health', while others refer to 'economics of health care' or 'economics of medical care'.[5] This suggests that health itself is an interesting economic issue. Indeed, there are many questions connected with health, which have nothing to do with 'health care', i.e., the provision of medical services by physicians and other professional suppliers. These deal with both positive and normative aspects of health.

One of the most important questions raised by the economics of health concerns the valuation of health in monetary terms, i.e., the weighing of good health against other objectives, in particular consumption of other goods. This normative issue ('How much consumption should society sacrifice to increase its average life expectancy by one year? How much should an improvement of the state of health measured by suitable indicators be worth?') arises primarily in connection with public projects, financed by levies, such as taxes or social security contributions, whenever they have an effect on the life expectancy or health of citizens. The typical feature is that the individual does not weigh himself health against consumption. Rather, government or parliament decide on behalf of the citizens, and it is the task of health economics to provide these authorities with decision-making rules which are well-founded in welfare economics. This will be the subject of Chapter 2.

The positive branch of health economics, by contrast, deals with individual health behavior, using the instruments of modern microeconomic theory. The basic paradigm of rational choice is applied to health, i.e., the individual is considered to maximize utility, which depends, among other things, on material consumption as well as on health. With the help of such a model (see Chapter 3), one can examine the effect on the individual's 'demand' for health (i.e., his health behavior) of changes in his budget constraint, i.e., in his income, or of changes in relative prices, caused, e.g., by changes in health insurance coverage.

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[5] Examples are FELDSTEIN (2005), FOLLAND ET AL. (2006), FUCHS (1986), MCGUIRE ET AL. (1988), MOONEY (2003), NEWHOUSE (1978), and PHELPS (2003).

1.3.2 Health and the Use of Health Care Services

The connection between the health status of the individual (or the population on the whole) and the use of medical services builds the link between 'economics of health' and 'economics of health care'. There are two relationships to be distinguished. They are represented by the headings, 'production function of health' and 'demand function for medical services'.

In the first case, the point at issue is the question, how much do medical services contribute to the preservation or improvement of health status? Economists, statisticians, and econometricians have applied empirical methods to answer this question (see Chapter 4). In general, the influence of health care on health

(1) can be assumed to be positive: higher consumption of medical services results in better health.

For logical reasons, this effect

(2) is supposed to set in with a time-lag: it is to be expected in empirical investigations that consumption of medical services in period t does not give rise to better health immediately but in some later period (say $t + 1$).

The second relationship runs from the state of health to the consumption of medical services, the so-called demand function for medical services. In this function, the state of health represents the explanatory variable. Here, the plausible assumptions are that

(a) the theoretically expected effect is negative (worse health goes along with increased consumption of medical services) and
(b) this relationship applies to simultaneously measured values of the two quantities.

1.3.3 Economics of Health Care

The demand function for medical services already belongs to the domain of the economies of health care. Taking the positive contribution of medical services to health as a given fact, the economics of health care – in its positive form – raises the issues of what determines the quantity and quality of medical services produced in a society. In its normative form, it sets out to investigate the conditions of production of these services and their distribution among individuals, identifying those mechanisms that are particularly appropriate for efficiency, taking the scarcity of resources used in their production into due account.

This leads us to the issues of organizing and financing medical services. Microeconomic analysis, with its concept of 'incentives', is well suited to investigate the effects of alternative regulations. The terms 'financing' and 'incentives' in fact amount to two sides of a coin.

(1) On the one hand, they describe how the recipients of medical services (the patients) pay for these services. Here, the point at issue is health insurance with its incentive effects on the insured dealt with in Chapters 5 and 6.

(2) On the other hand, they describe the way the money is channeled to the providers of services. Here, the analysis deals with the incentive effects of alternative payment systems for physicians and hospitals (Chapter 10) and suppliers of drugs (Chapter 12).

1.4 A System Analysis of the Economics of Health and Health Care

To conclude this introduction, an overview of the issues dealt within this book is given in Figure 1.3. This simplified system analysis begins with individuals and their objectives, among them to live as long and healthy as possible while consuming as much as possible. In their health-related behavior, they are guided by a variety of incentives, which are shaped especially by the form of their health insurance (see Chapters 5, 6, and 7).

Admittedly, the state of health is not fully under the individual's control. While chance has an important impact, individuals can still opt for more or less health through their behavior that exerts a systematic influence (see Chapter 3). This also means that an additional day spent in good health has its 'price' even if there is no market where it can be traded. This price consists in the additional consumption the individual could have enjoyed, had he not used his time and money to improve his health.

Opting for a probability with which a certain state of health is attained also calls for a decision on how to influence this probability. Very often people are willing to go through a phase of illness with minimal use of pharmaceuticals and no medical treatment. Instead they use their time as an input. Presumably, material incentives influence this choice between one's own and other inputs (see Chapter 3; for empirical evidence, see Chapter 4). If this choice increasingly tends towards inputs provided by a third party, i.e., health care services, then the result can be a cost explosion in health care.

The extent to which changes in individual health-related behavior affects HCE is very much dependent on the physician. She or he, positioned just below the patient in Figure 1.3, acts as a 'gatekeeper' to health care. In particular, the choice between outpatient and inpatient treatment has important consequences in terms of cost incurred. This is due to the fact that a hospital stay typically involves the use of a great deal