



The contribution of health to the economy in the European Union



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23 August 2005

Marc Suhrcke
Martin McKee
Regina Sauto Arce
Svetla Tsolova
Jørgen Mortensen

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Luxembourg: Office for Official Publications of the European Communities, 2005

ISBN 92-894-9829-3

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Printed in Belgium

PRINTED ON WHITE CHLORINE-FREE PAPER

About the authors

Marc Suhrcke is an economist at the European Office for Investment for Health and Development of the World Health Organization (WHO).

Martin McKee is Professor of European Public Health at the London School of Hygiene and Tropical Medicine (LSHTM) and Research Director at the European Observatory on Health Systems and Policies.

Regina Sauto Arce is Research Fellow at the Centre for European Policy Studies (CEPS).

Svetla Tsolova is Research Fellow at the Centre for European Policy Studies (CEPS).

Jørgen Mortensen is Associate Senior Research Fellow at the Centre for European Policy Studies (CEPS).

Acknowledgements

This book was made possible by a grant from the European Commission, Directorate-General for Health and Consumer Protection, Contract CNTR S12.384621 — SANCO/C5/2004/03. We are grateful to Bernard Merkel, Guri Galtung Kjaeserud, Paula Duarte Gaspar, Mary Heneghan and other Commission colleagues, (Health and Consumer Protection DG) for helpful comments on earlier drafts, to Nicola Lord of the DFID Health Systems Development Programme at LSHTM for administering the project, to Caroline White at the European Observatory on Health Systems and Policies for managing the references, to Claire Newey of the LSHTM and the LSE Health and Social Care for essential support on tracking the relevant literature, to Anne Harrington at CEPS for final editorial work. Panos Kanavos (LSE) provided valuable information on the determinants of health expenditure and Ellen Nolte (LSHTM) analysed data for the calculations of full income in Chapter 3. Martin McKee's work is supported by the European Observatory on Health Systems and Policies and the UK DFID's Health System Development Programme. Marc Suhrcke's work is supported by the Coordination of Macroeconomics and Health Unit of WHO. Views expressed in the report are entirely those of the authors and do not necessarily reflect the official views of the institutions they are affiliated with.

Foreword

In March 2000, the European Union's Heads of State or Government came together to agree the ambitious goal of making the European Union 'the most competitive and dynamic knowledge-based economy in the world, capable of sustainable economic growth with more and better jobs and greater social cohesion'. They highlighted the need to: create a knowledge-based economy and society, accelerating the process of structural reform for competitiveness and innovation; modernise the European social model, by investing in people and combating social exclusion; and sustain favourable growth prospects by means of an appropriate macroeconomic policy mix.

The relationship between health and the economy is one of the cornerstones of this agenda. Yet this relationship is complex. While it has long been recognised that increased national wealth is associated with improved health, it is only more recently that the contribution of better health to economic growth has been recognised. Yet while this relationship is now well established in low-income countries, the evidence from high-income countries, such as the Member States of the European Union, has been more fragmented.

The authors of this important book have, for the first time, brought this evidence together. Having confirmed the high cost falling on Europe's economies as a result of illness, they assemble a wealth of evidence to demonstrate how good health promotes earnings and labour supply. Of particular relevance to Europe, with its ageing population, they show how poor health increases the likelihood of early retirement. Taken together, this evidence provides a powerful argument for European governments to invest in the health of their populations, not only because better health is a desirable objective in its own right, but also because it is an important determinant of economic growth and competitiveness.

As the High-Level Group on the Lisbon Strategy for Growth and Employment noted, Europe needs to increase its investment in human capital as the productivity and competitiveness 'of Europe's economy are directly dependent on a well-educated, skilled and adaptable workforce that is able to embrace change'. It went on to emphasise that health and healthcare play a key role 'in generating social cohesion, a productive workforce, employment and hence economic growth'. By bringing together the information underpinning this argument in an accessible form, the authors have made an important contribution to the debate on the future of the European social model. I encourage you to read this excellent contribution.



Markos Kyprianou

Commissioner for Health and Consumer Protection

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Executive summary

Why is it important to discuss health and economic development now?

Recent years have seen important advances in our understanding of the link between health and economic development in low-income countries, exemplified by the report of the Commission on Macroeconomics and Health (CMH). Yet this issue has so far received scant attention in rich countries. Is this lack of attention justifiable? We argue that it is not. While the economic argument for investing in health in high-income countries may differ in detail from that in low-income countries, we have found considerable and convincing evidence that significant economic benefits can be achieved by improving health not only in developing, but also in developed countries. At the same time, we point to the existence of significant gaps in our understanding that can be addressed by scholars working in the field.

- The Commission on Macroeconomics and Health made a strong economic case for investing in health in their final report published in 2001. Although confined primarily to evidence from low- and middle-income countries, it helped bring about a shift in the prevailing paradigm: health was no longer seen as a mere by-product of economic development, but as one of several key determinants of economic development and poverty reduction. This has helped pave the way for health to be included in national development strategies and policy frameworks in poor countries.
- In contrast, the potential contribution of health to the economy has received rather less attention in high-income countries, where health has not made its way into national economic development strategies and plans. In most of these countries, the thrust of contemporary discussions on health reform typically sees interventions that promote health and the delivery of healthcare as costs that need to be contained. In most countries, health is among the weakest of ministries and there are only a few examples of finance ministries having engaged in discussions with health ministries about how the latter could contribute to national economic outcomes through activities that improve health, rather than exhorting them to cut costs.
- There is a sound theoretical and empirical basis to the argument that human capital contributes to economic growth. Since human capital matters for economic outcomes and since health is an important component of human capital, health matters for economic outcomes. At the same time, economic outcomes also matter for health. A recurring theme throughout this book is the existence of feedback loops offering the scope for mutually reinforcing improvements in health and wealth.
- From a European perspective, this question links closely with the debate on the European Union's Lisbon agenda. This discourse increasingly accepts that greater investment in human capital constitutes a necessary, albeit not sufficient, condition for making the European economy more competitive in the wider world. If this is to be achieved, it will be necessary to increase our understanding of the benefits to be derived from investments in human capital, including those in population health.

- Making the economic case for health is especially relevant at this moment in the history of European integration, following the most recent enlargement. Income disparities between the 10 new Member States and the EU-15 are large, but the health gap is also large. Some of the new Member States have life expectancies that are more than 10 years lower than the average of the EU-15. Closing this health gap will be both necessary for reducing the income differences in the EU and for demonstrating the success of enlargement.
- A related issue is the scope for restraint on future growth of European economies exposed to the costs of ageing populations that fall on pension and healthcare expenditures, with implications for macroeconomic stability. This highlights the need to make timely investments in health in order to reduce the future burden of preventable diseases and to allow Europe's citizens to lead healthier and more productive lives.
- It is not possible to assume that previous health gains will continue in the future. New health challenges, such as rising levels of obesity, particularly among children, mental illness, microbial resistance to antibiotics and newly emerging epidemics, remind us of the possibility of stagnation or even roll-back of the health status of the European population in the longer run. These trends give rise to increasing concern and are sufficiently worrying to justify undertaking a profound reconsideration of the role of public health policy.

What is the relevance of the CMH's report for the European Union?

The report of the Commission on Macroeconomics and Health constitutes an important reference point for our work and provides a powerful underpinning of the argument that good health is an essential determinant of economic growth, especially in developing countries, and that, conversely, bad health is a significant brake on economic and social development. However, our work also shows that the situation in high-income countries is specific in two important ways.

- First, while in developing countries the predominant disease burden is attributable to communicable diseases, maternal and perinatal conditions and nutritional deficiencies, in developed countries the greatest burden is attributable to non-communicable diseases (such as cardiovascular disease, diabetes, injuries and mental health problems). The Commission on Macroeconomics and Health was able to identify certain basic interventions to address the former type of diseases. The threats to health in Europe, however, are substantially more complex, and the nature of those threats is such that they will require multifaceted intersectoral policies to prevent them from arising and integrated multi-disciplinary management strategies to treat them.
- Second, production techniques in high-income countries have particular features. Agriculture and primary extraction are less important within the economy. Technological progress has meant that manual labour has become a less important factor in generating output than in developing countries. Whether labour is predominantly manual or not is likely to influence the ways in which ill health impacts upon labour market outcomes.

What do we find in high-income countries?

The main contribution of this book is its review and synthesis of the dispersed evidence on the contribution of health to the economy in high-income countries, bringing the relevant material together in a single place: cost-of-illness studies; the impact of health at the individual and household level; the macroeconomic impact of health, the 'full income' impact of health and the impact of the health system on the economy.

In our simple theoretical framework, we consider that health may contribute to economic outcomes in high-income countries through four main channels: higher productivity, higher labour supply, improved skills as a result of greater education and training, and increased savings available for investment in physical and intellectual capital.

What is the cost of illness?

There are numerous cost-of-illness studies in high-income countries. These studies estimate the quantity of resources (in monetary terms) used to treat a disease as well as the size of the negative economic consequences (in terms of lost productivity) of illness to the society. They represent a useful first step in developing some idea of the economic burden of ill health, showing that the magnitude of the economic impact is substantial. At the same time they are limited by certain methodological challenges and by their failure to determine the direction of causality in the relationship between health and economic outcomes. This is why we predominantly look at more ‘structural’ analysis in the subsequent sections.

What is the impact of health at the individual and household level?

A significant amount of evidence exists to support the economic importance of health in the labour market in rich countries. We present evidence that health matters for a number of economic outcomes: wages, earnings, the amount of hours worked, labour force participation, early retirement and the labour supply of those giving care to ill household members. In addition we reviewed the comparatively scarce evidence from developed countries of the effect of health on education and on savings. The impact of health on savings has received only limited attention in rich countries, despite the highly policy-relevant insights that could potentially be gained from studying these relationships.

Wages and earnings

- Several studies from high-income countries show that poor health negatively affects wages and earnings. The magnitude of the impact obviously differs across studies (given different health proxies and methodologies) and direct cross-country comparability of results is therefore limited. While a significant number of studies have analysed the impact of health on earnings and wages in high-income countries, overall there appear to be comparatively few studies dealing explicitly with EU countries.
- A number of studies find a significant impact of physiological proxies for health (e.g. height or body mass index) on earnings and wages, not only in developing but also in some high-income countries. Height tends to affect these labour market outcomes positively, while a higher body mass index (linked to overweight and obesity) appears to depress wages and earnings more for women than for men. It is, however, likely that some of the link between these physiological measures and labour market outcomes can be accounted for by the social meaning attributed to height, and by social stigma in the case of obesity, rather than by a direct effect on productivity.

Labour supply

- An extensive empirical literature, mainly from the USA but recently also from Europe, confirms that health increases the probability of participating in the labour force. There is, however, no

consensus about the magnitude of this effect and comparison of results from different studies is difficult as they use different measures of health, model forms and estimation techniques.

- A relatively large number of studies from high-income countries find a significant and robust role for ill health in anticipating the decision to retire from the labour force. The relationship has been more extensively researched in the USA than in Europe. When interpreting the results from different countries, one should keep in mind that they are likely to be very sensitive to the institutional framework (e.g. pension rules, availability of disability benefits and occupational insurance arrangements).
- Ill health matters not only for the labour market performance of the individual directly concerned but also for that of the household members, who have been found to adjust their labour market behaviour in response to another household member's illness. In the studies reviewed, men appear to reduce their own labour supply by substantial amounts in the event of their wives' illness, while in the reverse case women tend to increase their labour supply. This can partly be explained by the unequal distribution of gender roles within the family and the different situation of men and women in the labour market. The availability of health insurance can critically affect the response to a spouse's health condition.

Education

- Human capital theory predicts that more educated individuals are more productive (and obtain higher earnings). Good health in childhood enhances cognitive functions and reduces school absenteeism and early drop-out rates. Hence, children with better health can be expected to attain higher educational levels and therefore be more productive in the future. Moreover, healthier individuals with a longer lifespan in front of them would have more incentives to invest in education and training, as they can harvest the associated benefits for a longer period. While theoretically plausible and empirically supported in the case of developing countries, there has been relatively little work exploring and confirming this link in high-income countries. More research would be needed.

Savings

- It is again highly plausible to imagine that savings increase with the prospect of a longer and healthier life. The idea of planning and, hence, saving for retirement would be expected to occur only when mortality rates become low enough for retirement to be a realistic prospect. Some studies confirm such an effect in the case of developing countries. For high-income countries, our review found comparatively little published research in this area.

What is the macroeconomic impact of health?

Turning to the effect of health at the macroeconomic, i.e. country, level, historical studies exploring the role of health in a specific country over one or two centuries have shown that a large share of today's economic wealth is directly attributable to past achievements in health.

Health — typically measured as life expectancy or adult mortality — enters as a very robust and sizeable predictor of subsequent economic growth in virtually all studies that have examined growth differences between poor and rich countries. However, researchers have focused rather less on the specific role of health in economic growth among high-income countries alone, and in the few cases

where this was done, health was not always found to be positively related to economic growth. In some cases there was even a negative relationship. We attribute these results partly to the use of health indicators that imperfectly capture the existing health differences between high-income countries. This is confirmed by a very recent analysis showing that if cardiovascular disease mortality is used as a health proxy, health does matter significantly for subsequent economic growth in high-income countries, but not in low- and middle-income countries.

What is the contribution of health to the ‘full income’?

Taking the welfare or ‘full income’ impact of health into account gives an even stronger illustration of the ‘true’ economic importance of health. This approach starts from the uncontroversial recognition that GDP is an imperfect measure of social welfare because it fails to incorporate non-market goods, such as the value of health. The true purpose of economic activity is the maximisation of social welfare, not necessarily the production of goods by themselves. Since health is an important component of properly defined social welfare, measuring the economic cost of ill health only in terms of foregone GDP leaves out a potentially major part of its ‘full income’ impact, defined as its impact on social welfare. Most of the existing studies in this domain have focused on the US context.

What is the contribution of the health systems on the economy?

While there is a direct effect of health on the economy, there is also an impact of the health system on the economy irrespective of the ways in which the health system affects health. The health sector ‘matters’ in economic terms simply because of its size. As one of the largest service industries, it represents one of the most important sectors in developed economies. Currently its output accounts for about 7 % of GDP in the EU-15, larger than the roughly 5 % accounted for by the financial services sector or the retail trade sector. And around 9 % of all workers in the EU-25 are employed in the health and social work sector. Through its sheer accounting effect, trends in productivity and efficiency in the health sector will have a large impact on these performance measures in economies as a whole. Moreover, the performance of the health sector will affect the competitiveness of the overall economy via its effect on labour costs, labour market flexibility and the allocation of resources at the macroeconomic level.

Investing in health?

Following the evidence presented in this book, policy-makers who are interested in improving economic outcomes would have a strong case for considering investment in health as one of their options by which to meet their economic objectives.

It is beyond the scope of this book to define which health and healthcare policies should be implemented. What is important is for governments to establish an integrated policy framework by which they can assure themselves that what is being done to achieve good health is appropriate and effective. This book argues the case for mechanisms that will permit the assessment of the health needs of a population, the identification of effective interventions to respond to those needs and the monitoring of the results achieved. This will enable resources to be targeted most effectively.

The fact that the disease burden in developed countries is mainly due to non-communicable diseases, many of which are driven by lifestyle-related factors, and that, consequently, health, education, and cultural factors are intimately related, implies that health investment must inevitably involve actions

and measures addressing issues lying outside the reach of the traditional healthcare systems. Health investment therefore requires action across government.

Where do we go from here?

There is a crucial need to enhance the quality and availability of data on health as well as on the impact of health on household behaviour in Europe. It has become apparent that, in this respect, most of the EU Member States are far behind the United States where research can be undertaken with the benefit of a number of public domain longitudinal surveys, such as the Health and Retirement Survey (HRS). The serious lack of data is, as could be expected, a prime cause of the relative weakness of research on the effects of health on the economy in most EU countries. And to the extent that evidence serves as an input into policy-making, the lack of evidence may have been holding back an adequate policy response.

There is a need for more research on the role of health in economic growth in rich countries. This requires the testing and development of health indicators that are more contextually appropriate than those commonly used in the worldwide cross-country regressions. There is a particular need to explore the role of mental illness, obesity and other emerging epidemics for economic outcomes (including economic growth) in high-income countries.

As the next step in developing further the economic argument, more research is needed to assess the costs and benefits of broader public health interventions. This would represent the ultimate and necessary step in order to enable a direct comparison of the returns to health investment with alternative uses of money. In doing so, it would further facilitate the integration of health investment into over-all national economic development plans.

1. Introduction

In 2001, the Commission on Macroeconomics and Health (CMH) ⁽¹⁾ made a strong economic case for investing in health. Although confined primarily to evidence from low- and middle-income countries, it helped bring about a shift in the prevailing paradigm: health was no longer seen as a mere by-product of economic development, but as one — of several — key determinants of economic development and poverty reduction. This has helped pave the way for health to be included in national development strategies and policy frameworks in poor countries, exemplified by the poverty reduction strategy papers (PRSPs) and the millennium development goals (MDGs). While these instruments are not without limitations, they do demonstrate the commitment of the international community to acknowledge investment in health as a means to promote economic development.

In contrast, the potential contribution of health to the economy has received rather less attention in high-income countries. While policy-makers in high-income countries might rarely disagree, in general terms, with the proposition that the health of their populations does contribute positively to the national economy, in reality health has not made its way into national economic development strategies and plans. In most of these countries, the thrust of contemporary discussions on health reform typically sees interventions that promote health and the delivery of healthcare as costs that need to be contained. In most countries, health is among the weakest of ministries and there are only a few examples of finance ministries having engaged with health ministries in discussions about how the latter could contribute to national economic outcomes through activities that improve health, rather than exhorting them to cut costs.

This situation is reflected at an international level. Even those key international economic and financial organisations that are seen as health-promoting, e.g. the World Bank, frequently fail to mention the potential role of health when they assess future prospects of economic growth. Likewise, within the European Union, the strategy for economic development — the Lisbon strategy — so far says very little about health.

In this book we ask whether this relative neglect of the economic importance of health in high-income countries is justified. We ask specifically what, if anything, the high-income countries can learn from the economic case that has been made for promoting health in poor countries. We conclude, based on an extensive review of the available evidence, that the relative neglect of health is not justified. While the economic argument for health in high-income countries may differ from the argument in poor-country settings, there is already sufficient evidence that improving health can yield significant economic benefits, notwithstanding the remaining research gaps. This has immediate policy implications, in that it provides a rationale for economic policy-makers to use health investment, within and outside the health sector, as one additional means of achieving their economic objectives. In this light, health comes to be considered as an investment that brings an economic return, and not merely as a cost.

In examining the evidence for the economic impact of investing in health, we are aware that the relationship between health and wealth is bi-directional (Smith 1999). It is not the purpose of this book

(1) Established by the World Health Organization.

to argue that the contribution of health to the economy is any more important than the contribution of the economy to health. Whether one is more important than the other is a question that may be unanswerable and is anyway unnecessary to ask. For the present purposes it is sufficient to show that there is *also* a pathway going from health to the economy. It is this mutually reinforcing relationship between health and the economy that provides a higher return from investing a given amount in both compared with investing the same amount in one or the other.

Why is the issue relevant for the EU countries – and why just now?

There are a number of reasons why acknowledging the importance of health for the economy is important for the EU countries, particularly now.

Some might argue that the major gains in health in high-income countries over recent decades have brought them to a level where further investment is unlikely to bring adequate returns. Life expectancy at birth in the European Union Member States is already significantly above retirement age, with some commentators arguing that further gains will simply increase the numbers of the unproductive retired. Leaving aside the ethical issues that arise from such a position, it ignores two facts. First, average life expectancy at birth conceals a wide dispersion in actual lengths of life lived by individuals. In all European Union Member States a significant number of 20-year-olds (typically 10–15 %) will not survive to retirement. Second, the number of years lived in good, and thus potentially productive, health is even lower. Whether considering life expectancy or healthy life expectancy, there are widespread variations in the European Union, both within and among countries, and much could be achieved simply by bringing the worst-performing groups up to the level of the best. Reducing the inter-country differences in health has become a particular challenge with the latest enlargement. Some of the new Member States have life expectancies more than 10 years lower than the average of the EU-15. Closing this health gap will be both necessary for reducing the income differences in the EU, and for demonstrating the success of the process of enlargement.

The sheer endeavour to demonstrate the economic benefits of health may also seem a redundant activity to some observers, since they consider it intuitively clear that good health provides a sound basis for labour productivity and for the capacity to learn and grow intellectually, physically and emotionally. For individuals and families, health provides the capacity for personal development and economic security. Popular beliefs are not, however, always viewed by policy-makers as a substitute for rigorous empirical research as an input into decision-making. In fact, while human capital has long been recognised as a contributor to economic wealth in a substantial body of research, most of the theoretical and empirical research has for a long time considered education as the only relevant contributor to human capital. This is somewhat surprising, since people can only provide effective human capital if they are alive and healthy. The role of health as a decisive component of human capital and, hence, as a potential determinant of economic growth has only recently been the subject of major research attention.

One reason for this new interest has been a recognition that it is not possible to assume that previous health gains will continue as before. The experiences of both the former Soviet Union and sub-Saharan Africa show that, even in peacetime, life expectancy can decline (McMichael et al. 2004). While the situation is very different in the European Union, rising levels of obesity among children and the failure to reduce smoking rates among young women in some countries constitute an omen of possible stagnation or even a roll-back of the health status of the European population in the longer run. These trends are giving rise to increasing concern among politicians and their advisers and are sufficiently worrying to justify undertaking a profound reconsideration of the role and potential of public health policy.

Within the European Union the debate about health and economic development is currently also being shaped by discussions about the EU's Lisbon agenda. This discourse increasingly accepts that greater investment in *human capital* constitutes a necessary, albeit not sufficient, condition for making the European economy more competitive. This is said to require intensification of investment in research and development (R & D) but also investment in the education and health of the population. The formulation of public policies to achieve these goals will, however, require a considerable enhancement of our understanding of the effectiveness of and return on investments in human capital, including investments in public health.

Underlying the Lisbon agenda is a concern about Europe's slow labour productivity growth as well as its limited labour supply compared with the USA. For the first time in the post-war period, the average labour productivity growth in the EU since 1996 has been lower than in the USA. This has been linked to a decline in hourly productivity growth in the EU, while at the same time the American economy benefited from the longer hours worked and from higher labour force participation rates by the elderly. The report by the High Level Group on the Lisbon Strategy for Growth and Employment (2004) argues that Europe needs to increase the level and efficiency of investments in human capital as the productivity and competitiveness 'of Europe's economy are directly dependent on a well-educated, skilled and adaptable workforce that is able to embrace change' ^(?). As the same report states, health and healthcare play a key role 'in generating social cohesion, a productive workforce, employment and hence economic growth'.

It is not only labour productivity and supply that is a concern for Europe. The process of population ageing will also pose important challenges to all European economies. The low fertility rates of the last few decades will soon have an impact on the size of the available workforce. European economies facing slowing population growth, or even declines, cannot afford to lose potential labour resources due to avoidable disease and disability. In particular, the need to boost the participation in the labour force of older workers, which is one of the Lisbon targets, will require not only investments in lifelong learning, but also in policies that promote the physical and mental health of Europe's older population. A further concern is the expected costs attributable to an ageing population that will fall on pension and healthcare budgets. This presents an important challenge to macro-economic stability that could restrain future growth of European economies. In this context, it is important to consider the potential for savings on health costs that could come from more effective and efficient prevention and treatment of disease and disability, especially as they impact upon the elderly.

For all of these reasons, the moment seems to have arrived for the EU Member States to take health more seriously as an important contributor to the economy and to act upon this recognition.

Structure of the book

This book is structured into five chapters. Chapter 2 briefly lays out the main theoretical framework that underlies the subsequent review of the empirical evidence regarding the impact of health on the economy.

Chapter 3 represents the key part of the book, as it reviews the empirical evidence as to whether there are significant economic benefits from health in high income countries, and if so, to what extent. The section puts the present work into the context of the previous work done by the Commission on

^(?) High Level Group on the Lisbon Strategy for Growth and Employment (2004).

Macroeconomics and Health, summarises relevant cost-of-illness studies, and then presents the key microeconomic and macroeconomic evidence.

Having provided sufficient evidence to back up the hypothesis that health is good for the economy, Chapter 4 takes the analysis a step further by asking: how then should countries invest in health, and do cost-effective interventions exist to tackle the health challenges EU countries are facing? It would reach beyond the scope of this book to even try to answer this question exhaustively. Instead we seek to provide some basic principles coupled with illustrative examples. We focus in particular on one way of investing in health, which is via investment in the health system, acknowledging that there are important policy levers outside the health system that can impact upon health.

Chapter 5 concludes and proposes future potential areas of research. Three annexes cover some specific issues in more detail. Annex 1 discusses two different sets of indicators — indicators of health status and indicators of health system performance. Both are important for a proper assessment of the linkages between health, the health system and the economy. Annex 2 describes the search strategy used to identify the literature cited in this book. Annex 3 tabulates details of the studies that have been cited.

2. The impact of health on the economy: theoretical framework

This chapter introduces the theoretical framework that should help guide and structure the subsequent empirical evidence. As mentioned in the introduction, there has been wide acceptance of the idea that human capital is an important driver of economic outcomes on both the individual and the aggregate level. The rationale behind this idea is described in the first part. However, this view has been severely limited by its almost exclusive focus on education as the alleged key component of human capital. Only recently has the significance of health as an additional important component of human capital started to be recognised. The next part therefore explicitly introduces health into the concept of human capital. The third part then highlights the different possible channels through which health, being part of human capital, can impact upon the economy.

2.1 The contribution of human capital to economic growth

There is a sound theoretical and empirical basis to the argument that human capital matters for economic growth, but for the most part human capital has so far been rather narrowly defined as education.

Economic growth refers to the steady process by which the productive capacity of the economy is increased over time to bring about rising levels of national output and income (Todaro 2000). It is measured by the increase in gross domestic product (GDP) in real terms. According to neo-classical economic theory, economic growth depends on three factors: the stock of capital, the stock of labour, and productivity, the latter depending in turn on technological progress and, in neo-classical theory, was considered to be an exogenously given factor. More recently, researchers have tried to replace the assumption of exogenous technological progress by an explanation of just what is driving productivity. Technological progress thus came to be seen as an ‘endogenous’ process that could be driven in particular by investments in human capital, largely understood as skilled labour.

Much of this research was rooted in the initial formalisation by Becker (1964) of a theory of human capital formation. His ideas were motivated by the evidence that the growth in physical capital and labour, ‘at least as conventionally measured, explains a relatively small part of the growth of income in most countries’. He sought to shed light on the importance of education for economic development by providing evidence on the monetary rates of return to education.

According to Becker’s human capital theory, investments in human capital raise an individual’s productivity (both in market and non-market activities). Thus, individuals have an incentive to invest in themselves through education, training and health in order to increase their future earnings. But these investments also have costs associated with the direct outlays on market goods and the opportunity costs of the time that must be diverted from competing uses.

Subsequent work has confirmed the importance of human capital — narrowly defined as educational attainment — as a determinant of economic growth. When investigating the sources of growth in the United States from 1929 to 1982, Denison (1985) concluded that the increase in schooling of the average worker explained about one quarter of the rise in per capita income during this period. The analysis by Griffin and McKinley (1992) has supported this view (Fogel 1994). They argue in favour

of development strategies that place a greater emphasis on investments in human capital. In their opinion, this does not mean that additions to the stocks of natural and physical capital should be ignored, but does mean a major change in priorities. The justification for this change is: ‘first, that the returns on investing in people are in general as high as if not higher than the returns to other forms of investment, second, that investment in human capital in some cases economises on the use of physical capital and the exploitation of natural resources and, third, the benefits of investing in people are in general more evenly spread than the benefits from other forms of investment. A greater emphasis on human capital formation should therefore result in as fast and perhaps a faster pace of development, more sustainable development and a more equitable distribution of the benefits of development’.

2.2 The role of health as a component of human capital

The idea of health representing — next to education — an important component of human capital was introduced most prominently by Grossman (1972), but has recently been acknowledged more widely.

In the original formulation of his theory, Becker (1964) pointed to health as one component of the stock of human capital, but then focused in his early empirical work exclusively on education. The major contribution to our understanding of health as an integral part of human capital was provided by Grossman (1972), who was the first to construct a model of the demand for health applying human capital theory.

Grossman distinguishes between health as a consumption good and health as a capital good. As a consumption good, health enters directly into the utility function of the individual, as people enjoy being healthy. As a capital good, health reduces the number of days spent ill, and therefore increases the number of days available for both market and non-market activities. Thus, the production of health affects an individual’s utility not only because of the pleasure of feeling in good health, but also because it increases the number of healthy days available for work (and therefore income) and leisure.

Health is not only demanded, but also produced by the individual. Individuals inherit an initial stock of health that depreciates with time, but they can invest to maintain and increase this stock. Many inputs contribute to the production of health, as indicated in Figure 1. Healthcare is one among these factors. The demand for healthcare is therefore a derived demand for health. The production of health also requires the use of time by the individual away from market and non-market activities.

While the Grossman model has encountered some criticism ⁽³⁾, it continues to stand — with some extensions — as the key model of the demand for health.

2.3 Channels of influence between health and the economy

Since human capital matters for economic outcomes and since health is an important component of human capital, health also matters for economic outcomes. At the same time, economic outcomes matter for health.

(3) Zweifel and Breyer (1997) argued for instance that the empirical evidence would fail to confirm the crucial Grossman model prediction of the positive partial correlation between medical care and good health. Accordingly, the notion that expenditure on medical care constitutes a demand derived from an underlying demand for health cannot be upheld. This criticism, however, was countered by Grossman (1999).

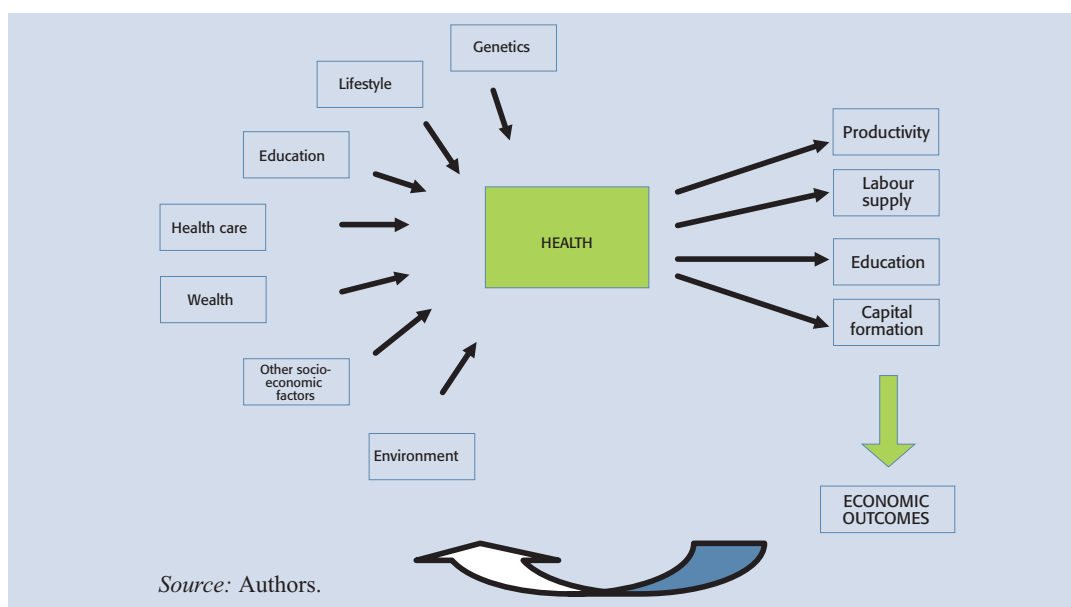
Health is determined by genetic, economic, social, cultural and environmental factors. But the health of a population may also, in return, influence the economic context.

In line with the scheme proposed by Bloom et al. (2001), we suggest in this study that health could contribute to economic outcomes (at both the individual and the country level) in high-income countries mainly through four channels: higher productivity, higher labour supply, higher skills as a result of greater education and training, and more savings available for investment in physical and intellectual capital. These four channels are represented in the right-hand side of Figure 1.

As illustrated in the left-hand side of Figure 1, the health of an individual depends on many factors: genetic endowments, lifestyle, living and working conditions (access and use of healthcare, education, wealth, housing, occupation) and the more general socioeconomic, cultural and environmental conditions ⁽⁴⁾. Several of these determinants of health can be influenced by public policies.

In assessing the contribution that health can make to growth, it is important to keep in mind the positive feedback from income to health. There are two ways in which income can influence health: through a direct effect on the material conditions that have a positive impact on biological survival and health, and through an effect on social participation, the opportunity to control life circumstances, and the feeling of security. Above a certain threshold of material deprivation, income may be more important because of its link with these social and psychological factors, particularly in societies where social participation depends heavily on individual income (Marmot 2002).

Figure 1 – Health inputs and health outputs



⁽⁴⁾ Definition of health determinants in the website of the Health and Consumer Protection DG: http://europa.eu.int/comm/health/ph_determinants/healthdeterminants_en.htm

The main interest of the present study is to review the evidence on the positive effect of good health on the economy, not the reverse pathway, which has been widely documented elsewhere (Marmot 2002). The four principal mechanisms that could explain the effect of health on the economy are briefly described in the following sections.

Labour productivity

Healthier individuals could reasonably be expected to produce more per hour worked. On the one hand, productivity could increase directly due to enhanced physical and mental activity. On the other hand, more physically and mentally active individuals could also make a better and more efficient use of technology, machinery or equipment. A healthier labour force could also be expected to be more flexible and adaptable to changes (e.g. changes in job tasks, in the organisation of labour).

Labour supply

The impact of health on labour supply is theoretically ambiguous. Good health reduces the number of days an individual spends sick, which consequently results in an increase in the number of healthy days available for either work or leisure. But health also influences the decision to supply labour through its impact on wages, preferences and expected life horizon. The effect of health on labour supply through each of these intermediate factors is not always obvious. On the one hand, if wages are linked to productivity, and healthier workers are more productive, health improvements are expected to increase wages and thus the incentives to increase labour supply (substitution effect). On the other hand, being healthy might allow higher lifetime earnings and therefore an earlier withdrawal from the labour force (income effect).

The way in which health affects individual preferences also affects whether and how health determines economic outcomes. One could imagine that, as health improves, working becomes less cumbersome, and therefore the individual might be ready to take up more work in exchange of leisure time. However, one could also imagine that a health improvement reduces the needs for consumption (e.g. of health treatments or medicines) and therefore reduces the relative preference for work, leading to a reduction of working time and an increase in leisure time.

Finally, if good health changes neither preferences nor wages, but raises life expectancy, the individual's needs for lifetime consumption would increase, leading to a higher labour supply ⁽⁵⁾.

Education

According to human capital theory, more educated individuals are more productive (and obtain higher earnings). Since children with better health and nutrition tend to achieve higher educational attainment and suffer less from school absenteeism and early drop-out, improved health in early ages indirectly contributes to future productivity.

(5) The decision to work could also be influenced by the health of relatives. In this case the impact of health is also theoretically ambiguous. On the one hand, if other family members leave work due to health deterioration, this could cause a drop in household income, which the individual might try to compensate for by increasing his or her labour supply. This could also be the case if the onset of a health problem increases financial needs (for example due to increased need for healthcare). On the other hand, the need to care for a sick or disabled person could lead the individual to reduce his or her labour supply or to exit from the labour force.

Moreover, if good health is also linked to higher life expectancy, healthier individuals would have higher incentives to invest in education and training, as the depreciation rate of the skills acquired would be lower.

Savings and investment

The state of health of an individual or a population is likely to impact not only upon the level of income but also the distribution of this income between savings and consumption and the willingness to undertake investment.

Individuals in good health are likely to have a wider time horizon and their savings ratio may consequently be higher than the savings ratio of individuals in poor health. Other things being equal, a population whose life expectancy increases may therefore also be expected to have higher savings. This should also result in a higher propensity to invest in physical or intellectual capital.

In sum, there are a number of channels that may causally link health and economic outcomes on the individual and on the aggregate (macro) level. The most common denominator of all of these channels is that health can be seen as an integral part of human capital.

3. The impact of health on the economy: empirical evidence

This chapter presents the empirical evidence on the impact of health on the economy, as it is considered relevant to the EU Member States. While the focus of the book is on EU Member States, it was necessary to include evidence from other countries, as the majority of research in high-income countries has been carried out outside the EU, mainly in the USA. In some cases, such as the economic growth literature, we included studies that examined low- and high-income countries in one common sample. Again, it would have been preferable to limit our analysis to studies of the contribution of health to economic growth in high-income countries, but there are only a few studies that do so.

The first part of this chapter starts from a brief review of the work of the Commission on Macroeconomics and Health, given that its work represents the most recent and comprehensive effort to assemble the evidence on the impact of health on the economy. It also discusses the constraints in applying its findings to high-income countries and it reviews some of the criticisms to which it has been subject.

In the second part we turn specifically to high-income countries, reviewing selected results from cost-of-illness (COI) studies. This is a useful starting point in that COI studies provide an estimate of the quantity of resources (in monetary terms) used to treat a disease as well as of the size of the negative economic consequences (in terms of lost productivity) of illness to the society.

While COI studies do not claim to prove causality from illness to costs, other research referred to in the latter part of the present chapter does explore the evidence that this relationship can at least in part be considered as causal. This research can be divided into ‘micro-’ and ‘macro-’ categories. The first category comprises studies at the individual or household level. Research in high-income countries adopting this approach has largely focused on the impact of (ill) health on labour productivity and supply, e.g. in the form of earnings, participation and early retirement. Reviewing this literature we find substantive support for an important role of health in determining labour market performance at the micro level. The second category comprises country-level historical case studies that are more or less quantitative. This research unequivocally demonstrates that the countries that are now high-income owe a large part of their current economic wealth to past achievements in health. The third category also assumes a macro perspective and utilises cross-country data to assess the impact of measures of health at the national level on the level of income or on income growth rates. While most of the literature on this topic focuses on developing countries, we nevertheless find some support for the argument that health can be a driver of economic growth in high-income countries. At the same time, we point to the urgent need for further research on the contribution of health to economic growth in rich countries. The subsequent section focuses on the direct impact of the health system on the economy, irrespective of the ways in which the health system affects health, before the last section applies a broader measurement concept of the welfare or ‘full income’ impact of health.



3.1 The Commission on Macroeconomics and Health and beyond

The work of the Commission on Macroeconomics and Health (CMH) has made an important contribution to making the economic case for health in developing countries. However, the work as it stands is of limited relevance to the EU countries as they are facing a very different health pattern the economic implications of which are not immediately clear.

The starting point for this study is the report of the CMH. The CMH was an independent expert group chaired by Professor Jeffrey Sachs that was given the task by the World Health Organization (WHO) to assemble the evidence of the economic benefits attributable to better health in developing countries and to make recommendations on how to act upon this evidence. The final report of the Commission was published in December 2001 and it was seen as the beginning of a process that would be taken further at country level through the development of national health investment plans.

The work of the CMH has been central to making the economic case for investment in health. Its report concluded that investing in people's health in developing countries — in addition to being a worthwhile goal in itself — produces enormous economic benefits, both for the people concerned and for the countries as a whole. This has helped bring about a paradigm shift according to which health is not merely seen as an end in itself, but — in addition — can be considered a means that brings further benefits, especially to the economy. The focus of the CMH has been on the developing world. However, some of the empirical evidence collected does refer to industrialised countries and is part of the evidence reviewed below. Moreover, the fundamental idea that health could contribute positively to the economy should in principle be applicable to all regional and economic contexts.

The report identified a number of cost-effective investments that will save millions of lives and result in billions of dollars worth of economic growth. It concluded that investing in essential healthcare for the poor would help millions of people to emerge from poverty, as well as contribute in important ways to overall economic growth.

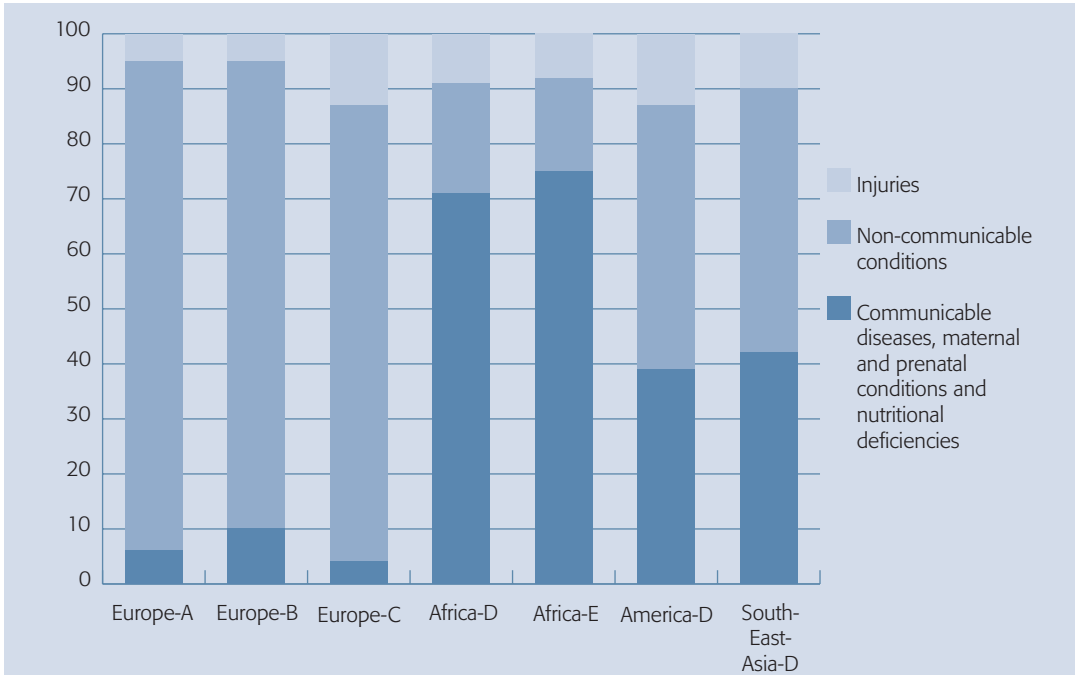
In the analyses undertaken for the report, the typical quantitative impact of life expectancy on economic growth was estimated to be of the following magnitude: a 10 % increase of life expectancy at birth increases economic growth at least by 0.3 to 0.4 percentage points of GDP per year ⁽⁶⁾. This translates into a growth differential between an average high-income and least-developed country of 1.6 points of GDP per year. When compound interest rates are applied, this annual growth difference, on top of initially unequal starting points, reinforces the wealth gap between rich and poor countries.

The vast majority (and the poorest) of the countries the CMH focused on are located in Africa. The CMH report on developing countries justifies its main (though not exclusive) focus on communicable diseases as well as on maternal and prenatal health in terms of intervention priorities. More specifically, the report identifies the following key health intervention targets: HIV/AIDS, malaria, tuberculosis, maternal and prenatal conditions, major causes of child mortality (including measles, tetanus, diphtheria, acute respiratory infection, and diarrhoeal disease), malnutrition, other vaccine-preventable illnesses and tobacco-related disease (its sole example of non-communicable disease).

When attempting to apply the results of the CMH report to EU countries, it is obvious that this list of priority interventions would not address the burden of disease in Europe, which differs in several respects from developing countries. This point is illustrated in Figure 2, which shows the burden of disease in disability-adjusted life years (DALYs) in the three European subregions (classified by WHO mortality strata) in comparison with four non-European subregions that are typically considered as part of the 'developing' world.

⁽⁶⁾ See CMH (2001), p. 24.

Figure 2 – Burden of disease in disability-adjusted life years (DALYs) by cause and mortality stratum in selected WHO regions, estimates for 2001 (% of total DALYs)



Source: WHO (2002a).

NB: WHO classifies countries into five possible mortality strata according to the two dimensions of child and adult mortality: A: ‘very low child, very low adult mortality’, B: ‘low child, low adult mortality’, C: ‘low child, high adult mortality’, D: ‘high child, high adult mortality’, E: ‘high child, very high adult mortality’. All EU-15 countries are part of the Europe-A category, while the new EU members are spread across Europe-A and Europe-B.

As Figure 2 shows, the disease burden in all three European subregions is by no means comparable to the disease burden in developing countries, and in particular to those in sub-Saharan Africa. At this very broad level of aggregation, the European region (7) as a whole appears surprisingly homogeneous in terms of the *distribution* of the disease burden, notwithstanding the significant economic heterogeneity within the wider European region, as well as the differences in the *levels* of health.

While the predominant disease burden in developing countries is from communicable diseases, maternal and prenatal conditions and nutritional deficiencies (accounting for almost two thirds of total DALYs), the European region is primarily facing the challenge of reducing the burden of non-communicable diseases. This requires a much more complex set of interventions than those that have been prescribed for the developing world. The CMH report focused largely on relatively simple interventions for specific diseases (such as insecticide-treated bed nets for malaria). Many of the interven-

(7) The WHO definition of the ‘European region’ that we use here includes the former Soviet States.

tions listed in the CMH report have, where applicable, been undertaken in Europe many decades ago, for example during the eradication of malaria in southern Italy in the 1950s. Responses to the remaining challenges in the European region are characterised by a much greater degree of complexity — for instance with respect to chronic non-communicable diseases, requiring intersectoral prevention or multidisciplinary disease management strategies (such as cardiovascular disease, injuries, and mental health problems), or more complex infectious diseases, such as hospital-acquired and drug-resistant infections.

For the purposes of this book, with its focus on high-income countries, the CMH report is of limited use. The role of high-income countries in the report is mainly envisaged as providing financial resources to health systems in poor countries. It proposes no effective, efficient interventions that would be directly relevant to rich countries. The direct transferability of the CMH findings to Europe is also constrained by the relative lack of evidence included on the economic implications of non-communicable diseases (NCDs) compared with what is available on communicable diseases and child and maternal malnutrition. If such disease-specific economic evidence is missing, a convincing economic case for the European countries cannot be made as, at first sight, one might well hypothesise that the economic implications are very different (e.g. because of a much older age structure among those most afflicted by NCDs) ⁽⁸⁾.

Further limits to transferability include the fact that the very fundamental ‘survival’ problems of health systems in the developing countries are of a different order of magnitude compared with the problems faced by the well-established health systems in EU countries. Moreover, given that the health status of the EU countries has already reached comparatively high levels, one might expect any further incremental improvement to become more difficult (and costly) to accomplish, thereby bringing fewer economic benefits.

The work of the CMH has stimulated some critical debate. Since the CMH has been the main stimulus for the present study, such criticism needs to be taken into account when trying to apply the economic argument to health in the EU countries. Part of the criticism was directed towards the absence of an empirical basis for the claims for economic development gains associated with the set of interventions recommended and to the problematic use of the ‘Burden of disease’ data. Others reproached the authors of the report for advocating a vertical approach to the eradication of specific diseases, rather than encouraging the development of integrated healthcare systems. Directing money at these problems would fail to overcome existing systemic problems that reduce the ability of health systems to absorb additional resources (Waitzkin 2003). Others argue that, rather than assuming a uni-directional relationship going from health to increased affluence, it is important to integrate strategies for improving health and economic opportunities (Ruger 2003). Clearly, all of these arguments contain elements that need to be taken into account not only in interpreting the original CMH work, but also in applying the CMH approach to EU Member States.

⁽⁸⁾ In follow-up work to the CMH, these issues are being addressed in the forthcoming report by the WHO European Office for Investment for Health and Development on Health and Economic Development in Eastern Europe and Central Asia (see WHO/EURO 2003 for some preliminary results). Although this work does not explicitly focus on the enlarged EU countries (except for the three Baltic States), the fact that the east European and central Asian countries also face a disease burden that is predominantly characterised by NCDs suggests that it will also be of some relevance to the EU countries.

3.2 Cost-of-illness studies

Cost-of-illness studies estimate the quantity of resources (in monetary terms) used to treat a disease as well as of the size of the negative economic consequences (in terms of lost productivity) of illness to the society. They represent a useful first step in developing some idea about the economic burden of ill health, and they show that the magnitudes of the economic impacts are substantial. At the same time, they are constrained by certain methodological challenges and by their failure to identify the direction of causality in the relationship between health and economic outcomes.

It seems obvious that there is a cost associated with being unwell. First, there is the cost of obtaining treatment, whether it is merely a trip to a shop to purchase a simple painkiller or a major operation in a hospital. Second, there is the income foregone by those who are sufficiently unwell to be prevented from working. Third, and less easy to measure, there is the loss of utility associated with pain, disability and suffering. The challenge is how to measure these costs.

This question has given rise to an extensive body of research using what is termed ‘cost-of-illness’ (COI) studies. COI studies translate the adverse effects of diseases or their risk factors into monetary terms, the universal language of decision-makers in the policy arena. The aim is to identify and measure all the costs associated with a particular disease or risk factor.

Following the divisions set out above, COI studies separate the costs ⁽⁹⁾ of illness into three components:

- direct costs refer to costs falling on the health sector in relation to prevention, diagnosis and treatment of disease. While not exhaustive, they may include costs under headings such as ambulances, inpatient, outpatient, rehabilitation, community health and medical services, and pharmaceuticals;
- indirect costs typically measure the lost productivity potential of patients who are too ill to work or who die prematurely (i.e. the ‘human capital approach’). The measurement of indirect costs is a matter of much debate. Some COI studies consider the loss of future earnings, discounted to take account of the fact that the income will arise in the future. Others use the willingness-to-pay method, in which individuals are asked to choose between different scenarios with the objective of assessing how much they are willing to pay to be in a particular state of health ⁽¹⁰⁾;
- intangible costs capture the psychological dimensions of the illness to the individual (and their family), i.e. the pain, bereavement, anxiety and suffering. This is the cost category that is typically hardest to measure.

The output of COI studies, expressed in monetary terms, is an estimate of the total burden of a particular disease from either a societal or (if a narrower set of costs is included) sector-specific perspective ⁽¹¹⁾.

⁽⁹⁾ Two methods of costing exist: the prevalence and the incidence approach. The former is more common and estimates the total cost of a disease incurred in a given year. The more data extensive incidence approach involves calculating the lifetime costs of cases first diagnosed in a particular year, providing a baseline against which interventions can be evaluated (Rice 1994).

⁽¹⁰⁾ The human capital approach estimates costs from discounted earnings while the willingness-to-pay method estimates costs based on an individual’s perception of the amount of money they would be willing to give up in order to avoid illness.

⁽¹¹⁾ A specific group could be employers, or the government.

There is a vast amount of literature applying the COI approach, although there is more from the USA than from Europe. It is beyond the scope of this book to provide a full account of this literature. In the following section we provide selected relevant examples of COI studies, focusing on the two disease categories that account for the largest burden of disease in Europe, i.e. cardiovascular disease and mental illness, as well as on four risk factors that have particular relevance for European countries (diabetes, obesity, smoking, alcohol) (Ezzati et al. 2004). In the space available it is not possible to provide a detailed methodological comparison of the studies that are listed; instead they are presented as illustrations of the work that has already been done.

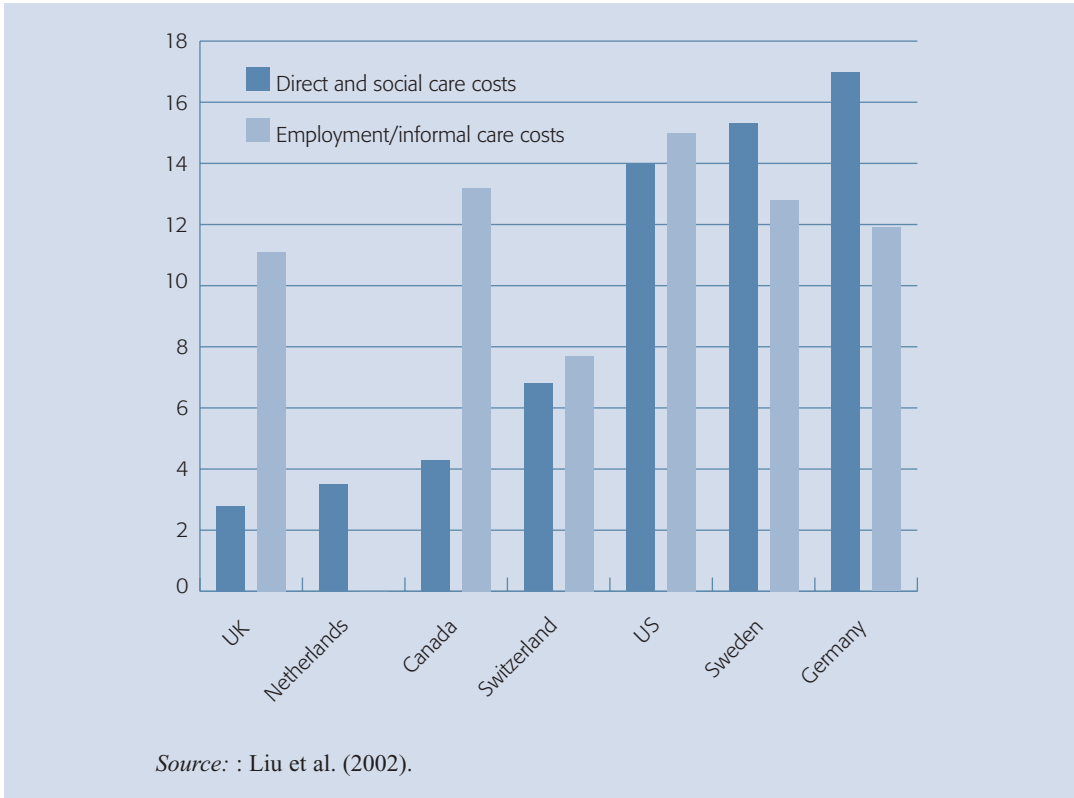
3.2.1 Cardiovascular disease

Liu et al. (2002) estimated the economic burden of coronary heart disease (CHD) in the UK using both direct and indirect costs, based on all UK residents with coronary heart disease. They concluded that CHD cost GBP 1.73 billion (EUR 2.5 billion) to the British National Health Service in 1999, GBP 2.42 billion (EUR 3.5 billion) in informal care, and GBP 2.91 billion (EUR 4.2 billion) in productivity loss (24.1 % of productivity loss was attributable to mortality and 75.9 % to morbidity). The total annual cost of all CHD-related burdens was thus GBP 7.06 billion (EUR 10.2 billion). This corresponds to almost 1 % of 1999 GDP and to almost 11 % of total national health expenditure in the same year ⁽¹²⁾.

The authors also compared the results of their study with estimates of the cost of coronary heart disease in other OECD countries (see Figure 3). While the results give some quantitative idea of the monetary magnitudes involved in different countries, we would caution against a too literal interpretation of the cross-country comparison in the figure, given the significant differences in the data and methodology used.

⁽¹²⁾ The percentages are calculated by using the GDP figure from the World Bank (2004) and the health expenditure figures from the OECD Health Data 2004.

Figure 3 – Expenditure on coronary heart disease per 100 000 persons in selected OECD countries (GBP million, 1999 prices)



Similar caution needs to be exercised when interpreting the comparison, again by Liu et al. (2002) of the costs of coronary heart disease to other diseases in the UK. Bearing these reservations in mind, it is nevertheless noteworthy that coronary heart disease appears to be the most costly disease of those for which measurement had been undertaken (see Table 1).

Table 1 –
Costs of selected diseases in the UK (GBP million, 1999 prices)

Disease group	Direct health costs	Indirect costs	Total	Authors and year of publication
Coronary heart disease	1 730	5 325	7 055	Liu et al. 2002
Back pain	1 673	5 143	6 816	Maniadakis and Gray 2000
Rheumatoid arthritis	969	1 049	2 018	McIntosh 1996
Alzheimer's disease	1 993	—	1 993	Gray and Fenn 1993
Lower respiratory tract infections	1 825	—	1 825	Guest and Morris 1996
Stroke	1 655	—	1 655	Dale 1989
Diabetes	1 304	—	1 304	Laing and Williams 1989
Arthritis	978	—	978	Wyles 1992
Multiple sclerosis	85	452	536	Holmes et al. 1995
Migraine	45	378	424	Bosanquet and Zammit-Lucia 1991
Deep vein thrombosis and pulmonary embolism	386	—	386	Griffin 1996
Depression	366	—	366	Jonsson and Bebbington 1994
Insulin dependent diabetes mellitus	273	—	273	Gray et al. 1995
Critical limb ischaemia	269	—	269	Hart and Guest 1995
Epilepsy	235	—	235	Griffin and Wyles 1991
Benign prostatic hyperplasia	134	21	155	Drummond et al. 1993

Source: Liu et al. 2002.

3.2.2 Mental illness

As the most recent 'Global burden of disease' study revealed, mental illness makes a major contribution to the overall burden of disease in high-income countries (Ezzati et al. 2004). Mental and addictive disorders are often chronic and recurring illnesses. Frequently, the onset occurs during the latter period of adolescence or in young adulthood. This means that these disorders strike during years when people typically invest in human capital such as schooling and training. They are also prevalent during peak earning years, unlike many other disabling conditions that occur later in life. As such, mental disorders are especially disruptive of careers and productivity. The disabling effects of mental illness can render individuals reliant on social insurance programmes for support for an extended time thereby placing heavy economic burdens on these programmes (Frank and Koss 2005; Rupp and Stapleton 1998).

Table 2 summarises selected studies on the cost of mental illness in high-income countries ⁽¹³⁾.

⁽¹³⁾ see Andlin-Sobocki and Wittchen (2005) for a review of European studies on the cost of affective disorders more specifically.

Table 2 –
Review of the cost of mental illness in high-income countries

Illness	Country	Year	Direct costs (USD million)	Indirect costs (USD million)	Direct costs in total health expenditure (%)	Authors and year of publication
Affective disorder	Australia	1997	—	1 400	—	Lim et al. 2000
Depression	Australia	1993/94	421	—	1.30	Andrews et al. 2000
Depression	UK	1990/91	665	4 783	0.90	Kind and Sorensen 1993
Depression	US	1990	12 400	31 300	1.30	Greenberg et al. 1993
Bipolar disorder	UK	1998	332	2 957	0.40	Das Gupta and Guest 2002
Schizophrenia	France	1992	2 340	—	2.00	Rouillon et al. 1997
Schizophrenia	Hungary	1990	41.1	68.5		Rupp et al. 1999
Schizophrenia	Italy	1995	8.3	19.5	0.01	Tarricone et al. 2000
Schizophrenia	Netherlands	1989	432.3	—	1.60	Evers and Ament 1995
Schizophrenia	Norway	1994	164	0.052	2.00	Rund and Ruud 1999
Schizophrenia	UK	1992/93	1 292	1 200	1.70	Knapp. 1999
Schizophrenia	US	1990	17 296	11 996	1.80	Rice and Miller 1998
Mental disorders	Australia	1997/98	567	903	1.80	Carr et al. 2003
Mental disorders	US	1990	67 000	74 900	7.00	Rice and Miller 1998
Other mental health	US	1990	19 740	17 597	2.10	Rice and Miller 1998

Source: Hu 2004.

The following paragraphs take a step back from specific illnesses to examine the cost of a series of factors that increase the risk of several diseases. This may be more appropriate for policy-makers than the studies of specific diseases as their policies are often designed to tackle these risk factors.

3.2.3 Obesity

The first is obesity, a subject of growing importance across Europe, especially among children. Like all COI studies, estimates of the healthcare costs of obesity vary depending on the method of calculation. The various studies differ also in the diseases that are included as being attributable to obesity.

Table 3 –
Healthcare spending attributable to obesity

Country	Year	Per cent of national healthcare spending attributable to obesity (actual cost) (%)
Australia	1989–90	2 (AUD 395)
Canada	1997	2.4 (CAD 1.8 billion)
France	1992	2 (FRF 11.9 billion)
Portugal	1996	3.5 (PTE 46.2 billion)
New Zealand	1991	2.5 (NZD 135 million)
USA	2003	6 (USD 75 billion) (excluding children)

Source: Yach and Hawkes 2004.

The estimates produced by these studies deal only with direct healthcare spending rather than decreased productivity or other indirect measures. An exception was the US Surgeon General's 2001 report that included both direct and indirect costs and estimated the societal costs of obesity to be USD 117 billion (USD 61 billion direct costs; USD 56 billion indirect costs). However, these estimates underestimate the real costs of obesity, which also include effects on other sectors where obesity-related health problems have an impact as well as on social well-being and on those who are outside the workforce (Kuchler and Ballenger 2002).

Katzmarzyk and Janssen (2004) have estimated the direct and indirect economic costs of physical inactivity and obesity in Canada in 2001. The economic burden of physical inactivity was found to be USD 5.3 billion (EUR 3.5 billion) (USD 1.6 billion (EUR 1.1 billion) in direct costs and USD 2.7 billion (EUR 1.8 billion) in indirect costs) while the costs associated with obesity amounted to USD 4.3 billion (EUR 2.8 billion) (USD 1.6 billion (EUR 1.1 billion) of direct costs and USD 2.7 billion (EUR 1.8 billion) of indirect costs). The total economic costs of physical inactivity and obesity represented 2.6 % and 2.2 %, respectively, of total healthcare costs in Canada.

The National Audit Office (2001) estimated that obesity in England accounted for 18 million days of sickness absence and 30 000 premature deaths in 1998. This equated to a cost to the National Health Service of at least GBP 500 million (EUR 715 million) a year to treat obesity. The wider costs to the economy of lower productivity and lost output were estimated to total a further GBP 2 billion (EUR 2.8 billion) each year.

3.2.4 Diabetes

While diabetes is a disease in its own right, its importance is increased because it is also an important risk factor for many other diseases, including ischaemic heart disease, renal failure and blindness. The International Diabetes Federation (IDF) has estimated the annual direct healthcare costs of diabetes worldwide. For people in the 20–79 age range, costs are at least USD 153 billion (EUR 127 billion), and may be as much as USD 286 billion (EUR 238 billion). It is predicted that if diabetes continues to increase, total direct healthcare expenditure will be between USD 213 billion and USD 396 billion (EUR 177 billion and EUR 329 billion respectively). This means that the proportion of

world healthcare budgets being spent in 2025 on diabetes care will be between 7 % and 13 %, with high-prevalence countries spending up to 40 % of their budget, and estimates of indirect costs are just as high as — or even higher than — direct costs.

There have been numerous estimates of the healthcare costs of diabetes in individual countries, although most are from outside the European Union and, in particular, from North America. The direct healthcare costs of diabetes, including the treatment of complications, ranges from 2.5 % to 15 % of national annual healthcare budgets, depending on diabetes prevalence and the level of treatment available (WHO 2002b).

In the USA, the direct costs of diabetes across all age groups were estimated at USD 91.8 billion (EUR 68.5 billion) in 2002 (American Diabetes Association — ADA 2003), an increase from USD 44 billion (EUR 32.8 billion) in 1997 (American Diabetes Association — ADA 1998)

An estimate of the cost of diabetes in Sweden found direct and indirect costs per person to be approximately USD 8 500 (EUR 6 338) per year, taking into account co-morbidity (Norlund 2001). Some 28 % of the costs were for healthcare, 41 % for lost productivity and 31 % fell on the municipality and relatives.

3.2.5 Tobacco

Tobacco is among the leading causes of premature death and disability in Europe. Consequently, the cost of the diseases it causes is very high. A recent study has estimated the direct and indirect costs of smoking in the EU-25 to total EUR 97.70 billion to EUR 130.31 billion in 2000, corresponding to between EUR 211 and EUR 281 per capita and between 1.04 % and 1.39 % of the region's GDP in 2000 (Ross 2004). Out of this amount the indirect costs account for at least half. Overall, these cost estimates are comparable to what has been estimated for developed countries using broadly comparable methodologies (see also Table 4). A 1986 study estimated that the total social cost of smoking represented 1.4 % of GDP in the USA (Rice et al. 1986). Smoking-related costs in Canada range between 1.39 % (Canadian Centre on Substance Abuse 1996) and 2.2 % (Kaiserman 1997) of its GDP. Studies from Finland found that smoking cost the society 1.2–1.3 % of GDP in 1987 (Pekurinen 1992), and 0.8 % of GDP in 1995 (Pekurinen 1999). A recent study from Hungary concluded that the total cost of smoking (including the direct and indirect costs) represented a loss of 2.7 % and 3.2 % of GDP in 1996 and 1998, respectively (Szilágyi 2004). This suggests that the relative economic burden of smoking may be larger among the new EU member countries, a finding that is consistent with the much higher death rates from tobacco-related disease.

Welte et al. (2000) estimate the costs of smoking-attributable mortality and morbidity in Germany in 1993. Costs were estimated from a societal perspective. Direct costs were mainly calculated based on routine utilisation and expenditure statistics and indirect costs were calculated according to the human capital approach. They find that 22 % of all male and 5 % of all female deaths as well as 1.5 million years of potential life lost were attributable to smoking. The costs of acute hospital care, inpatient rehabilitation, ambulatory care and prescribed drugs were DEM 9.3 billion (EUR 4.6 million), the costs of mortality were DEM 8.2 million (EUR 4.2 million) and the costs due to work-loss days and early retirement were DEM 16.4 billion (EUR 8.2 million). The total costs came to DEM 33.8 billion (EUR 16.9 million), i.e. 20 % of total health expenditure ⁽⁴⁾ and 2 % of GDP in 1993. When the productivity loss attributable to the reduction of unpaid work is included, there is a substantial increase in indirect costs.

Table 4 –
Healthcare costs due to tobacco

Country	Healthcare costs attributable to tobacco, 2002 (or latest available estimates: USD)	Equivalent in EUR
Australia	6 billion	4.5 billion
Canada	1.6 billion	1.2 billion
Germany	14.7 billion	11 billion
New Zealand	84 million	62.6 million
Philippines	600 million	447 million
UK	2.25 billion	1.7 billion
US	76 billion	56.7 billion

Source: Yach and Hawkes 2004.

Smoking also impacts heavily on employers in terms of lost productivity associated with, for example, sickness absence and smoking breaks. There are a number of studies that have generated estimates for the extent of lost productivity. These have recently been reviewed by Parrott et al. (2000). One (very conservative) estimate for ‘excess’ sickness absence among smokers in the UK is 0.9 days per annum. Time spent by smoking employees in smoking breaks has been estimated at 2.5 hours per week. Based on such statistics and taking into account wage rates, estimated costs to employers in terms of lost productivity may lie between GBP 700 (EUR 1 000) and GBP 1 000 (EUR 1 430) per smoking employee per year.

Yet the costs of tobacco go far beyond the medical expenditure and productivity impact: 20 % of all trash collected in the USA is cigarette butts (Mackay and Eriksen 2002). The annual cost of fires caused by smoking in the USA was estimated to be in the order of USD 27 billion (EUR 20 million). These figures highlight the importance of taking a broad perspective in relation to the consequences of (ill) health behaviour.

3.2.6 Alcohol

Like tobacco, alcohol also has a substantial impact on health. However, unlike tobacco, which is entirely harmful, the situation with alcohol is complicated because there are health benefits associated with regular moderate consumption among those over the age of 40, to whom it offers a degree of protection against heart disease. A detailed calculation of alcohol-related costs in Germany was carried out by Horch and Bergmann (2003) in the mid-1990s. Direct and indirect costs are estimated to total DEM 40 billion. This corresponds to 1.13 % of the GDP in 1995. Out of the indirect costs (DEM 24 billion), the greatest share is accounted for by premature mortality, followed by early retirement and inability to work. The greatest share out of the direct costs (which total DEM 15 billion) is due to hospital treatment costs.

(¹⁴) The share of direct costs in total health expenditures would be 5.6 %.

The work by Varney and Guest (2002) on alcohol-attributable costs in Scotland in 1999/2000 reveals that the overwhelming share of the costs falls on the non-health sectors (see Table 5). Similar studies have also been carried out in other high-income countries. Table 6 provides an overview of the cost estimates in six OECD countries.

Table 5 –
Annual societal cost of alcohol misuse in Scotland in 1999/2000

Cost component	Annual cost (GBP million)	Annual cost (EUR million)
NHS Scotland	95.6	136.7
Social work services	85.9	122.8
Criminal justice system and emergency services	267.9	383.1
Wider economic costs (foregone productivity)	404.5	578.4
Human costs (premature mortality in non-working population)	216.7	309.9
Total annual societal cost	1 070.6	1 531.0

Source: Varney and Guest 2002.

Table 6 –
Total annual societal cost of alcohol misuse in different OECD countries

Country	Year studies refer to	Equivalent annual cost at 2000 prices (GBP)	Cost per capita		Authors and year of study
Canada	1992	7 billion	GBP 222	EUR 317	Single et al. 1998
France	1996	10 billion	GBP 168	EUR 240	Reynaud et al. 1999
England and Wales	1983	4 billion	GBP 76	EUR 109	McDonnell and Maynard 1985
Japan	1987	82 billion	GBP 646	EUR 924	Nakamura et al. 1993
New Zealand	1991	373 million	GBP 97	EUR 139	Devlin et al. 1997
USA	1992	134 billion	GBP 482	EUR 689	Harwood et al. 1998

Source: Varney and Guest 2002.

This section has illustrated the economic dimension of ill health by using estimates based on the COI methodology. Studies of this kind can serve to make policy-makers aware of the seriousness of a given illness. It is important, however, to emphasise the difficulties involved in comparing the existing studies across countries and diseases or risk factors. As there are many ways of calculating direct and indirect costs, different studies often employ different methodologies. Since direct cost data require less assumptions and are more accessible, their calculation tends to be more accurate than indirect cost calculations. For COI studies to be useful, the underlying assumptions at least need to be made explicit to the reader (Rice 1994, Shiell et al. 1987).

It is also worth pointing out that the costs measured in cost-of-illness studies do not reflect the full economic costs associated with a given disease or risk factor. Nor does the total or average size of the cost of illness necessarily imply a macroeconomic impact in terms of reduced economic development. What matters for the latter is the marginal contribution of health to production and to the incentives to invest in human capital.

A further critique of COI studies is the widespread use of the present value of future labour earnings to determine the foregone economic value caused by mortality or morbidity, thereby implicitly assuming that people who are not part of the workforce are ‘unproductive’ and therefore have no (economic) value. This problem can, however, be addressed by methods that seek to measure the value of life (and in some COI studies by assigning the minimum wage to individuals outside the labour force) (Rice 2000).

Further concerns about the COI approach as it is generally applied involve the argument that the standard ‘frictionless’ models of production in competitive markets that underlie the calculation of indirect costs are unrealistic, and that many production processes incur adjustment costs when a worker’s health is adversely impacted.

For these reasons, there is a need for a more in-depth analysis of the economic impact of health. This is addressed in the next two sections that assess the economic impact on the individual and on the national level.

3.3 The economic impact of health at the level of the individual

A significant amount of evidence exists to support the economic importance of health in the labour market in rich countries. We present evidence that health matters for a number of economic outcomes: wages, earnings, the amount of hours worked, labour force participation, early retirement, and the labour supply of those giving care to ill household members. The impact of health on education — an issue widely researched and supported in the developing country context — has received much less attention in the high-income country context. The impact of health on savings has likewise only received limited attention in rich countries, despite the highly policy-relevant insights that could potentially be gained from studying these relationships.

3.3.1 Labour market impacts of health

It is intuitively obvious to argue that an individual’s health status impacts upon one’s *labour supply* and *labour productivity*. One would expect that health affects not only the number of hours or days that an individual would dedicate to his or her work, but also the very decision of participating in the labour force. Similarly, the choice of early retirement from the labour force may at least partly be driven by an individual’s poor or declining health status. All these choices are likely contributors to the overall labour supply choice of an individual.

It is also common sense to expect that, given the amount of an individual's labour supply, the quality of that labour supply or its productivity, i.e. the output produced per unit of labour input, is determined by the individual's health status. This is easiest to imagine in the case of heavy physical works, but also applies to non-manual work. An individual's labour productivity is generally proxied by the wage rate, because under the assumption of perfectly competitive markets the wage rate reflects marginal productivity. One would expect, hence, to find a negative impact of ill health on the wage rate.

Overall, by reducing labour supply and/or productivity, poor health status would be expected to affect an individual's earnings negatively, i.e. the wage rate times the actual labour supplied in a given period ⁽¹⁵⁾. While it would be desirable to separate out the effects of health on labour productivity on the one hand and on labour supply on the other, in the practice of empirical research this has rarely been possible, as many studies have looked at the effect of health on earnings (which captures both labour productivity and supply at the same time). Therefore, the following sections distinguish — necessarily somewhat artificially — between the results describing the economic impact of health on earnings and wages and then on labour supply.

3.3.1.1 The impact of health on earnings and wages

Several studies from high-income countries show that poor health negatively affects wages and earnings. The magnitude of the impact obviously differs across studies (given different health proxies and methodologies) and direct cross-country comparability of results is therefore limited. While a significant number of studies have analysed the impact of health on earnings and wages in high-income countries, overall there appears to be relatively little evidence from EU countries directly.

The Grossman (1972) model of the demand for health first captured the complex interrelation among work time, wages and health. Subsequently, many studies (mainly using American data) focused on the interlinkages between work, wages and health. Grossman and Benham (1974) used the household production model to examine the effect of health on wages (weekly wage) and on weeks worked, treating health as an endogenous variable. The estimated structural equations for wage determination and labour supply indicated that good health had a positive effect on earnings (wages times weeks worked). Contoyannis and Rise (2001) restate the fact that there is little evidence on the impact of health on wages, particularly for developed countries.

Luft (1975) ⁽¹⁶⁾ investigated several aspects of the impact of health status on earnings in the USA, and calculated the overall loss of earnings to the economy in 1967. He measured the effects of health status by comparing the different components of earnings (labour force participation, hourly wage, and hours worked per week) of persons who were healthy with those in bad health ⁽¹⁷⁾. Overall, he finds a rather sizeable effect of bad health, accounting for a loss of 6.2 % of total earnings, compared with a person who was not in bad health as defined in the study. Splitting the samples by gender and ethnicity, he identifies ways in which disability affects different groups. For example, black males turned out to be more likely to drop out of the labour force or work fewer weeks than white males, while the latter take larger cuts in hourly wages and annual earnings.

⁽¹⁵⁾ Note that from a theoretical perspective — as discussed in chapter 2 — one may also obtain opposite results, with labour supply increasing in response to health deterioration.

⁽¹⁶⁾ As quoted in Andr n and Palmer (2001).

⁽¹⁷⁾ A person in bad health was defined as a respondent who agreed with the statements 'there is a health problem which influences work' and 'there is a health problem which influences housework (questioned only to women)'.

Fukui and Iwamoto (2003) examined Japanese working-age (30-54) males by using data from the Comprehensive Survey of Living Conditions for 1989, 1992 and 1995. The authors estimate that about 1 % of total earnings are lost due to bad health, a value that is much lower than that estimated by Luft (1975), but still significant. The authors also find that subjective indicators such as work limitations or self-rated health state display a clearer relationship with earnings and labour force participation than more objective ones, such as having been diagnosed with a particular disease or a symptom.

Bartel and Taubman (1979) estimated the effect of specific diseases (physician-diagnosed) on wage rates and hours worked. Their sample is drawn from a population of white, veteran, male twins born in the continental United States between 1917 and 1927. The study was performed in 1974 (with 2 500 pairs). The authors assess the relative contribution of specific diseases to current earnings as well as the persistence of the effects over time. There is a strong effect on earnings (20–30 % reductions) around age 50 of certain diseases contracted during the preceding 10 years, i.e. heart disease and hypertension, psychoses and neuroses, arthritis and bronchitis, emphysema and asthma. The diseases are found to reduce both the individual's wage rate and his/her labour supply although the relative effects differ by diseases.

Chirikos and Nestel (1985) examined the effect of health problems in the preceding 10-year period on current economic welfare, using a two-equation model, estimated with the National Longitudinal Surveys (USA), of older men in 1966–76 and mature women in 1967–77. Controlling for gender, race and current health status, past health problems (up to 10 years) are found to adversely affect current earnings. The average reduction in earnings, caused by having had health problems is roughly the same for both white and black men and represents a loss of about 20 % of the earnings reported by the continuously healthy.

The question of whether sickness history affects annual earnings and hourly wages is also addressed by Andrén and Palmer (2001). The empirical part is based on data from Sweden (data from Swedish National Social Insurance Board, 1983–91, for people in working age 16–64). Using a longitudinal survey to examine the effect of sickness on the individual, Andrén and Palmer estimated both (annual) earnings and (hourly) wage equations, and found that people who are healthy in the current year, but who have had long-term sickness in the previous five years have lower earnings in the following years than persons without long-term sickness, even if they did not experience a new spell of long-term sickness.

Another study by Hansen (2000) from Sweden explored the effect of work absence — in particular due to illness — on wages. The results indicate that women's wages are significantly reduced by work absence caused by their own sickness, while absence to care for a sick child appears to have no significant wage effect. Taken literally this means that caring for a sick child is be considered more 'legitimate' than being sick oneself. The data ⁽¹⁸⁾ indicate that women are significantly more likely to be absent than men, both because of their own sickness and because of caring for a sick child. For men, no significant effect of illness-related work absence on wages was found.

Contoyannis and Rise (2001) examined the effects of self-assessed general and psychological health on hourly wages — separately for males and females — by using longitudinal data from six waves of the British Household Panel Survey ⁽¹⁹⁾. The results of the study suggest that reduced 'psychological health' — a variable defined by the authors — in the case of males leads to a decrease in hourly

⁽¹⁸⁾ Data obtained from the Swedish National Social Insurance Board (for the period 1991–92) as well as household data from Statistics Sweden; approximately 7 000 households were used for the study.

wages, while excellent self-assessed health increases the hourly wage for females. The results change in interesting ways, once the sample is split further into fully and partly employed respondents (again by gender). As for males, the gradient in self-assessed health is maintained, but the magnitudes of the coefficients on both the excellent and good self-assessed health variable are reduced substantially. In contrast, the gradient on self-assessed health is now more pronounced (and significant) for full-time employees compared with part-time employees.

The British Household Panel Survey (BHPS) has also been used by Gambin (2004) who examined the impact of health on wages, including a number of health indicators and estimating the equations for men and women using 11 waves of the BHPS (1991–2001). The sample is restricted to respondents indicating that they are employed at the time of the survey. Both part-time and full-time workers are included and an estimation is performed using the full sample as well as the sample consisting only of the full-time employees. Gender differences in the effect of health on wages are the particular focus of Gambin. Using the same self-assessed health variables as Contoyannis and Rise (2001), she finds that self-assessed health impacts upon wages more for women than for men. Holding all other variables constant, excellent health for males — compared with less than excellent health ⁽²⁰⁾ — increases the hourly wage by on average GBP 1.027 per hour while for women the impact would be around GBP 1.040. (The average wage for men in the sample is GBP 8.284 and GBP 6.419 for women.) Thus, the impact of health is found to differ slightly by sex and is more strongly related to women's wages than to men's.

Pelkowski and Berger (2004) examined the effect of health problems on employment, annual hours worked and hourly wages by using the US Health and Retirement Survey data (which contains retrospective and current health information on the individuals surveyed) and conclude that permanent health conditions have negative effects on labour market outcomes. The respondents of the survey are men and women born between 1931 and 1941 residing in the United States (and not in institutional care) ⁽²¹⁾. Poor health again has different consequences for males and females. Women face a slightly larger percentage reduction in wages than males as a result of permanent health conditions. Females are found to have reductions in wages, but males have bigger decreases in hours worked. Temporary health conditions have little impact on hourly wages or hours worked. The onset of health problems in the 40s produces the largest negative consequences for males, while for females negative effects peak in the 30s. In the authors' view this may be due to the severity of the health shocks experienced in those age groups, so that relative to healthy individuals, the biggest declines in wages and hours worked are observed for individuals whose health problems started at those ages, near the peak of their life-cycle earnings.

Gustman and Steinmeier (1986) ⁽²²⁾ use data for the years 1969 to 1975 from the US Retirement History Survey (RHS) and the Panel Study of Income Dynamics (PSID) for white males to determine

⁽¹⁹⁾ The British Household Panel Survey is a longitudinal survey of private households in Great Britain (England, Wales, Scotland), designed as an annual survey with the first wave conducted in 1991. In the survey, the self-assessed health question asks the individual to rate their health on average over the last 12 months relative to someone of their own age. This variable is coded as excellent, good, fair, poor, and very poor. Three dummy variables were created, equaling one if an individual has excellent health, has good health, or has fair health or worse. In addition a Likert scale indicator (from one to five) is used to capture more generally the respondent's psychological well-being. The use of the Likert scale in the estimations makes the interpretation of the respective coefficient less intuitive.

⁽²⁰⁾ As described above in the discussion of the results of Contoyannis and Rise (2001), the self-assessed health question uses five categories into which respondents can group themselves. 'Excellent' is the highest possible.

⁽²¹⁾ Partners (spouses or cohabitators) of the original targeted sample are also interviewed even if not initially age-eligible. The first wave was conducted in 1992–93. A total of 12 654 respondents from 7 703 households were interviewed.

if short-term and long-term illnesses have different impacts on real hourly wages of individuals. When the illness occurred before the age of 55, the long-term illness reduced the wages of full-time workers by 3.1 % and part-time workers by 4.9 %. For this same age category, short-term illness had a smaller negative impact on full-time workers (0.7 %) but had a larger negative impact on part-time workers amounting to a 12 % reduction in wages. When the illness occurred after the age of 55, the long-term illness reduced the wages of full-time workers by 8.4 % and part-time workers by 7.2 % while the short-term illness had a smaller negative impact on both full-time workers and part-time workers of 4.2 % and 3.7 %, respectively.

Impairment of mental health has been shown to have a major impact on earnings in a study by Currie and Madrian (1999) using data from the USA. This may be in part because psychiatric disorders affect workers at the peak of productive life whereas other measures such as limitations on activities of daily living affect primarily elderly people who already have a reduced labour force attachment. Bartel and Taubman (1986), building on earlier work using the NAS-NRC twin data by Bartel and Taubman (1979) — in the study already referred to above — report that the onset of mental illness reduces earnings initially by as much as 24 %, and that negative effects can last for as long as 15 years after diagnosis. Benham and Benham (1981) also find that having ever been diagnosed as psychotic reduces earnings by 27–35 %.

3.3.1.2 The impact of physiology on earnings and wages

A number of studies find a significant impact of physiological proxies for health (e.g. height or body mass index) on earnings and wages not only in developing but also in some high-income countries. Height tends to positively affect these labour market outcomes, while a higher body mass index appears to depress wages and earnings more for women than for men. It is likely that some of the link between these physiological measures and labour market outcomes can be accounted for by social perception of height, and by social stigma in the case of obesity, rather than by a productivity effect.

The problems of assessing health in large-scale surveys have meant that much research has examined a range of physiological measures, in particular height, age at menarche, and less frequently, body mass index ⁽²³⁾ that either influence or act as markers of health. The relevance of these measures as health indicators for high-income countries may be doubtful and is further discussed in Annex 1. It is important to note that their use in part reflects, on the one hand, their wide availability from survey data and, on the other hand, an extension of work in developing countries where physical strength is a major determinant of labour productivity. However, some measures, such as height and age at menarche, are relevant in developed countries as they provide a marker of health in childhood and thus of the risk of certain conditions, such as cardiovascular disease and, especially, stroke that are manifest in adulthood.

At the micro level, many studies have demonstrated that height has a positive impact on hourly wages (Strauss and Thomas 1998). While the empirical result is very robust, its interpretation is complex. Taller people are probably stronger (although height is much more than just a proxy for strength) — an attribute that is likely to be more highly rewarded in a low-income setting when physical strength is important for manual work. For developed countries where services and knowledge-based enterprises dominate, one might think that this link is not so strong; however, some studies prove positive correlation between height and level of earnings in highly developed countries.

⁽²²⁾ As quoted by Pelkowski and Berger (2004).

⁽²³⁾ Body mass index (BMI) is the accepted international indicator for comparing overweight.

Tallness particularly among men is associated with authority, capability and success. Compared with their shorter counterparts, taller men are found to have advantages in both the hiring process and in the earnings potential (Ross and Ferris 1981) ⁽²⁴⁾. However, one cannot a priori rule out that height differentials reflect differences in individuals' labour productivity. This is because human stature may well be considered to be the result of long-term investments in health capital a large share of which undertaken by an individual's parents rather than by him or herself.

Schultz (2002) has examined the impact of adult height on labour productivity (measured by wages) in two developing countries, Ghana (1987–89, ages 25–54) and Brazil (1989, ages 25–54), and in one developed country, the United States (1989–93, ages 20–28). Schultz explored alternative instrumental variables that proxy price and income constraints which are expected to influence the latter reproducible human capital investments in height. An additional centimetre in adult height is found to be associated with 1.5 % higher wages for men and 1.7 % higher wages for women in Ghana, 1.4 and 1.7 % higher in Brazil, respectively, and 0.45 and 0.31 % higher in the United States, respectively. The percentage increase in wages with respect to height in the United States is roughly one third of that in the two lower income countries. This may be due to diminishing returns to nutrition/health. Alternatively, the larger share of white-collar jobs in the US economy may warrant less of a wage premium for the extra physical work capacity that is associated with larger stature.

Heinek (2004) assesses whether taller workers earn more than their shorter counterparts. Using German Socio-Economic Panel data from 1991 to 2002 (including West and East Germany), regressions are run separately for male and female workers in both West and East German regions. The dependent variables used in all regressions are monthly gross earnings and hourly wages. As for height, the sample is limited to workers between 21 and 50 years old because of body height being constant in that age range. In the panel analyses, the sample is limited to workers being at least 21 years old in 1991 and at most 50 years old in 2002 ⁽²⁵⁾.

Earnings differentials by height are even more distinct for male workers from both parts of Germany. While the height classification by 10 cm increments supports the first impression that there is no linear relationship over the whole range of individuals' height, the results would suggest wage differentials of even up to 13 % between short East German males, i.e. whose height is less than 165 cm, compared with their counterparts with a body height between 185 cm and 195 cm. The findings from the Heinek's model specification using the continuous height indicator suggest earnings premiums of about 1.3 % for East German and 1 % for West German males with an additional centimetre of height. This corresponds to some 3 % earnings gain of above-average-height males in both East and West Germany, while the penalties for having below-average height differ somewhat: there is an almost 3 % earnings loss for West German males and even a 6 % penalty for East Germans. The results do not suggest an effect of height on the earnings of female workers.

Judge and Cable (2004 and 2003) show by using data for the USA and the UK that each one-inch increase in height results in an increase in annual earnings of, on average, an additional USD 789 per annum, after controlling for sex, age and weight. The authors complement their analysis by a meta-analysis of the literature, suggesting that height is significantly related to measures of social esteem, leader emergence and performance. Hence, it is not only greater productivity that accounts for the link between height and more favourable labour market outcomes.

⁽²⁴⁾ As quoted by Heinek (2004).

⁽²⁵⁾ 33 247 persons, full and part time, blue and white collar workers.

Persico et al. (2003) used data from Britain's National Child Development Survey (1979–85) and found that among white British men every additional inch of adult height is associated with a 2.2 % increase in wages. In a complementary analysis, drawing on data from the US National Longitudinal Survey of Youth (1979 youth cohort) the authors found that among adult white males in the USA, every additional inch of height as an adult is associated with a 1.8 % increase in wage. However, they suggest that it is not adult height that affects labour market outcomes, but rather that it is tallness as a teenager that matters. In their interpretation, it is social effects during adolescence, rather than contemporaneous labour market discrimination or correlation with productive attributes, that may be at the root of the disparity in wages across heights.

Although less often studied in the past, there is now an increasing body of literature that examines the effect of individuals' body weight on socioeconomic outcome ⁽²⁶⁾. The results from the empirical literature show that in particular heavier women are those who earn less (Averett and Korenman 1996, Cawley 2000, Mitra 2001, Pagán and Dávilla 1997, Register and Williams 1990). These negative effects that are associated with obesity are explained by decreased labour productivity as well as by social stigma. BMI (or weight for height) has been shown also to affect the proportion of working time that is spent on very physically demanding activities by men.

As pointed out by Thomas and Frankenberg (2002), evidence on changes of physiology have mixed results on labour market outcomes. In higher income settings, high BMI (or obesity) is thought to reduce wages. When income, marital status and hourly pay are investigated for differentials caused by body mass (in a sample of 23- to 31-year-olds drawn from the 1988 NLSY, USA), Averett and Korenman (1996) show that obese women have lower family incomes than women whose weight-for-height is in the 'recommended' range. However, the findings confirm that there is some evidence of labour market discrimination against obese women. These findings have considerable relevance given the increasing rates of obesity across Europe.

3.3.1.3 The impact of health on labour supply

A standard, if imperfect, illustration of the effect of illness on the labour supply of individuals is absenteeism from the workplace due to illness. In the EU-15, for instance, around 40 % of EU-15 workers reported having been absent from work at least once in the last 12 months due to health problems, according to the results of the Third European Survey on Working Conditions conducted in 2000 (European Commission and Eurostat 2004). According to responses to this survey, these absences represent an average loss of 7.3 working days per EU-15 worker due to occupational accidents, work-related health problems and other health matters (European Foundation for the Improvement of Living and Working Conditions 2001).

Sickness absences have the direct cost of the sickness benefits to be paid to absent employees (when applicable) and the indirect cost of the lost productivity during the days of work absenteeism. The lost productivity due to sickness absence in the UK was assessed at over GBP 11 billion in 1994. In Portugal, 5.5 % of all working days in the 2 000 largest enterprises were assessed to have been lost as a result of illness and accidents in 1993. In Belgium, EUR 2.8 billion was paid in 1995 on sickness benefits and benefits on work accidents and occupational diseases. In 1993, payments to cover absence of work were assessed to be up to EUR 30.6 billion in Germany and EUR 15.8 billion in the

⁽²⁶⁾ The increase in obesity in Western industrialised countries is documented in, for example, Popkin and Doak (1998) or Philipson (2001). For the development of body size of US Americans over the course of the 20th century, see Komlos and Baur (2004).

Netherlands (EUR 3.9 billion for benefits on sickness absenteeism and EUR 11.9 billion for disability benefits) ⁽²⁷⁾.

While this indicator has the disadvantage of also being determined by the incentives set by the policy environment, it may nevertheless serve as a first, simple approximation. More in-depth microeconomic research has focused on the extent to which less than full health reduces supply of labour. The following sections look at three different aspects of the potential labour supply effects of health: labour force participation, early retirement, and the labour supply of caregivers.

3.3.1.3.1 The effect of health on labour force participation

An extensive empirical literature, mainly from the USA but recently also from Europe, confirms that health increases the probability of participating in the labour force. Again there is no consensus about the magnitude of this effect and the comparison of results from different studies is difficult, as they use different measures of health, model forms and estimation techniques.

Chirikos and Nestel (1985), for instance, find strong evidence of the impact of health problems on labour supply. They distinguish the ‘direct effect’ of health on the annual hours of work (due to changes on the preferences between leisure and market work) from the ‘indirect effect’ through the impact of health on wages. Their analysis is based on data from the US National Longitudinal Surveys (NLSs) ⁽²⁸⁾. Information on health ⁽²⁹⁾ over a 10-year period was combined to construct four health categories under which all individuals could be classified: ‘continuously healthy’; ‘continuous poor health’; enjoying ‘improving health’; and ‘deteriorating health.’ Estimates were made separately for women and men, and for black and white people, giving rise to four sex-race groups. Those in ‘deteriorating health’ or ‘continuous poor health’ work less hours per year than those ‘continuously healthy’ over the same time period ⁽³⁰⁾. Also black men and women in ‘improving health’ supply less hours of work than those who are ‘continuously healthy’. The opposite is, however, the case for white men and women. In general, the negative impact of poor health on labour supply is higher for black people than for white people. However, while for white men and women, the effect of poor health on labour supply is mainly due to its indirect effects via reduced wages, for black men and women direct reductions in work effort due to changes in preferences are dominant. White people who had health problems during the previous 10 years, including those with ‘improving health’, had significantly lower wages than the ‘continuously healthy’ groups ⁽³¹⁾. This is particularly so for those in ‘continuous poor health’ whose wages were 36 % lower in the case of men and 48 % in the case of women. The average ⁽³²⁾ annual hours of work lost due to a history of any poor health represents 13.4 % of the hours worked by the ‘continuously healthy’ in the case of white men, 6.3 % for white women,

⁽²⁷⁾ Data on costs of absenteeism from the European Foundation for the Improvement of Living and Working Conditions (1997).

⁽²⁸⁾ Data on wages and annual hours worked come from the 1976 survey for men and from the 1977 survey for women. Data on health come from the NLSs over a 10-year period (1966–76 for men and 1967–77 for women).

⁽²⁹⁾ Including self-reports of functional limitations or impairments, self-ratings of general health status, retrospective assignments of health as having improved, deteriorated or remained unchanged over various time periods, and self-reports of whether health affects work effort.

⁽³⁰⁾ Controlling for other factors likely to affect labour supply such as other family income, class of the worker, age, and children less than six at home for women.

⁽³¹⁾ Controlling for other human capital characteristics.

⁽³²⁾ Obtained weighting differences attributable to each of the four health histories by their prevalence.

20.6 % for black men and 27 % for black women. The use of a historical measure of health can be expected to reduce the endogeneity bias that exists in the health–labour market relationship, although it does not completely eliminate it (as these health measures can be influenced by permanent wages or previous labour supply decisions, on which current labour market status might depend).

In a paper by Pelkowski and Berger (2004), the authors use data from the Health and Retirement Survey (USA) to distinguish between the labour market impact of permanent and temporary health conditions. The Health and Retirement Survey, the first wave of which was conducted in 1992–93, contains retrospective and current health and employment information that allows constructing health and employment experience profiles over the lifetimes of individuals. First of all, the authors find that permanent health illnesses have a stronger impact on the number of hours worked in males than in females. According to one of the estimates that controls for fixed individual effects (correcting for unobserved heterogeneity), a permanent illness reduced hours worked by 6.9 % for men and by 4.5 % for women. Secondly, the impact of temporary illnesses⁽³³⁾ on the number of hours worked is insignificant for both men and women. Thirdly, the authors distinguish between permanent illnesses by age of onset. Estimates controlling for the sample selection bias (as the probability of being employed could be different for individuals having health problems and could depend on the type of problems and their age of onset) show that when a permanent illness appears between ages 30 and 39, men reduce the number of hours worked by approximately 9.5 % compared with healthy men. This reduction is lower, 6.9 %, when the illness appears at ages 50 and older. According to the authors, this might be related to the different degree of severity of the health shocks that are experienced by different age groups.

Turning now to the evidence in European countries, in a study based on data from Ireland, Gannon and Nolan (2003) found that the probability of labour force participation was 61 % lower for men and 52 % lower for women who had a chronic illness or a disability ‘severely’ hampering their daily activities compared with men and women without such a chronic condition, after controlling for differences in age, education and marital status. The presence of a chronic condition hampering ‘to some extent’ daily activities reduced the probability of labour force participation by 29 % for men and 22 % for women. These estimates were obtained using a probit model and data from the 2000 Living in Ireland Survey (the Irish component of the ECHP⁽³⁴⁾) for individuals of working age (between 16 and 64 years of age). Similar results were obtained using data for 2002 from the Quarterly National Household Survey, looking at individuals reporting a long-standing health problem or disability that severely restricted the kind of work they could do: for this group, the probability of labour force participation was reduced by 66 % for men and by 42 % for women. The impact of a long-standing illness restricting ‘to some extent’ the kind of work the individual could do had a smaller, but still significant, impact on the probability of labour force participation, which was reduced by 12 % for men and by 14 % for women.

⁽³³⁾ As the distinction between temporary and permanent illnesses is based on the answer to the question ‘Is (was) the illness temporary (lasts three months or less)?’, only completed temporary illnesses are included in the analysis.

⁽³⁴⁾ The European Community Household Panel (ECHP) is a longitudinal survey based on a standardised questionnaire that involves annual interviews of a representative panel of households and individuals in each country, covering a wide range of topics: income, health, education, housing, demographics and employment characteristic, etc. It ran from 1994 to 2001. The then 12 Member States participated in the first wave. Austria (1995) and Finland (1996) have joined the project since then. Data for Sweden are available as of 1997, and have been derived from the Swedish Living Conditions Survey and transformed into ECHP format.

In their estimates of the impact of the degree of disability on employment of men with disabilities in Spain, Pagán and Marchante (2004) find that being severely disabled has an important and significant negative effect on the probability of being employed. These authors base their analysis on the self-assessed disability data for men in the ECHP from year 1995 to 2000. According to these data, only a quarter of men with disabilities are employed, compared with approximately three quarters of people without disabilities.

People with limiting long-standing illness are found to have a higher probability of being unemployed and inactive in Sweden in a study by Lindholm et al. (2001). The authors base their findings on the analysis of data from the Swedish Surveys of Living Conditions for a sample of people interviewed twice with an interval of eight years, the first interview taking place in the period 1979–90 and the second one between 1986–97. Men and women included in the sample are aged 25–64 years, at the time of the first interview do not have any limiting long-standing illness (self-reported) and are employed. Odds ratios are calculated for those who become ill at the time of the second interview, controlling for differences in age, gender and socioeconomic group ⁽³⁵⁾. The results show that the probability of economic inactivity, unemployment and long-term unemployment is significantly higher for those who have a limiting long-standing illness. A problem for interpretation of these results as evidence of causation is that the interval between the two interviews is very long (eight years), and we are not able to know whether it is illness that precedes economic inactivity (or unemployment), or the other way round. Moreover, the social context (average unemployment and labour force participation rates) changed dramatically at the end of year 1991, with some second interviews taking place before this change, and some after, so the results might be biased by a confounding effect of time.

In order to avoid the potential bias arising from the endogeneity in the relationship between labour market participation and health status, Riphahn (1998) focused on sudden deteriorations of health, or health shocks, arguing that labour-attributable health deterioration can be expected to act over a longer time period. Her analysis is based on pooled data from the first 11 waves of the German Socio-Economic Panel (1984–94), and on a sample of full-time employed West German individuals aged 40 to 59 (since at age 60 individuals might be entitled to retirement benefits). Riphahn defines a health shock as a drop of at least five points on the level of health satisfaction within one year (based on a scale from 0 to 10) ⁽³⁶⁾. She finds that 13 % of those suffering a health shock were no longer fully employed in the next period, compared with 5.3 % in the overall sample. The percentage increases to 17.5 % after two years of suffering the health shock. Importantly, the impact of a reduction in health is much greater among women, 20.5 % of whom leave full-time employment after experiencing a sudden health deterioration. In addition, a greater proportion of women move into part-time employment after suffering a health shock. Using a multinomial logit model, Riphahn estimates the probability of labour transition after suffering a negative health shock ⁽³⁷⁾. She finds that suffering a negative health shock increases the probability of entering part-time employment by about 60 %, unemployment by 90 % and of leaving the labour force by more than 200 %. Moreover, among all the characteristics examined, a health shock is found to be the most important determinant

⁽³⁵⁾ Five socioeconomic groups are used: unskilled manual workers, skilled manual workers, lower non-manual employees, intermediate non-manual employees and upper non-manual employees. The intermediate and upper non-manual employees were taken as the reference group.

⁽³⁶⁾ A caveat of this measure is that it does not differentiate between temporary and permanent health problems.

⁽³⁷⁾ Controlling for demographic and human capital measures, characteristics of current employment and labour demand effects.

of dropping out of the labour force. Riphahn concludes that these results demonstrate the scope for public policies to retain older workers in work by, for example, offering incentives to employers to accommodate workers whose health is impaired or promoting more intensive use of rehabilitation programmes.

Lechner and Vazquez-Alvarez (2004) also use the data from the West Germany sample of the German Socio-Economic Panel, but focus on disability indicators. Their results suggest that becoming disabled can lead to a significantly lower probability of being in employment, which can be as much as 9.6 % lower. They use data from waves of years 1984 to 2001 for people between 17 and 60 years of age. The 18-waves sample is divided in sequences of observations in three consecutive years for a same individual. Individuals are divided in two groups: (1) a treatment group, that is observed to be non-disabled in the first year of a sequence of three consecutive years and then disabled in the following two years; and (2) a control group, that is observed to be non-disabled during three consecutive years. The labour market outcomes of the treatment and control group in the third year of each sequence are compared using two different matching techniques according to each individual's propensity score ⁽³⁸⁾ in the first year of the sequence. In this study, individuals are identified as being disabled if they declare a degree of disability equal to or greater than 30 % (however, in the used sample, the majority of individuals becoming disabled had a zero degree of disability in the first year of the observed sequences). The authors control for the observable characteristics of the disabled and non-disabled individuals that can affect both their probability of becoming disabled and their probability of employment.

The authors do the same analysis for a restricted part of the sample, those who declare to be full-time workers in the first year of each three-year sequence. These individuals might be expected to be better informed about disability policies and the labour market, and therefore suffer less than the whole sample in terms of employment when becoming disabled. However, the study shows that the effect is similar in this more restricted group of individuals, where the probability of being out of work is estimated to be between 8.5 % and 9.2 % higher for those becoming disabled than for those who remain non-disabled.

In the Netherlands, Van de Mheen et al. (1999) find that health problems in 1991 were significantly associated with a higher risk of mobility out of employment and a lower probability of mobility into employment in 1995. Their study is based on data from the 'Longitudinal study on socio-economic health differences in the Netherlands', for a sample of men and women aged 15–59 in 1991, and interviewed again in 1995. The authors use three indicators of health status in 1991: perceived general health, health complaints (from a list of 23 items) and chronic conditions (from a list of 23 conditions). Regarding labour market position, people are categorised into paid employed on one hand and unemployed and economically inactive on the other hand (unemployed, disability pension, housewives/househusbands and early retirement). This study uses odds ratios to compare the probability of being out of employment or in employment in 1995 to those with and without health problems in 1991 (adjusting for differences in age, sex, educational level and marital status). The results show that among those employed in 1991, the probability of being out of employment in 1995 is significantly higher for persons suffering from health problems in 1991, whether measured by general perceived health, chronic conditions (reporting one or more), or health complaints (reporting four or more). In addition, among those out of employment in 1991, those with health problems have a lower probability of being employed in 1995 than those without health problems.

⁽³⁸⁾ Propensity to becoming disabled that is estimated according to a series of characteristics of individuals that might have an effect on their probability of becoming disabled.

3.3.1.3.2 The effect of health on early retirement

A relatively large number of studies from high-income countries find a significant and robust role of ill health in anticipating the decision to retire from the labour force. The relationship has been more extensively researched in the USA than in Europe. When interpreting the results from different countries one should keep in mind that they are likely to be very sensitive to the institutional framework (e.g. pension rules ⁽³⁹⁾, availability of disability benefits, occupational insurance arrangements).

Most empirical studies have focused on the influence of health on decisions concerning workforce participation at older ages, and more particularly on the decision to retire. Following a review of research in the USA, Sammartino (1987) concludes that a significant effect of health on the probability to retire has been established. This is also the conclusion of a recent literature review by Deschryvere (2004) that includes evidence from European countries.

Sammartino (1987) concludes that those in poor health are likely to retire between one to three years earlier than workers in good health with similar economic and demographic characteristics. Gordon and Blinder (1980), who considered the impact of health on both the relative marginal utility of leisure and consumption and on the expected wage, found that in white male workers aged 60 to 67 poor health increased the probability of retirement by 14–18 %. Gustman and Steinmeier (1983) estimated that a long-term health problem beginning at age 55 reduced the average age of final retirement by 2.8 years. Most of this effect was due to the impact of health on changes in leisure/consumption preferences (2.7 years), with only a minor effect via changes in wages ⁽⁴⁰⁾.

Sickles and Taubman (1984) find a strong effect of health on male retirement decisions. Based on data from the US Retirement History Survey (years 1969 to 1977), they generated a model that includes an equation linking health status to retirement as well as an equation determining health stock (considered as a form of human capital) on the basis of individual characteristics.

Coile (2003) finds that health shocks have a large effect on labour supply decisions by both men and women between the ages of 50 and 69, mainly when accompanied by major changes in functional status. For example, the onset of a heart attack or stroke accompanied by an important deterioration in the ability to perform activities of daily living ⁽⁴¹⁾ was estimated to reduce the number of work hours supplied by men per year by 1 030 or to raise the probability of leaving the labour force by 42 %. A comparable effect of 654 hours' decrease or a 31 % increase in the probability of leaving the labour force was found for women.

Bound et al. (2003), using data from the US Health and Retirement Study, estimate that a representative individual in poor health is 10 times more likely than a similar person in average health to retire before becoming eligible for pension benefits. In another study, Bound et al. (1999) found that not

⁽³⁹⁾ Gruber and Wise (1999) found a strong link between the level of participation of older people and the opportunity cost of continuing to work after early retirement age imbedded in the pension system (and measured as the percentage of total net loss of pension benefit for the years from early retirement age until age 69 for working an additional year, over the net wage earned in that additional year). They argued that about 81 % of the variation in participation of older people (aged 55–65), among 11 OECD countries, could be explained by the system's opportunity cost. One could, however, question whether people reacted to the system's structure or whether the system adapted to people's behaviour.

⁽⁴⁰⁾ The results of the studies by Gordon and Blinder (1980) and Gustman and Steinmeier (1983) are quoted in Sammartino (1987).

⁽⁴¹⁾ New four or more limitations in activities of daily living.

only contemporaneous health affected labour force behaviour, but also past health shocks ⁽⁴²⁾. Their study is based on data from the first three waves of the US Health and Retirement Survey (covering people aged 50–62 in the first wave in year 1981). The authors tried to address the limitations of self-reported health measures by constructing a health index that depends on a series of exogenous factors (such as age and education) and on a measure of functional health. The authors estimate that only 30 % of men whose health deteriorated in the last year remained in the labour force, compared with 87 % of those who continued in good health. Estimates for women show a similar pattern: 33 % of those whose health deteriorated remained in the labour force, against 82 % of those in continued good health. A similar pattern is found for women: 33 % of those whose health deteriorated against 82 % of those in continued good health. They also found that the earlier a health shock occurs, the less likely it is to lead to labour force exit, and the more likely that individuals will change job, suggesting a strategy of adaptation. Yet even those who suffer a shock at an early age had lower labour force participation than those who were always in good health. The authors also control for the selection bias that arises because those continuing to work after having suffered a first negative health shock are less likely to leave work due to poor health in the future. Doing so increases the likelihood that a negative health shock will lead to exit from the labour force.

Turning to evidence from European countries, Jiménez-Martín et al. (1999) found that health ⁽⁴³⁾, particularly among males, was a very important factor in the decision of an individual to retire as well as that of their spouse to retire with them. The authors use information on labour market transitions between 1994 and 1995 from the ECHP, pooling data from across the EU, to analyse retirement patterns of individuals and couples in a sample of men older than 54 years and women older than 49. Considering men and women separately, poor health status is found to have a positive effect on the probability for own retirement ⁽⁴⁴⁾. When couples are considered together, having serious health problems ⁽⁴⁵⁾ raises the probability that men will retire by 289 % (compared to the reference couple ⁽⁴⁶⁾) when the wife is already out of the labour force and by 1 375 % ⁽⁴⁷⁾ when she is still working. For women, having serious health problems increases the probability of retirement by 324 % when the husband has left the labour force, but only by 58 % when he is still working.

Strong evidence of the influence of health status on the retirement decision is reported by Siddiqui (1997), using data from the German Socio-Economic Panel to look at men in West Germany who have reached the minimum retirement age (which is at 58 years in the German institutional framework) ⁽⁴⁸⁾. The author analyses retirement behaviour using a model that describes an individual's retirement decision as a trade-off between the gain in income from postponing retirement and the gain from leisure obtained by early retirement. It estimates the influence of several explanatory variables,

⁽⁴²⁾ Controlling for contemporaneous health status.

⁽⁴³⁾ The health variables refer to year 1994 (to minimise the endogeneity bias) and include the following indicators: self-reporting good health; self-reporting a chronic physical or mental health problem (data only available for 1995); having been admitted as an in-patient during the previous year; having visited a doctor between one and five times in the year; having visited a doctor more than five times in the year.

⁽⁴⁴⁾ Controlling for different demographic and socioeconomic characteristics in the year 1994 and for differences between countries. The significant health variables for men are: having a chronic health problem, having been admitted to hospital in the previous year, having visited a doctor more than five times per year. For women: self-reporting good health status (which reduces probability to retire) and reporting a chronic health problem.

⁽⁴⁵⁾ Having a chronic condition, having been admitted to hospital in the previous year and visiting a doctor more than five times a year.

⁽⁴⁶⁾ Among other characteristics of the reference couple, the husband is 55 years old and the wife 52.

⁽⁴⁷⁾ The probability that the husband in the reference couple retires is very low.

⁽⁴⁸⁾ The self-employed are withdrawn from the sample due to their different pension systems.

including two measures of health status ⁽⁴⁹⁾, on an individual's preference for leisure. The health measures used are: the degree of disability based on a physician's assessment of the capacity to fulfil the job requirements; and a dummy variable indicating whether the person suffers from a chronic disease (self-assessed). The regression results show that being disabled or suffering from a chronic disease significantly increases the probability of early retirement. Indeed, the degree of disability seems to be the dominant factor explaining early retirement, with the probability of leaving the labour force at the earliest possible age for disabled men being four times that of men without disability. As the author notes, these results suggest that improving employees' health could be a highly effective measure to raise the actual age of retirement.

Deterioration in an individual's 'health stock' is found to be an important predictor of retirement in a study undertaken in Great Britain ⁽⁵⁰⁾ by Disney et al. (2003). The authors find some evidence of asymmetry in the effect of health variations: the impact of improving health on transition into economic activity is weaker than the impact of deteriorating health on the transition into inactivity. The study uses data from the first eight waves of the British Household Panel Survey (1991–98) for people aged 50 to 64 in 1991. This survey includes a standard measure of general health status: 'Over the last 12 months and compared with other people of your own age, would you say that your health on the whole has been: excellent; good; fair; poor; very poor; don't know'. In order to avoid potential reporting biases, an instrumental variable ('health stock') is constructed. This variable is calculated from a set of individual characteristics and some more objective health indicators: (1) whether the individual is registered as disabled or not; (2) whether the individual feels that health limits his or her ability to perform the following daily activities compared with most people of his or her age: doing housework, climbing stairs, dressing oneself, walking for at least 10 minutes, and (3) whether the individual does or does not have a series of health problems and disabilities ⁽⁵¹⁾. A reduced form model of labour market activity/inactivity is then estimated using the 'health stock' variable as well as the following variables: age, state pension age reached or not, marital status, regional unemployment rate, house ownership. The model is estimated for individuals that transit the states of economic activity and inactivity, avoiding individuals who may have never worked. The results show that an improvement (or deterioration) of an individual's relative health status is strongly and positively associated with economic activity (or inactivity).

3.3.1.3.3 Responsibility for others: the impact of health on labour supply by those giving care to others

Ill health matters not only for the labour market performance of the individual directly concerned but also for that of his/her household members, who have been found to adjust their labour market behaviour in response to another household member's illness. In the studies reviewed men appear to reduce their own labour supply by substantial amounts in the event of their wives' illness, while in the reverse case women tend to increase their labour supply. This can partly be explained by the unequal

⁽⁴⁹⁾ Marital status and educational status are included among the other explanatory variables.

⁽⁵⁰⁾ England, Wales and Scotland.

⁽⁵¹⁾ These include: problems with arms, legs, hands, feet, back or neck; difficulty seeing; difficulty hearing; skin conditions and allergies; chest or breathing problems including asthma and bronchitis; heart problems and blood pressure or circulation problems; stomach, liver, kidney or digestive problems; diabetes; anxiety, depression or bad nerves; alcohol or drug-related problems; epilepsy; migraine or frequent headaches; other health problems.

distribution of gender roles within the family and the different situation of men and women in the labour market. The availability of health insurance can critically affect the response to a spouse's health conditions.

The deterioration in an individual's health does not only influence his or her own labour force participation, but also the labour force participation of those who care for him/her. The effect on a third person's labour supply is, however, theoretically ambiguous (Coile 2003). On the one hand, if an individual decides to leave work due to deterioration in his or her own health, this could cause a drop in household income that other family members might try to compensate for by increasing their labour supply. This could also be the case if the onset of a health problem increases financial needs (for example, due to increased need for healthcare not publicly provided or for which the individual is not insured). On the other hand, if due to health deterioration an individual needs to be taken care of, other family members may decide to reduce their labour supply or to leave the labour force. The need to care for others could also deter the entrance into the labour market.

In the studies undertaken in the USA, it is important to take account of the fact that a partner leaving employment may have health insurance coverage removed from the whole family, which may be a significant deterrent. It is also important to note that the compensating behaviours of different family members might not make it possible to observe the effect of health on labour supply at the household level. The reduction of labour supply arising from an ill family member might be compensated by healthy family members working (and earning) more. These compensating responses do not, however, come without a cost, as the healthy family member might be giving up competing investments, such as education.

Some studies have focused on the impact of health on a spouse's labour behaviour. For example, the above mentioned study by Jiménez-Martín et al. (1999) found that, for men with wives outside of the labour force, the fact that their wife had a chronic condition increased the probability that they would retire by 13 %. The opposite was the case for women whose husband was inactive, for whom the probability that they would retire reduced by 24 % when the husband had a chronic condition. This study used ECHP data to estimate the impact of spouses' health status on each other's probability of retirement. When both spouses were working in the first year, the probability that both decided to retire in the second year changed from 0.1 % for the reference couple ⁽⁵²⁾ to 5.5 % when the husband had a serious health problem, while it slightly decreased to 0.08 % when it was the wife who had the serious health problem.

Evidence of significant reactions to spousal bad health is found by Charles (1999), using data from the American Health and Retirement Survey (HRS), who reports that men reduce labour supply by substantial amounts in response to their partner's poor health, whereas wives of ill husbands significantly increase theirs. The author explains these results by arguing that husbands and wives specialise in market and home production, and that illness of a partner makes the other take up more of the activity typically done by the ill person. In addition, Berger (1983), using data from the USA, found that a spousal illness increased market work time of women, while reducing market work time of

⁽⁵²⁾ The reference couple has the following characteristics: husband 55 years old and wife 52, none of them with higher education, none unemployed in the initial period, both starting their working lives at 18, with no part-time job, none working in the public sector, none self-employed, living independently and without any other family member. The shares of the household income for the reference couple are: 25 % wife income, 50 % husband income and no capital income.

men. Parsons (1977) finds that men increase home production time and women market work time when a spouse becomes ill, but in both cases these increases come out of leisure time, so they do not imply a reduction in working time by men ⁽⁵³⁾.

Although Coile (2003) does not find a significant effect of health shocks on a spouse's retirement, her results based on American data suggest that this might be partly due to offsetting responses of different groups of people. For example, according to her estimates, if a man's wife has an acute health problem ⁽⁵⁴⁾ and receives disability benefits, the husband's annual labour supply reduces by 813 hours, and he has a 20 % increased probability of leaving the labour force. However, if the wife applies for disability benefits but does not receive them, the husband's work hours rise by 651 hours and his probability of leaving the labour force falls by 22 %. These results suggest that a spouse's labour response is affected by the need to provide health insurance, the presence of other potential caregivers, the importance of the lost income, and the availability of disability benefits.

The results for both the EU and the USA suggest that men and women react differently to spouses' illness, with men generally reducing labour supply and women increasing it. This seems to be related to gender differences in the pattern of occupations of men and women and the availability of insurance and related benefits linked to them. The results obtained by Coile (2003) confirm the role that the availability of these resources plays on the partner's employment decisions.

The reaction to illness of any family member is studied by Roberts (1999) using data from the 1987 US National Medical Expenditure Survey. In this case, it is men who are found to have a higher probability of labour force participation in the presence of mental illness in the family, when this is accompanied by a chronic physical illness, while women's probability of labour participation is not affected. However, for both men and women, the number of weekly hours of work is substantially reduced in the presence of a mentally ill family member when he/she also has difficulties with an ADL ⁽⁵⁵⁾ or is afflicted by an additional physical or mental illness.

The need to care for one's parents is an example of how a family member's health could influence an individual's labour decisions. Ettner (1996) found that care-giving had a large negative impact on the number of weekly hours of work supplied by women providing care to parents residing outside the household. A significant effect was not, however, found when care was provided to disabled parents living at home. But, as noted by the author, the true labour supply effect could have been underestimated as, due to limitations of the data, it was assumed that all children living with a disabled parent provided care. This study is based on data from the 1987 National Survey of Families and Households, which covers non-institutionalised US population aged 19 and over. In order to correct for endogeneity bias, care-giving by parents was instrumented by combining a series of related variables. Also in the USA, simulations by Stern (1996) suggest that caring for an elderly parent reduces the probability of labour force participation by 18–22 %, for both men and women ⁽⁵⁶⁾.

The study of the impact of the need to provide care on women's labour decisions is particularly relevant, as female employment is lower than male employment in all EU countries. Moreover, women are more likely to engage in care-giving (7.2 % look after an old person compared with 3.8 % of men) and provide more time-intensive support than men (between one and two weekly hours more

⁽⁵³⁾ These two studies, Berger (1983) and Parsons (1977), are quoted in Currie and Madrian (1999).

⁽⁵⁴⁾ Heart attack, stroke, new cancer.

⁽⁵⁵⁾ Activities of daily living.

⁽⁵⁶⁾ As quoted in Currie and Madrian (1999).

than the average population in most EU countries). In particular, the probability that someone will be a care-giver is highest among women aged 45–59, 12.1 % of whom look after an old person (Schulz 2004).

Spiess and Schneider (2004), using ECHP data, analyse simultaneous decisions about work hours and care hours taken by women in mid-life (aged 45 to 59) in Europe. Spiess and Schneider estimated the correlation between changes in weekly work hours and changes in weekly care hours over a two-year period (from 1994 to 1996), pooling data for 12 EU countries. Their results show that commencing care-giving and increasing the hours spent on informal care are significantly and negatively correlated with a change in the number of hours worked by women. The opposite effect is, however, not found. Ceasing care-giving or reducing the number of care hours do not have a significant impact on hours worked⁽⁵⁷⁾. This asymmetrical effect suggests that women who reduce work hours or exit from the labour force are not likely to recover after giving up caring activities. There is a difference between northern and southern European countries. Commencing care-giving is negatively associated with women's labour supply in northern European countries, but there is no significant association in southern European countries.

3.3.1.3.4 Methodological issues in estimating the causal effect of health on labour market outcomes

The attempt to detect a causal impact of health on labour market outcomes faces certain methodological challenges, but this is no different from other areas of empirical research in the social sciences. Empirical methodologies — also widely applied in other fields — have been used in the literature in order to separate the effect of health on economic outcomes from the potentially simultaneous impact of economic outcomes on health. Some specific challenges regarding the correct measurement of health in surveys form part of a future research agenda.

Two main issues that arise when trying to estimate the true impact of health on labour market outcomes are: (1) possible reporting errors in the subjective self-reported health measures, and (2) possible endogeneity in the health–labour market status relationship. Both could create estimation biases. As the studies reviewed above show, different strategies and techniques have been proposed to avoid or at least minimise these biases.

Regarding reporting errors, some authors have criticised the use of subjective indicators of health to assess the impact of health on labour force participation, arguing that they do not reflect true differences in health status. The main problem with errors in subjective health measures is that they are not likely to be random, but to depend on a person's labour situation. An individual could, for example, have incentives to declare his/her health worse than it truly is if poor health status gives access to special benefit schemes. A person could also use health to justify his/her behaviour if there is social prejudice against those who do not work but are fit enough to do so (referred to in the literature as the justification bias).

The existence of a justification bias affecting self-assessed health measures has, for example, been suggested by Ahn (2003). He suggests that this might be the reason why the proportion of men reporting disability, bad health and very bad health in Spain is lower in the age group 65–69 than in the age

⁽⁵⁷⁾ It should, however, be noted that the model has a low explicative power.

group 60–64, 65 years being the normal retirement age for men in Spain ⁽⁵⁸⁾. This fall in disability prevalence with age is not found in any other age group, and does not appear for women (who have a lower labour force participation rate and experience less social prejudice against not working). Ahn, however, also suggests that the observed phenomenon might be due to a true improvement in health status of those retired if they are able to devote more time to health-promoting activities or are free from working activities that are detrimental to their health.

The errors linked to the use of subjective health measures can also lead to under-reporting of health problems. In some surveys, the individual is asked directly whether he/she has health problems that limit his/her capacity to work. Individuals with health problems might choose jobs where these problems do not limit their capacity to work, problems that will then not be reported. Despite this, some authors argue that such questions provide better measures of ‘work capacity’ than more objective measures of health, and are therefore more appropriate when trying to assess labour outcomes.

Thus, reporting errors could, in principle, lead to both overestimation and underestimation of the impact of health on labour force participation status.

In addition, the relationship between health and labour market status could be endogenous, as each of them may influence the other or both might be influenced by common third factors. There is no consensus about the direction of the influence of labour status on health. The most common hypothesis in the literature is that due to boredom, a general lack of activity and a low self-esteem, health deteriorates in individuals that exit the labour market. Yet it could also be argued that bad working conditions or work-related stress cause deterioration in health. For example, the study by Kerkhofs et al. (1999), reviewed below, finds that health improves among non-workers. Evidence of a deleterious effect of work on health ⁽⁵⁹⁾ is also found by Stern (1989) and is consistent with recent results by Ruhm (2003), although this is contrary to the extensive evidence of a negative impact of unemployment on health ⁽⁶⁰⁾. As a result of endogeneity, the impact of health on labour force participation could therefore be either underestimated or overestimated, depending on whether working has a negative or a positive effect on health.

A study by Kerkhofs et al. (1999) shows how the size of the estimated effect of health on the retirement decision can vary depending on the health measure used. The authors use a dynamic model for retirement behaviour to analyse the factors underlying the decision to take three alternative routes out of the labour market in the Netherlands: early retirement schemes, disability insurance and unemployment insurance. The retirement model is estimated using panel data on wage income and labour force participation over the period 1991 to 1995 ⁽⁶¹⁾. Health data are obtained from two waves of the CERRA panel survey ⁽⁶²⁾ conducted in 1993 and 1995. This survey provides information on a subjective measure of health ‘does your health limit you in your ability to work?’ and on a more objec-

⁽⁵⁸⁾ According to the ECHP data for 1994. This is a cross-sectional comparison and age and cohort effects might be confounded. However, the author finds unlikely that the cohort effects are the cause of the decrease in disability observed in the age group 65–69.

⁽⁵⁹⁾ In a later study (Lindeboom and Kerkhofs 2002), this is estimated to happen only beyond 25 years of work experience.

⁽⁶⁰⁾ Review of evidence on the impact of unemployment in health by Mathers and Schofield (1998).

⁽⁶¹⁾ For more information see Heyma (1999).

⁽⁶²⁾ CERRA is a Dutch panel survey designed for the analysis of health and retirement issues. The first wave conducted in 1993 included 4 727 households in which the head was between 43 and 63 years old. Both the head of the household and partner, if present, were interviewed.

tive measure: the Hopkins Symptom Checklist ⁽⁶³⁾. Health instruments are also constructed using a health dynamics model estimated on CERRA panel data. According to their estimates, health improves for non-workers, and therefore endogeneity leads to an underestimation of the impact of health on retirement when this effect is not taken into account.

Comparing the results with different health measures, the authors find important effects of endogeneity on the estimates of both the probability of early retirement and the probability of receiving unemployment benefits. The effect of reporting errors in the estimation of these probabilities is, however, negligible. On the contrary, the probability of receiving disability benefits is strongly affected by reporting errors (overestimating the impact of health), while in this case endogeneity plays a minor role. Controlling for the effects of endogeneity and reporting errors, health is found to be highly significant and the dominant factor explaining the receipt of disability and unemployment benefits ⁽⁶⁴⁾. In the case of early retirement, after controlling for the impact of endogeneity, health is also found to have an important effect (significant at the 10 % level), although the financial incentives seem to be the most important factor in the decision to retire early.

Bound (1991) shows that neither self-reported measures nor more objective measures of health provide unbiased estimates of the impact of health on labour force participation of older men. However, the biases that result from both types of measures go in opposite directions (overestimation in the case of subjective health measures and underestimation using mortality information). The author therefore suggests that both types of measures could be used to obtain a high and low bound of the real effect of health on labour force participation. His estimates are based on data from the US Retirement History Survey covering the years 1969–79.

Most of the studies on the impact of health on labour force participation in developed countries use self-reported indicators of health, as these are the most widely available. There is no consensus in the literature about whether the use of these measures leads to significant biases in the estimates, and about the direction of these biases. However, when assessing the estimates of the impact of health on labour supply in any particular study, one must keep in mind that these ‘estimates may be very sensitive to the measure of health used, and to the way in which the estimation procedure takes account of potential measurement error’ (Currie and Madrian 1999).

3.3.2 The impact of health on education

Human capital theory predicts that more educated individuals are more productive (and obtain higher earnings). Good health in childhood enhances cognitive functions and reduces school absenteeism and early drop-outs. Hence, children with better health can be expected to reach higher educational attainments and be therefore more productive in the future. Moreover, healthier individuals, with a longer lifespan in front of them, would have greater incentives to invest in education and training as they can harvest the associated benefits for a longer period. While theoretically plausible and empirically supported in the case of developing countries, there has been relatively little work exploring

⁽⁶³⁾ This test includes 57 questions, the responses to which provide a mental score, a physical score and a total health score. This study uses the total health score.

⁽⁶⁴⁾ Other factors considered are: gender, married or not, educational level, white collar worker or not, age, replacement rates of three alternatives schemes (early retirement, disability insurance and unemployment insurance), and calendar time effects.

this link in high-income countries. Nevertheless, there is reason to believe that at least part of the association between health and education is due to a casual impact of the former upon the latter.

A large body of literature has provided evidence of a strong positive correlation between adult health and education (Freedman and Martin 1999). Most of the studies have attributed this correlation to the impact of education on health outcomes. This explanation corresponds to the prediction by Grossman (1972) who assumes that education increases the efficiency of producing health (and other goods), and that more educated people would therefore choose higher levels of health capital.

Strauss and Thomas (1998), for example, found that among men between 25 and 34 years, a 10 cm gap in height was associated with one additional year of schooling in the USA (a 8 % increase) and 1.5 years in Brazil (a 25 % increase) ⁽⁶⁵⁾. Perri (1984) estimates the number of completed years of schooling using a simple model of schooling choice that maximises lifetime earnings, considering health status as an exogenous variable and earnings dependent on both health status and education. Using data from the US National Longitudinal Survey of Male Youth for 1971, and the index of functional limitations constructed at Ohio State University ⁽⁶⁶⁾, the author distinguishes four categories of health status. Those individuals with health problems limiting their activities are classified, according to functional limitations, as having: ‘fair’, ‘moderate’ or ‘poor’ health. Most of them fall under the ‘fair’ category. Individuals without health problems are categorised as having an ‘excellent’ health. Perri finds that having a limiting health problem reduces the probability that an individual will be enrolled in school by 5–6 %. This probability is reduced by 25 % for those who have poor health compared with individuals in excellent health, and by 19 % for those in moderate health ⁽⁶⁷⁾. Regarding the effect on the years of schooling, the author estimates that those in poor health have on average 2.4 years less of schooling completed than those in excellent health, those in moderate health 1 year less, and those in fair health 0.3 years less ⁽⁶⁸⁾. Adult men with limiting health problems have on average 0.7 years less of schooling than those with no health limitations. The results of these studies do not, however, allow us to infer a causal relationship running from health to education.

A study by Berger and Leigh (1989) examined the alternative explanations for the observed positive correlation between schooling and good health. First of all, the authors used data from the US National Longitudinal Survey of Young Men (NLS), which included a sample of men aged between 14 and 24, to estimate the number of completed years of schooling in 1976 on the value in 1966 of a number of variables ⁽⁶⁹⁾, which included a measure of ‘whether health limits work, school, or other activities’. Berger and Leigh found a significant and negative impact of poor health in 1966 on the number of completed years of schooling in 1976. This suggests that part of the correlation between schooling and health is due to the fact that those who are less healthy invest less in schooling.

The authors were particularly interested to test the hypothesis that the strong correlation between schooling and good health might be because both are influenced by some common unobserved factors like genetics, personality or preference variables (such as rate of time discount). To do so, they

⁽⁶⁵⁾ US data from the second National Health and Nutrition Examination Survey (1976–80). Data for Brazil from the ENDEF (National Study of Family Expenditure) conducted in 1974–75.

⁽⁶⁶⁾ Center for Human Resources Research.

⁽⁶⁷⁾ Also controlling for age and proxies of family earnings.

⁽⁶⁸⁾ Controlling for age and proxies of family earnings.

⁽⁶⁹⁾ Other variables include: age, marital status, race, household size, whether the individual is a household head, whether he lives in an SMSA (standard metropolitan statistical area), ability measures, and measures of family background.

estimated health status in 1976 in two different ways: (1) using an instrumental variable for the level of schooling, and (2) using a self-selection model that allowed separating the partial effect of schooling on health from the effect of common unobservable factors (affecting both health and schooling) on health. Two measures of health status were available in the NLS ⁽⁷⁰⁾ for year 1976: a measure of presence or absence of functional limitations, and a measure of presence or absence of work limiting disabilities.

Both the effect of the predicted value of schooling (using an instrumental variable) and the partial effect of schooling (using the 'self-selection model') are found to be significant and have a negative effect on the two measures of health limitations. This effect is only slightly lower (between 11 and 29 % lower) than what results using directly the number of completed years of schooling observed in 1976. Moreover, the impact of other common variables on health, and of their interaction with schooling, is found to be insignificant. The authors therefore conclude that the direct effect of schooling on health is more important than the effect of unobserved third variables, such as the rate of discount. Their conclusion corresponds to the findings in a study by Fuchs (1980), according to which the effect of time preference on health behaviour and health status was not always significant, and, even when statistically significant, was frequently small.

Using data from Great Britain, Case et al. (2004) find that children with poor health have significantly lower educational attainment. Exploring alternative explanations for the widely documented positive association between good health and higher economic status in adulthood, these authors analyse the impact of health and economic circumstances in childhood on adult health, employment and socioeconomic status. One of the channels the authors explore is precisely the impact of health on educational attainment. Their study makes use of the panel data from the 1958 National Child Development Study (NCDS), which followed all children born in Great Britain (Scotland, England and Wales) ⁽⁷¹⁾ in the week of 3 March 1958 from birth until age 42, with follow up interviews conducted also at ages 7, 11, 16, 23 and 33.

The measures of prenatal and childhood health used are: low birth weight (less than 2 500 grams), indicators of how much the child's mother smoked during pregnancy (moderately, heavily, variable), the number of physician-assessed chronic health conditions observed at ages 7 and 16 (differentiating between physical impairments, mental and emotional conditions, and other 'systems' conditions), and height at age 16. For this analysis, the measure of education used is the number of O-level (school) exams passed at age 16 ⁽⁷²⁾. Controlling for different factors of family background and for the height of the child's mother and father, Case et al. find that children with low birth weight passed on average 0.5 fewer O-level exams. A mother's smoking during pregnancy is also associated with significantly fewer O-level passes, 0.4 fewer for heavy smokers.

Each chronic condition at age 7 is associated with a 0.3 reduction in the number of O-levels passed, and each condition at age 16, with an extra 0.2 reduction. Height at age 16 has a significant and positive relation with the number of O-level exams passed. Mental and emotional conditions in childhood are, among the three types of conditions distinguished, those more strongly related with educa-

⁽⁷⁰⁾ The authors conducted the same estimates on a second set of cross-sectional data, on which we do not report here. The results with this second data set were similar to those reported here.

⁽⁷¹⁾ There has been attrition from the original sample of 17 409 children. Around 700 children born during the same week who immigrated to Great Britain prior to age 16 have also been added to the survey.

⁽⁷²⁾ Information on the British school system can be found in the appendix of Case et al. (2004).

tional attainment, as measured by the number of O-level exams passed. The authors note that estimates done with other measures of educational outcomes (passing the English O-level at age 16, passing the Math O-level at age 16, and the highest educational qualification at age 23) yield very similar results.

The same UK data set is used by Gregg and Machin (1998), who among other things estimate the effect of whether a child has ever been sick (because of ‘minor ailments’ or because of ‘more serious ailments’) in the last school year (age 15–16) on two outcomes: school attendance in the autumn term and the probability of staying on at school after the compulsory school leaving age. The authors find that for both males and females, not only is school attendance lower for those who were ever sick, what might seem more obvious, but also that having suffered either minor or more serious ailments in the last school year reduced the probability of staying on at school after compulsory school leaving age.

The relationship between health in childhood and cognitive development has been the subject of several studies in the USA. Edwards and Grossman (1980) find a significant correlation between two indicators of cognitive development (an IQ measure, and a measure of school achievement) and several health indicators. The authors use cross-sectional data from the Cycle II of the Health Examination Survey (HES) which covers children aged 6 to 11 years over the period 1963–65. They estimate the effect of 13 health-related dimensions (four related to past health status and nine related to current health status) on two measures of the children’s cognitive development. The impact of a series of non-health variables ⁽⁷³⁾ is controlled for.

Their results show a significant correlation between the two measures of cognitive development used (the IQ measure and the measure of school achievement) and the following health-related variables: low birth weight (negative), being breast-fed (positive), having a ‘significant abnormality’ ⁽⁷⁴⁾ (negative), height (positive effect), and the number of decayed teeth (negative). The measure of school achievement was also found to be significantly and negatively correlated with having hearing problems and with health being assessed as poor or fair by the child’s parents. Finally, the IQ measure was lower for children whose mother was younger than 20 years at birth and higher for those whose mother was older than 35 years compared with those whose mother was between 20 and 35 years old.

However, as noted by the authors, these findings cannot be interpreted as evidence of a causal relationship running from health to cognitive development, for at least the following three reasons: (1) the results might be partially due to causality running from cognitive development to health, (2) the relationships could be due to third factors (genetic or environmental factors) omitted from the analysis, and (3) some of the health indicators used might be proxies for other non-health related factors (for example, breast-feeding could be a proxy for mothers’ allocation of time to children).

Using a longitudinal sample of children and adolescents ⁽⁷⁵⁾, Shakotko et al. (1980) find a significant negative effect of having one or more significant health abnormalities ⁽⁷⁶⁾ and of high diastolic blood pressure in childhood, on the IQ measure in adolescence. The authors compile data from a 1963–65

⁽⁷³⁾ Sex of the child, whether the child is the first born in the family, whether the child is a twin, whether the child attended kindergarten or nursery school, size of the family, years of formal schooling completed by the mother and by the father, labour force status of the mother, family income, whether a foreign language is spoken at home, region of residence, and size of place of residence.

⁽⁷⁴⁾ Significant abnormalities reported by the examining physician include heart disease (congenital or acquired); neurological; muscular, or joint conditions; other congenital abnormalities; and other major diseases.

⁽⁷⁵⁾ Compiled from two nationally representative cross-sections of children: Cycles II (years 1963-65) and III (years 1966-70) of the Health Examination Survey (HES).

⁽⁷⁶⁾ Heart disease; neurological, muscular, or joint conditions; other major diseases.

survey and a 1966–70 survey. Individuals in the sample are aged between 6 and 11 years in the 1963–65 period and between 12 and 17 years in the 1966–70 period. The authors use the same two measures of cognitive development as Edwards and Grossman (1980): an IQ measure and a school achievement measure. Using an ordinary least squares regression method, this paper estimates the measures of adolescent cognitive development on measures of childhood health, childhood cognitive development, and on a series of variables regarding family background.

The authors also regress adolescent health on several measures of childhood health, childhood cognitive development, and family background. Their analysis finds that higher school achievement in childhood is significantly and positively correlated with health in adolescence for four out of six health indicators used ⁽⁷⁷⁾. Two indicators of health in childhood ⁽⁷⁸⁾ (out of six) are also significantly correlated to the measure of IQ in adolescence. The authors therefore conclude that there is feedback both from health to cognitive development and from cognitive development to health, but that the latter of these relationships seems stronger. Their results suggest that there is a continuous interaction between health and cognitive development over the life cycle. The authors also find a significant and strong positive correlation between cognitive development in childhood and cognitive development in adolescence.

In a more recent study conducted in a large north-eastern city in the USA, Del Gaudio Weiss and Fantuzzo (2001) find that two health risks (low birth weight and lead poisoning) increased the risk of poor school adjustment in children of first grade. The study was done on a sample of 9 088 students enrolled in first grade during 1995–96. The mean age of the students at the end of first grade was 7.1 years. The authors sought to examine the relationship between seven risk factors (three related to the child's health and four related to the child's caretaking environment) on the adjustment of children to the first year of elementary school.

According to the authors, it is relevant to look at early achievement, as the patterns of educational achievement are quite stable over time, and 'early school achievement patterns are likely to persist'. For each of the risk factors under analysis, the authors choose a threshold beyond which a child is considered to be at risk. The health risks studied are: low birth weight (less than 2 500 gr.), lead poisoning (10 µg/dl of lead in blood), and the Apgar score ⁽⁷⁹⁾ (risk at scores ≤ 6). The indicators of school adjustment used are: an indicator of school performance, an indicator of school behaviour, grade retention (not meeting the criteria to pass first grade at the end of the year) and an indicator of school attendance ⁽⁸⁰⁾. Controlling for age and poverty concentration in the child's area of residence, logistic regression analyses were conducted for each of these outcome variables. The results suggest that low birth weight increases the probability of poor academic performance by 34 % and of grade retention by 32 %. Moreover, lead poisoning increased the probability of poor school behaviour by 16 %. On the contrary, risk as measured by the Apgar score was found to have a positive impact on

⁽⁷⁷⁾ A periodontal index; the presence or not of one or more significant abnormalities as reported by the examining physician; parent's assessment of the adolescence overall health; and excessive school absence for health reasons during the past six months or not.

⁽⁷⁸⁾ As mentioned previously, these were: having one or more significant abnormalities and having high diastolic blood pressure.

⁽⁷⁹⁾ The five-minute Apgar score is a measure that discriminates infants in need of resuscitation at birth from those who do not need medical intervention. Newborns are rated on five physical signs and scores range from 0 to 10.

⁽⁸⁰⁾ An indicator of presence or absence of 'special education' was initially also included, but there were very few children receiving this sort of education, and no risk factor appeared as significant.

school behaviour, reducing the probability of poor school behaviour by 50 %. None of these health risks was, however, found to have a significant effect on school attendance.

The evidence presented here suggests that, although the strong positive correlation between health and education might be mostly due to the impact of education on health, at least part of this relationship could be due to the impact of health on education, mainly through the effect of health conditions in childhood in cognitive development. This provides an additional argument in favour of investing in children's health.

3.3.3 The impact of health on saving

It is highly plausible that savings will increase with the prospect of a longer and healthier life. The idea of planning and, hence, saving for retirement would be expected to occur only when mortality rates become low enough for retirement to be a realistic prospect. Some work confirms such an effect in the case of developing countries. In the high-income country context, our review found comparatively little published research in this area ⁽⁸¹⁾.

As Smith (1999) argues, there would be important insights to be gained from studying the effect of health on savings behaviour, for 'as people age, the evolving variation in their health offers statistical information to estimate parameters of household savings and consumption behaviour that so far have proven to be somewhat elusive' (Smith 1999, p. 146). Given the relative shortage of empirical literature on this issue, we limit ourselves to a brief description of the main potential channels that could account for an impact of health on saving, and complement this by some empirical illustration.

Arithmetically, savings would fall as current health deteriorates because poor health reduces current period income or increases either consumption or out-of-pocket medical expenses. A striking result of a study reported by Smith (1999) is how modest out-of-pocket medical costs are for the average person in a high-income country, such as the USA, and how relatively insensitive costs are to the onset of even serious illnesses, in contrast to the situation in low-income countries.

Individuals or households may well adjust in more subtle ways to present or anticipated changes in health. If the marginal utility of consumption is a function of health status (i.e. the utility of consuming one additional unit increases with the health status), then individuals will seek to consume more when they are healthy than when in ill health. If so, savings will rise when the prospect of poor health increases ⁽⁸²⁾.

Some households may also adjust to new or anticipated health events not by reducing current or future consumption, but instead by decreasing financial transfers to their heirs. This hypothesis finds some initial empirical support in the US context. More than half of the survey respondents in poor health report they are certain they will not leave an inheritance larger than USD 10 000, while more than half of households in excellent health are just as certain that they will leave such an inheritance (Smith 1999).

⁽⁸¹⁾ Some exceptions are Hubbard et al. (1994), Lillard and Weiss (1996), and Palumbo (1998).

⁽⁸²⁾ Whether or not the marginal utility of consumption is increasing in health is an empirical question though, and different authors have found conflicting results (see Smith 1999).

The onset of ill health may also affect savings by reducing the amount of labour supplied. This channel takes the abovementioned impact of ill health on labour supply one step further. In the research by Smith (1999), the labour supply effect accounted for a substantial amount of the income effect caused by a new and severe health problem.

Overall, the evidence presented in this section does support the hypothesis of a positive economic impact of health on economic outcomes on the individual or household level. Certain methodological challenges remain, such as the ‘right’ measurement of health, or the question of how to tackle endogeneity, but they are not very unique to this field of research and there are ways of overcoming them. The following section turns to the review of the macroeconomic evidence.

3.4 The impact of health on the macroeconomy

The key question for this book is whether the micro effects discussed above translate into an aggregate effect on the country level in terms of GDP or the GDP growth rate. This will be discussed in the subsequent sections. The first section looks at the contribution of historic achievements to contemporary economic wealth, as reported by more or less quantitative studies of single countries. The second section reviews the results of studies that have used more extensive quantitative methods in order to determine the contribution of health to economic growth across a larger set of countries.

3.4.1 The impact of historic health improvements in determining contemporary national wealth

Historical studies exploring the role of health in a specific country over one or two centuries have shown that a large share of today’s economic wealth is directly attributable to past achievement in health.

Several important historical studies have examined the contribution of health improvement to the economic development of one or more countries over one or two centuries. This approach has been pioneered by the Nobel laureate Robert Fogel ⁽⁸³⁾. While a description of the detailed methods used goes beyond the scope of this book, for our present purposes the key finding is the overwhelming strength of evidence that health has made a substantial contribution to the current level of economic development in industrialised countries.

Fogel (1994) reported that improvements in health and nutrition have accounted for about 30 % of income growth in the United Kingdom, or about 1.15 % per capita per annum in the 200-year period from 1780 to 1980. The author pointed out that what he terms the average efficiency of the human engine in the United Kingdom, by which he meant the ability to convert energy into work, increased by about 53 % between 1790 and 1980. He concluded that the combined effects of the increase in dietary energy available for work (as less was required for domestic tasks), and of increased human efficiency in transforming dietary energy into work output, to account for about 50 % of the British economic growth since 1790.

In a more recent study, Arora (2001) argues that the assessment of the influence of health on economic growth requires longer sample periods. The author investigates the influence of health ⁽⁸⁴⁾ on the

⁽⁸³⁾ For an overview, see for example Fogel (1997).

⁽⁸⁴⁾ The author used the following five health-related variables: life expectancy at: birth; 5 years old; 10 years old; 15 or 20 years old; and stature at adulthood.

growth paths of 10 industrialised countries over the course of 100 to 125 years. The countries and the time spans selected are Australia (1881–1994), Denmark (1870–1992), Finland (1881–1992), France (1870–1994), Italy (1875–1992), Japan (1891–1994), Netherlands (1880–1992), Norway (1870–1992), Sweden (1870–1994) and the United Kingdom (1871–1992). Arora concludes that improvements in health increased the rate of growth in these countries by 30 to 40 %, altering permanently the slope of their growth paths.

3.4.2 Health as a determinant of economic development

Health — typically measured as life expectancy or adult mortality — emerges as a very robust and sizeable predictor of subsequent economic growth in virtually all studies that have explored the issue in explaining differences in growth between rich and poor countries. Researchers have focused much less on investigating the specific role of health in economic growth in high-income countries only, and in the few cases in which this was done, health was not always found to be positively related to economic growth, and in some case there was even a negative relationship. We attribute these results partly to the use of health indicators that imperfectly capture the existing health differences between high-income countries. This is confirmed by a very recent analysis showing that if cardiovascular disease mortality is used as a health proxy, health does matter significantly for subsequent economic growth in high-income countries. The institutional policy framework in high-income countries, in particular through the definition of the retirement age might also prevent health (of the elderly) from making its full beneficial impact on economic growth in high-income countries.

If, as was shown above, health is a major determinant of long-term economic growth, to what extent are contemporary differences in the wealth of nations attributable to health? There are essentially two methods that have been employed to assess empirically the macroeconomic impact of health gain: the aggregate production function approach (which seeks explanations for variations in per capita income) and the economic growth regressions approach. The aggregate production function approach is an adaptation of the firm-level production function at the national level. Obviously, this assumes that there exists an aggregate production function that works in a similar way as the firm level production function ⁽⁸⁵⁾.

The economic growth regression approach is rooted in the broader literature on the determinants of economic growth (see Barro and Sala-I-Martin (1995) for an overview) and has a more solid theoretical foundation than the production function approach. Most of the studies use a global sample, including rich and poor countries. The volume of this research focusing specifically on health as a determinant of growth in rich countries is rather limited and there remains significant scope for further research.

Nearly all studies that have examined economic growth using one of these two methods have found evidence of a positive, significant and sizeable influence of life expectancy or adult mortality (or other health indicators) on the subsequent pace of economic growth (see, for example, Barro 1996,

⁽⁸⁵⁾ Some of the production function studies reviewed below regress changes in the level of income (hence growth rates) on changes in the independent variables. This is, however, equivalent to the estimation of levels controlling for country-specific fixed effects, and it does therefore not make these studies comparable to proper economic growth studies.

Barro 1991, Barro and Lee 1994, Barro and Sala-I-Martin 1995, Bhargava et al. 2001, Easterly and Levine 1997, Gallup and Sachs 2000, Sachs and Warner 1995, and Sachs and Warner 1997)). In some studies, initial health even seems to be a better predictor of subsequent growth than is initial education (Barro 1996).

While potentially delivering more powerful results, growth regression studies tend to suffer from problems of multi-collinearity, leading to a large variation in the significance and size of the coefficient estimates. Hence, in the economic growth literature only very few variables have been found to be robust predictors of economic growth. In these circumstances, it is especially notable that two prominent studies that have attempted to identify robust determinants of growth did find life expectancy to be part of this 'exclusive' set of variables (Levine and Renelt 1992, and Sala-I-Martin et al. 2004).

As is noted above, most of these studies include rich and poor countries at the same time. Their findings may or may not be directly applicable to rich countries alone. Below we review in more detail the results of a selection of key studies that have used a global sample. A few of these studies find important differences in the relationship between health and economic growth in poor and rich countries, although some find evidence of a negative impact of certain health indicators on economic growth (or on income) in high-income countries but not in low- and middle-income countries. As we argue below, however, such a result cannot lead us to conclude that health is bad for growth in high-income countries for the reasons below.

- The global studies did not specifically examine economic growth in high-income countries.
- Where health indicators do seem to be negatively associated with economic growth in high-income countries, this may be because increasing health in these countries increases the share of people beyond retirement age, i.e. those outside the formal labour force, which in turn puts a burden on public budgets and thereby might indirectly hamper economic growth prospects. If so, then the reason for the negative economic impact of health is not improved health per se, but the consequence of having a too early retirement age. Should retirement age be increased, bringing more and healthier older people into the workforce, this would most likely allow health to 'deliver' its positive impact on the labour market and on the economy.
- The most plausible explanation for the surprising finding that there may be a negative impact of health on the economy is that it is an artefact, related to the choice of health indicator. It is apparent that life expectancy and adult mortality vary more widely among low- and middle-income countries than in high-income countries where there is some evidence of convergence at a high level. It is perhaps no great surprise that if the chosen health indicator varies little between the sub-samples of rich countries, then it can hardly have much of an explanatory power. A serious examination of the role of health in rich countries clearly requires the use of health indicators that are better able to discriminate between levels of health among these countries.

A few studies have focused specifically on high-income countries. These will be reviewed further below. There we shall also present the results of so far unpublished work by some of the authors of this book, which seeks to address specifically the latter point.

3.4.2.1 Macroeconomic studies using a worldwide sample of countries

The cross-country studies of the impact of health on income levels and growth rates, as stressed by Strauss and Thomas (1998), date back to the first of the World Bank's reports on poverty (World Bank 1980). In 1993, the World Bank's World Development Report 'Investing in health' (World Bank

1993) reported strong economic effects of health using an aggregate production function methodology. More recent studies have examined the impact of life expectancy on economic growth in a worldwide set of countries (see, for example, Barro 1996, Sachs and Warner 1997, and Bloom and Williamson 1998), consistently finding strong positive effects of improved health on economic development.

Using a panel data set from about 100 countries for the period from 1960 to 1990, Barro (1996) has identified the following variables as being the most powerful predictors of subsequent economic growth: lower initial GDP; initial human capital, measured by male secondary and higher schooling and life expectancy; lower fertility rate; lower government consumption ratio; rule of law; terms of trade; and a lower inflation rate. In particular, Barro detected a significantly positive effect of health (measured by life expectancy) on economic growth, and the size of the effect even appeared to be bigger than the effect of education. Holding the other factors constant, a rise in life expectancy from 50 to 70 years (i.e. by 40 %) would raise the growth rate by 1.4 percentage points per year. Barro also notes that the link between overall health status and subsequent economic growth runs both ways. Better health tends to enhance economic growth in various ways. At the same time, economic advance encourages further accumulation of health capital.

From the work of Barro and other related research, it can be surmised, if all other conditions are equal, a five-year advantage in life expectancy will give a country 0.3 to 0.5 % higher annual growth of GDP than its less healthy counterparts. This would represent a significant boost to growth, given that in the last 25 years, average per capita income growth in the world has been only 2 % per annum (Zamora 2000).

Essential evidence on the potential effect of health investment on economic growth has been provided by Bloom, Canning and Sevilla (Bloom et al. 2001, Bloom and Canning 2000). Their main conclusion is that good health has a positive, sizeable, and statistically significant effect on aggregate output for a broad range of countries. They extend the conventional production function model by including work experience and health (in addition to education) ⁽⁸⁶⁾ and analyse panel data for GDP for 104 countries for every 10 years from 1960 to 1990. The researchers use life expectancy as a proxy for health of the workforce. A key finding of their research is that a one-year improvement in a population's life expectancy contributes an increase of 4 % in GDP. They stress that this is by most standards a very large effect, indicating that increased expenditures on improving health might be justified purely on the grounds of their impact on labour productivity. However, the authors note that accounting for economic growth is only the first stage in explaining the effect of health on the economy.

⁽⁸⁶⁾ The approach used by Bloom et al. is to include health in a well-specified aggregate production function in an attempt to test for the existence of a true effect of health on labour productivity, and to measure its strength. However, because human capital is multidimensional, the model of growth has to include all its major components, in order to ensure that the contribution of a single component is not overestimated. For this reason, the authors of the model added work experience to the model, because considerable microeconomic evidence indicates that it has an impact on workers' earnings (see, for example, Mincer 1974). The macroeconomic measures of health and work experience have been constructed to examine whether microeconomic evidence of their importance as forms of human capital carries over to a significant, positive macroeconomic impact. Other studies use a similar approach as Bloom et al. (2001, 2002). Strauss and Thomas (1998) list several studies where microeconomic evidence is used on factor shares and the effect of human capital on wages to calibrate production function models of aggregate output (Klenow and Rodriguez-Clare 1997, Prescott 1998, Weil 2004, Young 1994, 1995).

Bhargava et al. (2001) use adult survival rates (i.e. essentially the inverse of adult mortality rates) between ages 15 and 60 as a health proxy in order to assess the effect of health on economic growth in a worldwide panel data set for the period 1965 to 1990. A novel aspect of the analysis is that the authors are sensitive to potential non-linearities in the relationship between health and economic growth. By interacting the health proxy with per capita income, they detect a threshold income level beyond which adult survival rates may have negligible or even negative effects on growth rates. Below the threshold income level, i.e. for the poorest countries, a 1 % improvement in the adult survival rate was associated with an approximate 0.05 % increase in the growth rate. Beyond the threshold income, i.e. for developed countries, the estimated effect of adult survival rates on growth rates tends to be negative.

Jamison et al. (2004), using data from more than 50 developing and developed countries, conclude that improvements in health (as measured again by the adult survival rate) accounted for about one tenth of economic growth in the period 1965–90 ⁽⁸⁷⁾. Countries with initially high levels of adult survival typically achieved a more modest contribution to their growth rates from health improvements than did countries with an initially lower initial adult survival rates. Decomposing income growth into its sources, the authors find that increases in physical capital stock dominate (accounting for 67 % of total growth) but both educational improvements (14 %) and health improvements (11 %) make up for an important share, too. Jamison et al. (2004) find diminishing returns from investment in health, consistent with the previously reported ones by Bhargava (2001). However, as the authors pointed out, these results should be interpreted with some caution for several reasons. First, lack of data on morbidity or disability required use of mortality rates as a proxy for overall health conditions but it is plausible that changes in morbidity may also be significant for income growth while they are only partially correlated with mortality decline and they might lag mortality decline. Second, health improvements above age 60 are likely to be important (in terms, for example, of age of retirement) and may show scope for significant improvement well after the adult survival rate has reached high levels.

Knowles and Owen (1995) examined the effects of incorporating a proxy for health capital in a human capital-augmented economic growth model ⁽⁸⁸⁾. A sample of 84 countries is used in the model. The results show a strong and relatively robust relationship between life expectancy, as a proxy for health capital, and income per capita.

Brinkley (2001) examines the health–wealth causality for the US only. GNP data since 1900 is used as a proxy for wealth and are tested against four health variables, namely life expectancy, infant mortality rates, crude death rates, and investment in medical research ⁽⁸⁹⁾. The author tested both hypotheses: that health triggers wealth and that wealth causes health. The results are unequivocal — for all four health variables, the causal pathway runs from health to wealth. Given the long observation period, which is, depending on the variable, from 1900, 1915 or 1948 until 1991, Brinkley considers his results as highly robust and thus he concludes that governmental intervention should not focus on pro-growth but rather on health-enhancing policies. Improving health thus becomes key to creating the conditions for sustainable economic growth.

⁽⁸⁷⁾ Data are extracted from PWT, version 5.6, WDI (World Bank 2001).

⁽⁸⁸⁾ The basic data set is the one used in Mankin-Romer-Weil (MRW).

⁽⁸⁹⁾ Granger-causality framework is applied.

3.4.2.2 Macroeconomic studies focusing on high-income countries

Very few studies have focused on the role of health in determining income levels or economic growth in high-income countries specifically. Exceptions include Knowles and Owen (1995), Knowles and Owen (1997), Rivera and Currais (1999a, 1999b) and Beraldo et al. (2005). Knowles and Owen use life expectancy as a proxy for health in the sub-sample of 22 high-income countries they specifically examine and find an insignificant impact of that health indicator on economic growth (Knowles and Owen 1995) and on the level of per capita income (Knowles and Owen 1997). The panel estimates used by the authors span the period 1960–85. As Tompa (2002) argues, the insignificant result is most likely due to the very limited variability of life expectancy within the sample of rich countries.

In contrast, Rivera and Currais (1999a, 1999b) and Beraldo et al. (2005) ⁽⁹⁰⁾ use health expenditures (as a share of GDP) as proxies for health in OECD countries. All three studies find a statistically significant impact of health expenditures on economic growth and on income levels. While the authors make a case in favour of their health proxy, at the same time it must be recognised that health expenditures are a rather questionable proxy for health in high-income countries. They are not closely correlated with the more usual measures of health such as life expectancy and child mortality, and it is perhaps questionable whether the marginal dollar spent on medical care translates into morbidity reductions (Tompa 2002).

Bearing these reservations in mind, the results are nevertheless important. Beraldo et al. (2005) find the role of spending on health to explain a much larger share (between 16 and 27 %) of growth rates than expenditures on education (around 3 %). Similar results are found by Rivera and Currais (1999a, 1999b). Taking the results at face value this suggests that (a) investing in health contributes to economic growth even in countries that presumably already have a high health status, and (b) investing in health is at the very least as important, if not more important, a contributor to economic growth than investing in education.

There is also a slightly different interpretation of these results, offered in particular by Beraldo et al. (2005). Health (and education) expenditures may be seen as proxies for the size of the welfare state. According to Beraldo et al., the result of a positive impact of health (and/or education) expenditures on economic growth in high-income countries would therefore be consistent with the hypothesis that the contribution of welfare expenditures more than compensates for the distortions caused by the tax system ⁽⁹¹⁾. It may be worth elaborating on this interpretation and the highly controversial policy implications that flow from it, such as the question of whether the welfare state is good for growth.

Mainstream economic reasoning would forcefully deny such a beneficial effect, because the financing of the welfare state occurs via taxation, and taxation distorts the optimal allocation of goods, imposing an efficiency loss upon the economy. Everyone would be better off, so goes the standard argument, if the tax burden were to be reduced. On the other hand, as Atkinson (1995) suggests, this argument is in itself somewhat ‘distorted’, as it highlights only one side of the coin. In fact, through the revenues generated via taxation, the welfare state makes available potentially productive public expenditure that could reasonably have a positive impact on people’s health, skills and knowledge, and, through this channel, on economic growth.

⁽⁹⁰⁾ Beraldo et al. (2005) use a panel of 19 OECD countries for the period from 1971 to 1998. They apply a production function approach.

⁽⁹¹⁾ This interpretation brings the results very close to the findings and interpretations of Lindert (2004). For the theoretical arguments supporting the hypothesis, see also Atkinson (1995).

Naturally, it is important not to assume that all public expenditures traditionally included under the definition of the welfare state would have a positive effect on human health (and skills). The argument should not be extrapolated to justify massive levels of taxation and public expenditures. At the same time, the recent remarkable economic performance of some of the Nordic European countries tends quite convincingly to reject the hypothesis that high taxation and public expenditures inevitably represent a brake on dynamic economic development.

Recent and ongoing work by Suhrcke and Urban (2005) has taken a different line in assessing the role of health in economic growth in rich countries. Starting from the notion that non-communicable diseases (NCDs) characterise the health pattern in high-income countries better than in low-income countries, they asked what the role of the most important NCD, i.e. cardiovascular disease (CVD), would be in determining economic growth. Using panel regressions for the period 1960 to 2000 for a worldwide set of countries, they find that, when focusing on the sample of 26 high-income countries, CVD mortality (of the working-age population) turns out to be a robust predictor of subsequent economic growth. In one specification, a reduction of CVD mortality at working age of 10 % is associated with an increase in the growth rate of per capita GDP by 1 percentage point ⁽⁹²⁾.

These results underline the need to look for more appropriate health indicators when trying to assess the impact of health on economic growth in rich countries. The mortality rate from CVD appears to be one such indicator, not least because it displays more variability among the high-income country group than does life expectancy. Other health indicators, for instance mental illness or morbidity indicators, might also be important in the rich country context (Tompa 2002).

3.5 The direct impact of the health system on the economy: an accounting approach

While there is a direct effect of health on the economy as described in the previous section, there is also an impact of the health system on the economy irrespective of the ways in which the health system directly affects health. The health sector ‘matters’ in economic terms simply because of its size. It represents one of the most important sectors in developed economies, representing one of the largest service industries. Currently its output accounts for about 7 % of GDP in the EU-15, larger than the roughly 5 % accounted for by the financial services sector or the retail trade sector ⁽⁹³⁾. Through its sheer accounting effect, trends in productivity and efficiency in the health sector will have a large impact on these performance measures in economies as a whole. Moreover, the performance of the health sector will affect the competitiveness of the overall economy via its effect on labour costs, labour market flexibility and the allocation of resources at the macroeconomic level.

The economic importance of the health sector can be further illustrated by its direct labour market effect. According to the Eurostat Labour Force Survey, the share of persons employed in the health and social sector represented 8.8 % of all people employed in the EU-15 and 9.3 % of all those employed in the EU-25 in the second quarter of 2003 ⁽⁹⁴⁾. As Table 7 shows, employment figures in the health and social care sectors are growing in the USA and in Europe, even if rates of change vary significantly across countries.

⁽⁹²⁾ When looking at the sample of low- and middle-income countries only, the impact of CVD working-age mortality becomes insignificant. This is the converse result of other studies that have used life expectancy (e.g. Knowles and Owen 1997) which found a significant positive impact in the low- and middle-income sample, but an insignificant one in the high-income sample.

⁽⁹³⁾ O’Mahony and Van Ark (2003).

⁽⁹⁴⁾ For similar analysis and figures, see also Buchegger and Stoeger (2003).

Table 7 – Growth in number employed and hours worked in the health and social work sector

	USA	EU-15	France	Germany	Netherlands	UK
Growth in total number employed, average % per annum						
1979–90	3.9	2.7	2.3	3.6	2.8	2.8
1990–95	3.1	1.7	1.4	3.8	2.4	1.5
1995–2001	1.9	1.7	1.0	2.8	3.2	0.5
Growth in total hours worked, average % per annum						
1979–90	4.1	2.0	0.6	2.9	1.0	2.4
1990–95	3.0	1.4	1.3	2.8	1.6	1.8
1995–2001	2.3	1.4	0.3	2.3	2.7	–0.2

Source: O'Mahony and Van Ark (2003).

Through its sheer economic size, developments in the health sector have significant consequences for the macroeconomy. But the economic context of the health sector is very different from other sectors and this has specific implications for the impact of the health sector on the economy: there is very little international trade in health services and, hence, health providers in EU countries face little international competition. This specific situation may become either a great opportunity or a risk for the overall economy. Unless appropriate regulatory measures are in place, it may lead to inefficiencies that have a knock-on effect on the rest of the economy, leading to the potential for misallocation of resources. This in turn may affect competitiveness at the macroeconomic level by diverting resources away from other, potentially more productive, sectors of the economy.

More specifically, there are two main channels through which the health sector can directly affect the competitiveness of the overall economy. The first is the impact of the health system on labour costs, and hence international competitiveness. The second is the effects the system will have on job mobility and hence on labour market flexibility. If the health sector expands out of control, this will affect labour costs via tax rates and insurance contributions. Labour costs are an important determinant of international competitiveness and increased taxation or insurance contributions will affect it negatively, unless the increased health spending brings with it a parallel increase in productivity, such as reductions in the number of days lost through ill health. If there is over-consumption of healthcare services — due to problems of supplier induced demand for example — the increase in costs is unlikely to result in such an increase in productivity (European Commission 2004).

Evaluating performance in the health sector therefore becomes key to ensure that the outcomes of the health system are optimised (i.e. that of maintaining and improving health in the first place). However, evaluating performance in services, and the public sector in particular is fraught with difficulties (O'Mahony and Stevens 2002). Doing so for the health sector is more difficult than in other service sectors since both the system of provision and the nature of the production process have a number of unique features (European Commission 2004).

3.6 The contribution of health to ‘full income’: taking a welfare approach

The new approach presented here starts from the uncontroversial recognition that GDP is an imperfect measure of social welfare because it fails to incorporate the value of health. The true purpose of economic activity is the maximisation of social welfare, not necessarily of the production of goods by itself. Since health is an important component of properly defined social welfare, measuring the economic cost of ill health only in terms of foregone GDP leaves out a potentially major part of its ‘full income’ impact, defined as its impact on social welfare. Taking the welfare impact of health into account gives an even stronger illustration of the ‘true’ economic importance of health. Most of the existing studies have focused on the situation in the USA.

Health is clearly ‘valued’ very highly, and more than most other market or non-market goods, even if it cannot typically be given a ‘market price’⁽⁹⁵⁾. Yet while health has no market price, this does not imply that health has no value. When asked, people are ready to give up substantial income for better and longer health. Therefore, even if no explicit value exists, there must be an implicit value that people attribute to health. While this value is high, it is not infinite, since in the day-to-day context we are not willing to give up everything in exchange for better health⁽⁹⁶⁾.

The challenge is to make the high value attributed to health more explicitly visible by measuring the extent to which we are willing to trade-off health with specific market goods for which a price exists. This is undertaken in willingness-to-pay (WTP) studies. WTP is often inferred from the existence of risk premiums in the job market. Jobs that entail health risks, such as miners and construction workers in hazardous industries, receive higher compensation in the form of a risk premium. There is now a large number of WTP studies, making it possible to calculate a ‘value of a statistical life’ (VSL) that can in turn be used to value changes in mortality. Usher (1973) first introduced the value of mortality reductions into national income accounting. He did this by generating estimates of the growth in ‘full income’ (or ‘wealth’) — a concept that captures the changes in life expectancy by including them in an assessment of economic welfare — for six countries and territories (Canada, Chile, France, Japan, Sri Lanka, and Taiwan Province of China) during the middle decades of the 20th century. For the higher income countries in this group, about 30 % of the growth of full income resulted from declines in mortality. Estimates of changes in full income are typically generated by adding the value of changes in annual mortality rates (calculated using VSL figures) to changes in annual GDP per capita. Even these estimates of full income are conservative in that they incorporate only the value of changes in mortality and do not include the total value of changes in the health status.

For the USA, Nordhaus (2003) found that the economic value of increases in longevity in the last 100 years is about as large as the value of measured growth in non-health goods and services. In a rediscovery of Usher’s pioneering work, Nordhaus tested the hypothesis that improvements in health status have made a major contribution to economic wealth (defined as full income) over the 20th century. A more detailed assessment reveals that ‘health income’ probably contributed to changes in full income somewhat more than non-health goods and services in the first half of the 20th century and marginally less than non-health goods and services since 1950. If the results of this and other related studies (e.g. Costa and Kahn 2003, Crafts 2003, Cutler and Richardson 1997, Miller 2000 and Viscusi

⁽⁹⁵⁾ The healthcare inputs are included in the measurement of GDP, but they represent only a small share of the true value of health, as argued further below.

⁽⁹⁶⁾ We are describing here situations in which people face marginal trade-offs between health and other goods. We do not consider the far less representative situation in which people are facing an immediate death threat, the prospect of which would clearly increase the readiness to give in the maximum amount of other goods in order to prevent death.

and Aldy 2003)) are confirmed, then the role of health (and of the activities that promote health, among others the healthcare system) should be reconsidered. It raises the possibility that the social productivity of spending on health (via the health system and via other sectors) might be many times greater than that of other forms of investment.

Most of this very recent research has focused on the USA. Similar studies from the EU context are rare, with Crafts (2003) being one notable exception. Like Nordhaus (2003), he examines the value of life expectancy improvements in the UK between 1870 and 2001 and concludes that these health improvements have had an impact on full income that is equivalent to large additions in material consumptions.

Preliminary analysis by partners in the present project, carried out in parallel with the preparation of the book, has applied the full income approach to selected EU countries (UK, Sweden, France, Italy and Spain) to assess the value of changes in life expectancy between 1990 and 1998 (McKee et al. 2005). The value of a life year used by Nordhaus (\$2,600) was applied to the change in life expectancy at birth to calculate the gain in health income. However, in a refinement of the method, the value of a life year gained was also applied to the gain in life expectancy that is attributable to healthcare (based on an earlier study of mortality avoidable by timely and effective care (Nolte and McKee (2004))). These are then compared with changes in expenditure on healthcare. By these means, and for the sake of simplicity disregarding time lags, it can be shown that there are substantial economic welfare returns to health (Table 8). The value of life expectancy improvements amounts to between 60 and almost 100 % of the increases in per capita GDP in that period. In addition, the authors propose an estimate of the return to health expenditures in terms of that part of the resulting life expectancy improvements that can be ascribed to improved healthcare provision. The results show rates of return between about 50 and 270 % — a magnitude that is not matched easily by other types of investment. The study makes no comparison with the returns from investment in broader population health interventions, for which the return is likely to be even greater. Furthermore, as this analysis considers only mortality and not the less easily measured improvements in quality of life, and as Nordhaus's figure has not been updated to account for inflation, the gains are likely to be a considerable underestimate.

Table 8 –
The value of life expectancy improvements between 1990 and 1998
in selected EU countries (USD)

	UK	Sweden	France	Italy	Spain
Increase in GDP per capita	6 000	4 810	5 200	5 420	5 180
Increase in total health income	4 108	4 732	3 302	4 992	4 498
Increase in health expenditure	630	395	676	403	506
Increase in health income attributable to healthcare	1 561	1 478	996	1 325	1 780
Return on health expenditure	148 %	274 %	47 %	229 %	252 %

Source: McKee et al. 2005.

We consider the development of a similar indicator for the EU countries ⁽⁹⁷⁾ as an approach that would give a powerful quantitative argument to illustrate the contribution of health to economic welfare. At the same time, it would overcome some shortcomings in the use of GDP as a measure of social welfare. It could help reshape the way we think about health, health policy, and the associated returns.

⁽⁹⁷⁾ Within the EU one could build on some studies referring to the UK context (see references in Costa and Kahn 2003).

4. Investing in health

The research reviewed in the previous chapter supports the premise that improving the health status of a population can be beneficial for economic outcomes at the individual and the national level. There is indeed much evidence to suggest that the association between economic wealth and health does not run solely from the former to the latter. An immediate, if general, policy implication that derives from this conclusion is that policy-makers who are interested in improving economic outcomes (e.g. on the labour market or for the entire economy) would have good reasons to consider investment in health as one of their options by which to meet their economic objectives.

This raises the question of just how should we invest in health and how much does it cost for what return? Investment in health includes spending on any activity whose main objective is the re-establishment, maintenance, improvement and protection of health in a country during a defined period of time. Investment in health takes place both outside and inside the ‘health system’⁽⁹⁸⁾. The resources that a country will assign to the different sectors of its economy reflect both the needs of the country and the priorities of society, expressed through the decisions of its government. Thus, the share of GDP allocated to healthcare and other activities that promote health provides a means of identifying the priority given to health, especially when related to indicators of health needs.

It is beyond the scope of this book to review and evaluate all the possible ways of investing in health — in and outside the health sector. In what follows we limit ourselves to first describing the need for an integrated, multi-sectoral policy response. Subsequently, we scrutinise one specific way of investing in health, which is via investment in the health system. We do not elaborate on health investment taking place outside the health sector, even though this is considered as an important part of investing in health. A new, independent Commission on Social Determinants of Health (CSDH), set up by WHO, has recently started to collect and produce the evidence on this subject.

4.1 An integrated policy response

It is important that governments establish an integrated policy framework by which they can assure themselves that what is being done to achieve good health is appropriate and effective. This book argues the case for mechanisms that will permit the assessment of the health needs of a population, the identification of effective interventions to respond to those needs, and the monitoring of the results achieved. Given that the burden of disease in developed countries is mainly due to lifestyle

⁽⁹⁸⁾ We follow the definition proposed by the WHO (WHO 2000), according to which a health system comprises ‘all organisations, institutions and resources that are devoted to producing health actions’. A health action is further defined as any effort, whether in (1) personal healthcare, (2) public health services or (3) through intersectoral initiatives, whose primary purpose is to improve health. This definition goes beyond the narrower concept of the ‘healthcare system’, which only refers to the first two items. The wider definition explicitly excludes those actions that do impact upon health, but whose primary purpose is not health improvement. An example of the latter is the general education system, while specifically health-related education would be part of the health system. In the literature these two concepts are often used interchangeably and this may cause some confusion. In part this may be due to the fact that the narrow concept can be measured far more easily, so that even if one wanted to refer to the wider concept, measurement problems often pose a limit to this ambition.

factors, health investment must inevitably involve actions and measures addressing issues lying outside the reach of the traditional healthcare systems, requiring action across government.

This section reviews the steps that might be taken by a country seeking to ‘invest’ effectively in the health of its population. The first step is to determine the major causes of ill health afflicting one’s population. These causes act at several levels ⁽⁹⁹⁾.

First, there are the immediate causes, with the major examples common to all EU Member States including cancer, cardiovascular disease, mental health problems and injuries. The inclusion of mental health acts as a reminder of the need to go beyond narrow measures of mortality to include those causes that increase distress and disability. Second, there are a series of individual determinants of health that are common to several disease processes, related to lifestyle and living conditions (including access to healthcare), of which the main examples in Europe are tobacco, poor nutrition (and lack of physical exercise), and hazardous drinking. Third are the wider determinants of health, related to the general socioeconomic, cultural and environmental conditions, which include poverty, poor education, unsafe environments, and more broadly defined social exclusion. However, a comprehensive assessment of health needs should go beyond existing problems to anticipate future developments, including both those that can be predicted, for example by extrapolation of current disease trends, as well as those that are less predictable, such as infectious disease outbreaks. These steps clearly imply that each country has put in place the necessary information systems to monitor the health of its population and to analyse appropriately the resulting data.

The second step is to identify appropriate policy responses, based on the best available evidence. These will inevitably span a range of activities from health promotion through disease prevention, treatment and rehabilitation. Some will be the responsibility of the healthcare system, for others the healthcare system can play either a leadership or a catalytic role by encouraging and supporting other sectors, and in some cases the main responsibility will be in other sectors, such as transport or education.

The third step is to establish a system to monitor the impact of the policies being put in place, recognising that, as with any complex human system, there is a risk of unintended consequences and there is rarely a linear relationship between the implementation of a policy and its outcome.

From this brief review it will be apparent that a pro-growth policy that includes a focus on health will require action across government to tackle the main determinants of health. Many governments have already done much to achieve this, as illustrated by the increasing numbers of countries that are banning smoking in public places. It is, however, important not to overlook the contribution that the healthcare system can make. This is considered in the following section.

4.2 Investing in health via the health system

What is the role that the health system plays in determining health? This is far from being the trivial question it might look like. The contribution of the health system to population health has long been debated. We first review briefly this discussion and conclude that the contribution of healthcare in promoting health is likely to have increased over the last decades. We then take the discussion one step further by asking, what then could be the ‘right’ level of spending on healthcare.

⁽⁹⁹⁾ See also Figure 1 for a set of health determinants.

4.2.1 The impact of the health system on population health

Various commentators have argued that the role of healthcare was rather small and may even have been detrimental (Illich 1976, McKeown 1979) back to the 1960s when healthcare offered much less than now. In fact, the impact of ‘curative medical measures’ may reasonably be assumed to have had little effect on mortality decline prior to the mid-20th century (Colgrove 2002). Since then, the scope and quality of healthcare have changed almost beyond recognition.

A reassessment of the contribution of healthcare to population health has followed the development of the concept of ‘unnecessary untimely mortality’, or ‘avoidable’ mortality, first developed by Rustein et al. (1980) and Rutstein et al. (1977). This work analyses mortality trends for a selection of conditions in which death can be avoided by adequate preventive or therapeutic intervention. Most studies, in which socio-demographic variables are used to control for the influence of external factors, have shown that healthcare interventions have had a substantial effect on the decline in mortality, especially over the past 30 years: Poikolainen and Eskola (1986), Charlton et al. (1983), Holland (1986), Jouglu et al. (1987), Mackenbach et al. (1988).

Nolte and McKee (2004) have undertaken a systematic review of empirical and methodological studies using the concept of ‘avoidable’ mortality and of its use in attributing health outcomes to healthcare. This review confirmed the ability of ‘avoidable’ mortality to assess the contribution of healthcare to population health. Building on this work, the authors used a modified version of this concept by updating the list of conditions considered amenable to healthcare in the light of advances in medical knowledge and technology and using a higher age limit of 75 years. This was then applied to routinely available data from selected countries in the European Union to investigate the potential impact of healthcare on changing life expectancy and mortality in the 1980s and 1990s. Importantly, they noted that the healthcare system now has a role that goes beyond treating people who fall ill, but also encompasses development of a wide range of preventive activities to reduce the risk of disease in the first place.

They showed that, since 1980 all European countries experienced increases in life expectancy between birth and age 75 although the pace of change differed over time and between countries. Reductions in amenable mortality made substantial positive contributions in the 1980s in all countries except for men in Italy. The largest contribution was from falling infant mortality but also improvements among the middle-aged, for example in Denmark, the Netherlands, the UK, France and Sweden. In many countries the pace of improvement slowed in the 1990s although not in the Mediterranean countries, a finding that would imply a continued catching up in the southern European countries. Overall, these findings support the notion that improvements in access to effective healthcare had a measurable impact in many countries during the 1980s and 1990s and, for the purposes of this book, confirm the potential for investment in health services to improve population health outcomes.

The conclusion that healthcare matters for population health does, however, not give us much guidance as to just how much should be spent on healthcare — a key question in today’s health policy discussions.

4.2.2 How much to spend on the health system?

If the health system matters for health, there is a case for spending money on the health system. But how much should be spent? Obviously, there is no simple answer to this question, as health expenditures are driven — legitimately or not — by a multitude of factors.

The following sections provide a very brief overview of some of the issues surrounding the factors that do or should influence the level of health expenditures. The level of a country’s economic development is one important determinant of health expenditures. This does not mean that countries should

only decide their health expenditure level according to some pre-defined function of their GDP per capita. In fact there are more appropriate ways of determining the right level of expenditures. Last but not least there is the key issue of how much improving the health of the elderly can or cannot contribute to easing some of the pressure on the demand for rising health expenditures.

4.2.2.1 Health expenditure as a function of the level of economic development ⁽¹⁰⁰⁾

The notion of healthcare being a luxury good frequently underpins the debate on healthcare funding. In this section we argue that this is based on a simplistic interpretation of the available evidence, which when taken together shows that it is not at all inevitable that healthcare expenditure will increase and countries become more wealthy. At the same time, many commentators have argued that additional health expenditure brings little tangible benefit. This too is unsupported by the evidence. By extension, these findings compel us, when asking how much a health system should spend, to first ask what it is required to achieve, given factors such as the burden of disease confronting it.

Expenditure on healthcare in EU Member States typically accounts for about 9 % of GDP, having increased from about 7 % in 1980. As a significant part of the economy, it is important to understand what factors determine a country's level of health expenditure. Is it driven by patterns of health, by political preferences, by the cost of inputs, or is it, as some have argued, simply a reflection of national income? In other words, is healthcare a 'luxury good' in that increasing wealth fuels higher expectations, so that the share of national income spent on healthcare increases inexorably as national income increases? If this is the case, as some argue, then the case for further increasing healthcare expenditure is weakened as it implies that rising expenditures are simply a reflection of economic growth and not a legitimate response to health needs. Sound fiscal policy should therefore seek to reduce this level of expenditure.

The earliest analyses of the determinants of health expenditure date from the early 1960s when Abel-Smith attempted to standardise the sources of data used in cross-national comparisons. In an analysis of 15 countries, he showed that, after adjustment for exchange rates, inflation and population size, and using a simple linear model, GDP was a major determinant of health expenditure (Abel-Smith 1967). This was followed by a 1974 study by Kleiman, using a log-linear model with cross-sectional data, that reported that the income elasticity of demand for healthcare was greater than 1 (Kleiman 1974). In other words, the increase in health expenditure was proportionately greater than that of national income. A 1977 paper by Newhouse was extremely influential (Newhouse 1977). It used a linear model to examine cross-sectional data from 13 countries for the years between 1968 and 1972 (the years selected were not the same for each country) and found that GDP explained a remarkable 92 % of variation in health expenditure and again reported an income elasticity of greater than 1 ⁽¹⁰¹⁾. Newhouse interpreted this finding as indicating that 'medical care services at the margin have less to do with common measures of health status ... and more to do with ... relief of anxiety, somewhat more accurate diagnosis and heroic measures near the end of life'. There was no attempt to examine whether the increased expenditure on healthcare was contributing to population health.

⁽¹⁰⁰⁾We are especially grateful to Dr Panos Kanavos for his advice on this section.

⁽¹⁰¹⁾Elasticity is the measure of responsiveness of demand to changes in prices or incomes, measured as the proportionate change in the quantity demanded divided by the proportionate change in income. Normal goods are those with positive income elasticity and inferior goods are those with negative income elasticity.

This research was, however, being undertaken shortly after the publication of McKeown's report 'The role of medicine', which argued that healthcare had contributed little to population health since the middle of the 19th century (McKeown 1979) as well as Illich's report 'Medical nemesis', which introduced the concept of iatrogenesis, proposing that much healthcare was actually damaging to health (Illich 1976). Consequently, Newhouse's paper was used to argue in favour of containing rising costs on what was seen as somewhat ineffective healthcare. This view was supported in a 1979 paper by Cullis and West who again reported that healthcare was a luxury good and stated that 'at the margin [healthcare] may contribute little to physiological health' (Cullis and West 1979).

At the same time, a body of literature was emerging, using household or subnational data that came to a rather different conclusion. Research on the relationship between income and, variously, hospital, physician or total health expenditure in American States (Baker 1997, Feldstein 1971, Fuchs 1980, Levit 1982) or Canadian provinces (Di Matteo and Di Matteo 1998) found income elasticities of between 0.5 and 0.9, implying that healthcare is not a luxury good, as did studies on household income and consumption (Gbsemete and Gerdtham 1992, Wagstaff 1986).

What was by now becoming established wisdom that healthcare expenditure would rise inexorably with growing national income, while bringing little benefit to population health, was challenged on two fronts. The first was from an economic perspective. Parkin et al. (1987) noted that exponential models were viewed as most appropriate for goods that are considered to be luxuries, making the finding of a large elasticity a self-fulfilling prophecy (see Table 9). Subsequently, other researchers have explored the relationship using either general purchasing power parities (derived from a broad range of goods from all sectors of the economy) or health specific purchasing power parities (derived from a basket of health-related goods, although dominated by pharmaceuticals) (Gerdtham and Jönsson 1991). Most found elasticities of greater than 1, although several have been the subject of re-analysis to take account of statistical features of the data (such as heteroscedasticity) (Murthy 1992) resulting in the identification of elasticities less than 1.

Table 9 –
Income elasticities for GDP and healthcare expenditure: 18 OECD
countries, 1980 data

Model form	Exchange rate conversions	PPP conversions
Linear	1.12	0.9
Semi-log	0.8	0.8
Exponential	1.57	1.12
Double log	1.19	1.00

Source: Parkin et al. (1987).

The second challenge came from the perspective of epidemiology. The concept of 'avoidable mortality' or 'mortality amenable to medical/healthcare' was developed (as discussed in the previous section), separating those deaths that could not be avoided by timely and effective healthcare from those that could (Rutstein et al. 1977). Healthcare appeared to have contributed substantially to the observed gains in life expectancy in Western industrialised countries (Charlton et al. 1983, Holland 1986, Mackenbach et al. 1988).

Recognition that factors other than national income are likely to play a role in determining health expenditure has led to studies that use more complex multivariate models. Leu hypothesised that health expenditure would increase faster where the share of public expenditure was highest (Leu 1986). His analysis explored this variable as well as national income, a range of demographic variables, and some system specific factors. He was able to confirm his main hypothesis and demonstrate an income elasticity greater than 1 as well as associations with the demographic variables that were in the directions predicted. He also showed that the presence of a national health service model (as in the United Kingdom and New Zealand) reduced expenditure, a finding attributed to the central control exerted on the system.

Subsequent researchers, using different years and functional forms, have not, however, been able to replicate these findings. For example, Gerdtham et al. found that an increased share of public financing was associated with a lower health expenditure whereas, as expected, fee for service payment was associated with higher expenditure (Gerdtham et al. 1992). Another analysis by Gerdtham (1992) using data from 22 countries for the period 1972–87, which also took account of demographic changes and the share of public financing, found an income elasticity of less than 1, in contrast to that found by Leu, as well as identifying a series of country- and period-specific effects. Hitiris and Posnett, using a larger data set, as well as additional statistical refinements, found an income elasticity that was close to unity (1.026 when using exchange rate conversions and 1.16 with purchasing power parities) (Hitiris and Posnett 1992).

Research using time series analyses confronts the problem of underlying trends that may introduce bias that can occur if using cross-sectional data. Studies using time-series approaches have generally found income elasticities of less than 1 or a non-significant association between GDP and health expenditure (Blomqvist and Carter 1997, McCoskey and Selden 1998, Saez and Murillo 1994).

Analyses that have focused on the relationship between national income and health expenditure have thus yielded conflicting results. While it is a widely held view that healthcare expenditure inevitably increases faster than national income and the increased expenditure contributes little to population health, it is not a view that is unequivocally supported by the available evidence. Any relationship that exists between national income and health expenditure is influenced by the choice of years, countries and model form. As a previous section showed, healthcare does contribute positively to population health and the appropriate level of expenditure is that needed to deliver the amount and type of healthcare that is appropriate for the needs of the population in question. This approach is elaborated in the following paragraphs.

4.2.2.2 An alternative way to decide how much to spend on the health system

There is no simple answer to the question of how much a country should spend on healthcare, as each country faces a different burden of disease, its populations have differing expectations, and it faces different geographical constraints on what it can do. Furthermore, the inputs required to provide an appropriate package of care vary considerably, largely as a consequence of decisions taken in other sectors.

One of the few examples where an attempt has been made to relate the required level of healthcare expenditure to health needs is in the United Kingdom, where the Treasury has commissioned two reports by a senior executive from the financial services sector, Sir Derek Wanless. In his first report he was asked to estimate the future cost of providing healthcare to the British population in 2020. To do this he began from the bottom up, assessing what the health service was presently providing and what, on the basis of the best available evidence, it should be providing. In doing so, he was greatly helped by earlier work developing a series of National Service frameworks. These frameworks, produced by the British government's National Institute for Clinical Evidence, reviewed the evidence for

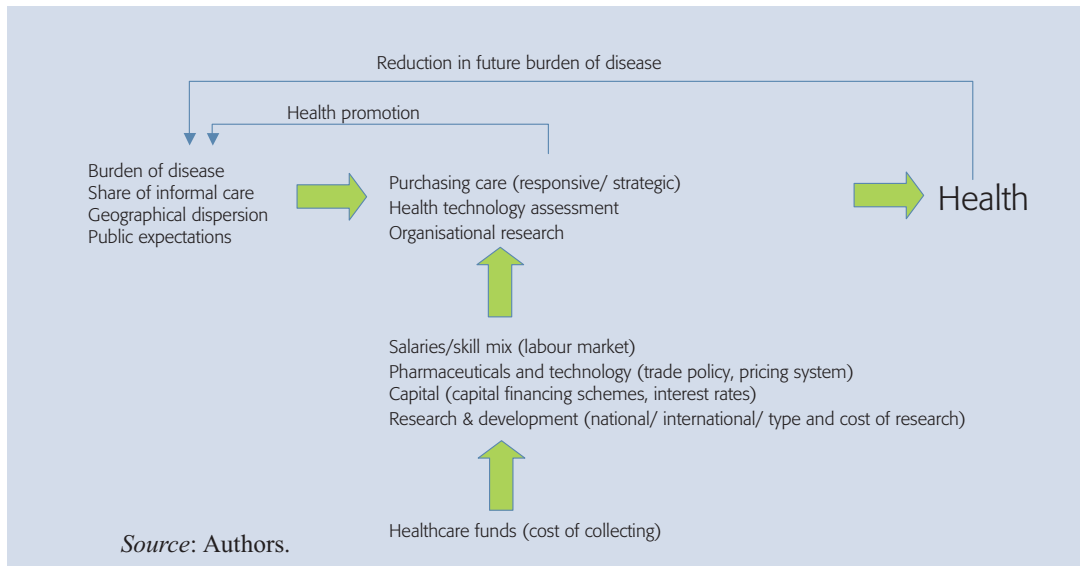
cost-effectiveness of healthcare interventions used in the management of common disease categories, such as cardiovascular disease and diabetes. These interventions ranged from prevention through diagnosis and treatment to rehabilitation.

This approach has a compelling logic, in that rather than attempt to distil some figure from regressions of frequently incomparable data where the association between inputs and outcomes is to say the least opaque, it begins by asking what the healthcare system should actually be seeking to achieve. Having done this, it then decides what it needs to achieve its objectives. This is exactly the same approach that is adopted in most other sectors. We can only speculate why it has not been done previously in the health sector, although reasons are likely to include both the complexity and the limited analytical capacity in many health ministries (and here it is noteworthy that these reports were prepared under the auspices of a finance ministry).

Although the methods employed in the Wanless reports are the principal focus of interest here, the findings are also important. The first report concluded that the future level of expenditure on healthcare was critically dependent on investment now. He identified three possible scenarios, one of which, fully engaged, involved a major investment in the promotion of health and the provision of effective healthcare. Specifically, it recognised the long time horizons involved in healthcare investment, so that decisions were needed many years in advance if necessary numbers of trained staff and appropriately designed facilities are to be in place when they will be needed.

The Wanless reports provide a very solid basis for defining the appropriate level of healthcare expenditure. However, they look at the situation in only one country while each country has a number of specificities. The remainder of this section builds on that work to propose a schematic model of the key elements to be taken into account when seeking to understand the need for financial resources for the health system within a country. It uses a highly simplified model of the inputs into the production of health by a healthcare system (Figure 4).

Figure 4 – Simplified representation of the production of health by a healthcare system



The amount of money needed to fund a healthcare system adequately is a function of a large number of variables. The first set relates to the demands placed upon the healthcare system. The most obvious, but one that is often overlooked, is the burden of disease requiring treatment. A sicker population will require more healthcare. However, there is no simple linear relationship between conventional measures of burden of disease and the need for resources as the key issue is the nature of the disease. Some conditions can be treated simply and at low cost while others that account for the same aggregate burden of disease may require a complex and expensive package of care. A second factor is the extent to which care is provided informally, by families and friends. In many countries a combination of ageing populations, greater female participation in the workforce, and changing societal attitudes is causing much care that was once provided within the family to be transferred to the health and social care sectors. A third is the nature of public expectations. These too are changing, consistent with the growth of consumerism in other sectors. Finally, it is necessary to take account of issues such as geographical dispersion. Thus, it is more expensive to provide care to a low-density population, such as that in northern Sweden or Finland, as there is a need to provide many small facilities in isolated areas, as well as mechanisms to enable the inhabitants to obtain care in specialised centres elsewhere.

The second set of factors relates to the supply of healthcare and in all cases these are to a considerable extent determined by factors external to the health sector. The first is the cost of employing the staff that will provide healthcare. The level of salary required to recruit and retain staff is a function of the labour market, which is influenced by both the supply (for example, output of educational programmes, migration) and demand (including in other sectors). The cost of recruiting staff is also influenced by skill-mix, for example the extents to which tasks are undertaken by different types of health professionals. A second is the cost of pharmaceuticals and technology. All EU Member States have imposed some form of price controls and, while parallel trade has led to some degree of harmonisation, there are still considerable variations among countries. A third is the cost of capital, influenced by factors such as interest rates and, in some countries, the use of new models of capital financing. Expenditure in an individual year is also influenced by the inherited stock of capital, an issue of particular importance for the new Member States in central Europe where, prior to 1989, the model of care was based on widespread substitution of cheap labour for what would have been expensive capital. Free movement of professionals, who can now move to Member States where wages are higher, means that this model is no longer sustainable. A fourth is the cost of research and development, with some countries investing in indigenous medical and health services research while others take advantage of evidence obtained elsewhere. It is also influenced by the extent to which countries engage in translational research and getting research into practice. The cost of many of these inputs is affected by EU legislation, most of which has been decided by ministers responsible for other sectors. Examples include the European working time directive, which is having profound implications for staffing healthcare facilities, and the European directive on clinical trials, which is increasing greatly the cost and difficulty of undertaking clinical research in Europe.

4.2.2.3 Financing of health care

The inputs to healthcare systems require money, and countries vary in the way that they collect it. The system in place in a particular country often reflects historical factors; the complexity of healthcare financing means that countries never begin with a blank sheet when developing a financing system. For the present purposes it is important to ensure that the funds that are necessary to provide healthcare are raised in a way that promotes growth, drawing on a wide revenue base that does not discourage investment or employment.

The issue of revenue generation was addressed by the UK Treasury's Wanless report, which concluded that there was no justification for changing the tax-based system of financing the British National Health Service to any of the other possible models, in particular a social insurance system, which had been advocated by some political commentators. In doing so, Sir Derek Wanless noted the disproportionate burden on employment costs of social insurance, in contrast with the much broader revenue base available with taxation, which could draw on not only income tax but also company tax, value added tax, and a wide range of other sources of government revenue, including customs tariffs and the burgeoning number of taxes on specific activities and goods (such as vehicle excise duty, transport surcharges, etc.). This echoed debates taking place in some other countries, such as France, where there has been concern about the ability of a system based on social insurance, which was established at a time when patterns of employment and family structures were quite different from now, to respond adequately to changing circumstances.

It is then necessary to bring together the appropriate mix of inputs in ways that meet the demands on the healthcare system. At the risk of simplification, there are essentially two approaches. One is to assume a reactive approach, hoping that the sum of interactions between individual patients and health professionals will lead to the delivery of an appropriate package of care that maximises health. However, there are many reasons why this is unlikely to happen. First, there is often unmet need for care, with those at most need often failing to seek it as they face obstacles both within and outside the healthcare system. Second, the care that is provided might not necessarily be appropriate, for example where providers respond to inappropriate incentives. The alternative model is strategic purchasing, involving assessment of health needs, identification of evidence-based models of care, and monitoring the impact of these interventions on health.

A health-promoting health system can be expected to reduce future costs by reducing the burden of disease within the population. However, it can go beyond this by engaging in health promotion, both through its own efforts and by catalysing the efforts of those in other sectors that have the ability to adopt policies that will promote health.

4.2.2.4 Health and healthcare expenditure in the context of an ageing population

The population of Europe is ageing, as life expectancy increases and fertility declines. Consequently, in the future there will be fewer people of working age to support those in retirement. What are the consequences for healthcare expenditure?

Total public expenditure on healthcare represented 6.2 % of GDP in 2002 on average in the EU-15 countries (including both curative activities and long-term care) (this figure is lower than that cited in the previous section, which included expenditure from all sources). Research by the Netherlands Bureau for Economic Policy Analysis (CPB), in the context of the AGIR project ⁽¹⁰²⁾, indicates that this figure can be expected to increase to 7.2 % in 2020 and to 8.9 % in 2050. The increase in health expenditure is expected to be particularly dramatic in certain countries, and to reach the 10 % of GDP in countries such as Sweden, Finland and the Netherlands by 2050, under the current institu-

⁽¹⁰²⁾AGIR (acronym for 'Ageing, health and retirement in Europe') is the name of a three-year European research project on the economic consequences of ageing financed by the European Commission under the fifth research framework programme. Researchers from nine European economic policy research institutes have participated in this project. The AGIR project has explored all available information on the health developments in the EU-15 countries during the last 50 years, and analysed how different future demographic and health scenarios could affect pension and healthcare expenditure in several EU countries. Further information on this project can be found at: <http://www.enepri.org/Agir.htm>

tional framework and expenditure patterns. These projections considered not only variations on health expenditure by age, but also the different healthcare costs of survivors and decedents ⁽¹⁰³⁾. The demographic data were taken from the Eurostat 2000 population projections. CPB ⁽¹⁰⁴⁾ assumed that healthcare expenditures would rise in line with GDP.

As the Wanless report noted, future needs for healthcare can be reduced if the population is not simply getting older (as assumed in the Eurostat demographic projections) but also becoming healthier. The impact of such a compression of morbidity hypothesis on expenditure was projected by CPB in an optimistic ‘living in better health scenario’, which assumes that in the next 50 years the number of years lived in bad health will be kept at the current level (and that therefore all improvement in life expectancy will be of years lived in good health). CPB assumed that the elasticity of health expenditure to improvements in average health status is of -0.3 for people in ages 0–64 and of -0.2 ⁽¹⁰⁵⁾ for people aged 65 and older. According to their calculations, the compression of morbidity scenario would correspond with a level of expenditure on healthcare of 8 % of GDP in 2050 for the EU-15, this is, a 0.9 % of GDP lower than in the baseline scenario. This further highlights the importance of investing in population health as a means of mitigating future economic impacts of ageing populations.

The present section has shown that investing in healthcare can indeed be considered as one of several effective ways of investing in health. Again, we emphasise that investing in healthcare is not the only way of investing in health, since many of the determinants of health lie outside the health system. Moreover, the fact that healthcare does matter for population health by itself does not answer the question of how much a country should invest in healthcare. It does, however, suggest that the hypothesis that healthcare is a mere luxury good producing little in terms of tangible results cannot be supported. We also showed briefly that, under certain conditions, investing in the health of the elderly could reduce the rising healthcare costs associated with an ageing society.

4.3 Cost-effectiveness of investment in healthcare and health promotion

The strength of the empirical evidence assembled to produce this book demonstrates the importance of investment in health. The precise policies that Member States should consider will depend on their individual circumstances. However, they all face the challenge of establishing mechanisms that can assess the health needs confronting their populations, define interventions that respond effectively to those needs, and assess progress towards better health. Although the volume of research on the cost-effectiveness of public health programmes remains relatively small, what exists frequently shows that investments yield substantial positive returns.

This section provides a brief, and of necessity highly selective, illustration of some interventions that have been shown to be cost-effective in reducing the burden of disease in a population. Evidence on the cost-effectiveness of health interventions is one of several key inputs into the decision-making

⁽¹⁰³⁾Healthcare costs are lower for survivors than for non-survivors, following recent evidence that the major expenditure on health happens in the last months of life. Profiles of expenditure on healthcare therefore vary according to both age and proximity to death. This approach forecasts a lower increase on healthcare expenditure than the approach followed by the EPC (Economic Policy Committee) considering only the relation between healthcare expenditure and age.

⁽¹⁰⁴⁾The report on CPB projections’ results is available at the ENEPRI website.

⁽¹⁰⁵⁾Derived from the results in Lubitz et al. (2003).

process at the policy level, as it provides information on those interventions that work and the resources required to implement them. In our view the attempt to measure costs and effects (or benefits) associated with one or several narrowly or broadly defined health interventions is crucial in helping to integrate health investments into national development strategies, as they allow more direct comparison of the return from investing in health with potentially competitive, 'traditional' economic investment outside the health domain. Perhaps because health has not been seen primarily as an 'investment', the cost-effectiveness studies that exist at present are insufficient to provide information on a sufficiently broad range of interventions.

Many of the interventions for which cost-effectiveness assessments exist focus on those at the individual level rather than on populations as a whole, although the overall impact of the former on population health is relatively small. Some types of population-based interventions with the potential to make very substantial improvements in population health have either not been implemented very frequently or have rarely been evaluated. While the evidence on cost and effectiveness of these interventions is less certain, it is important to consider them because they have the potential to make very substantial differences in health outcomes.

Nevertheless, some evidence does exist. Perhaps the most comprehensive effort to assess cost-effectiveness of a fairly comprehensive set of interventions over a large range of regional settings has been made by the WHO-CHOICE project ⁽¹⁰⁶⁾. In this section we focus on the representation of one influential study from Australia, which has been at the forefront of economic evaluation of public health policies.

Australia has adopted policies to reduce consumption of tobacco for many years, with considerable success. The proportion of adult male smokers in the population fell from 75 % in 1945 to 45 % in 1974 and subsequently to 27 % in 1995. Among adult women, the proportion declined from 33 % in 1976 to 29 % in 1986 and 23 % in 1995 ⁽¹⁰⁷⁾. Among smokers, the number of cigarettes smoked per day has also fallen substantially since the 1960s, as has the real expenditure per adult on tobacco products.

This reduced tobacco consumption has given rise to major health benefits, with large reductions in premature deaths from lung cancer, chronic obstructive pulmonary disease (COPD) and coronary heart disease. In 1998, for example, an estimated 17 421 premature deaths were averted: 6 492 deaths from coronary heart disease; 3 998 deaths from lung cancer; 3 581 deaths from COPD; and 2 900 deaths from stroke and other cancers.

It has been estimated that the present value of the expenditure savings for government would provide savings of about USD 2 for every USD 1 of expenditure on public health programmes to reduce tobacco consumption ⁽¹⁰⁸⁾.

⁽¹⁰⁶⁾CHOICE: 'Choosing interventions that are cost-effective'. Generally, WHO-CHOICE has been developing the tools and methods for generalised cost-effectiveness analysis (CEA). Its objectives are to: develop a standardised method for CEA that can be applied to all interventions in different settings; develop and disseminate tools required to assess intervention costs and impacts at the population level; determine the costs and effectiveness of a wide range of health interventions, undertaken by themselves or in combination; summarise the results in regional databases that will be available on the Internet; assist policy-makers and other stakeholders to interpret and use the evidence. For details, relevant papers and continuous updates see <http://www.who.int/whosis/cea>

⁽¹⁰⁷⁾NHMRC — National Health and Medical Research Council (1997).

⁽¹⁰⁸⁾National injury prevention activities (1998).

Since the 1960s, most Australian States have implemented programmes to encourage women to have regular cervical screening. The proportion of women aged 15 and above having cervical smears within the public health system has increased markedly and, in 1997–98, reached 64 %. The cost per life saved by these programmes is estimated to be approximately AUD 30 000 (NHMRC — National Health and Medical Research Council 1997).

Australian governments at state and federal levels have engaged in sustained campaigns to reduce the toll from road traffic injuries. The number of people killed per registered road vehicle has fallen steadily since 1970 even though the amount of road travel has almost doubled over this period (Abelson 2003). This trend reflects improvements in roads (e.g. construction of high standard roads, skid resistant pavement, road delineation and staggered T-intersections), vehicles (e.g. anti-burst door latches and hinges, energy absorbing steering columns), driver skills, and road safety education. Newstead et al. estimate that minor engineering works, declining alcohol sales, unemployment and road safety programmes reduced serious crashes by 46 % below the expected trend in Victoria (Newstead 1995). They also estimate that random breath testing, speed cameras, traffic infringement notices and supporting media publicity were responsible for a 25–27 % reduction in serious crashes.

Road safety programmes are estimated to have saved governments AUD 750 million a year in the late 1990s (Abelson 2003). The Traffic Accident Commission (TAC) in Victoria, which administers the no-fault accident compensation scheme and provides funds for specific enforcement activities, intensive media campaigns, school and traffic safety education and research, estimates that its prevention policies achieve a benefit–cost ratio of at least 3:1 (NHMRC — National Health and Medical Research Council 1997). There have been relatively few economic evaluations of prevention activities in Europe, with most coming from a few university departments. Thus, research undertaken in the United Kingdom has shown the cost-effectiveness of the English smoking cessation programme (Godfrey et al., 2005) and the benefits achieved by treating drug misuse in England, largely because of the reduction in the cost of crime (Godfrey et al., 2004). In The Netherlands, several studies have examined the economics of infectious disease control (Welte et al., 2004) and research from Sweden has assessed the cost-effectiveness of injury prevention (Lindqvist, 2001). These are, of course, purely illustrative examples but, in general, economic evaluation of prevention has been less well integrated with policy in Europe than in Australia.

4.4 Implications for the new EU Member States

The research reviewed in previous sections supports the premise that improving health of a population can be beneficial for economic outcomes at the individual and the national level. There is indeed much evidence to suggest that the association between economic wealth and health does clearly not solely run from the former to the latter. An immediate, if general, policy implication that derives from this conclusion is that policy-makers that are interested in improving economic outcomes (e.g. on the labour market or for the entire economy) would have good reasons to consider investment in health as one of their options by which to meet their objectives. This has particular relevance for the new Member States in central Europe where levels of both health and economic performance lag behind the EU-15.

In many of the new Member States, investment in health has historically been given a relatively low priority. This has continued at a time when the policy agenda was dominated by the process of EU accession, in which health considerations played a minor role (Hager and Suhrcke 2001). As with all Member States, these countries face major budgetary pressures, often exacerbated by the decision to adopt healthcare financing systems based predominantly on employment-related contributions. In a period of relatively high official unemployment, coupled in some countries with a large informal sec-

tor that does not contribute to the healthcare budget, there is a risk of promoting a self-perpetuating cycle in which the necessary expenditure to promote health adds disproportionately to the cost of employment as contributions fall on a narrow revenue base, thus reducing competitiveness of economies and decreasing formal employment further, a situation experienced in some western European welfare states over recent years (Alber and Köhler 2004, Esping-Andersen 1996, Scharpf and Schmidt 2000).

Like all investments, the return on expenditure on health and healthcare is at some point in the future. In this respect it is no different from a major infrastructure project. It is, however, an area where the potential for return on investments, and the uncertainty associated with a return, has been less well understood than in other sectors, and where fewer efforts have been undertaken to explicitly measure the returns to public health investment in monetary terms so that they can be more directly compared with alternative investment projects. The absence of a precise cost-benefit scenario may by itself have prohibited the inclusion of health investment into national economic development plans.

5. Conclusions

The main purpose of this book has been to review the empirical evidence on the economic impact of health as it applies to EU Member States. Our point of departure has been the work of the Commission on Macroeconomics and Health, which has made a powerful economic case for investing in health in developing countries. A specific question guiding our review of the evidence was to what extent a similar case could be made with respect to high-income countries, such as the EU Member States. This is a far from trivial question, partly because one might expect improved health to give rise to a lower pay-off in countries that are already very healthy compared with countries in which disease is rampant. It is also a question that gives rise to potentially important policy implications: if health were to become recognised as an investment that brings an economic return, then this would be expected to strengthen the position of health ministries in rich countries' governments where to date they often play only a marginal role. More broadly, it should strengthen the position of health and might make other economic policy-makers seek to consider health as one, of several, options by which to achieve their primarily economic objectives. In sum, we find that there is much evidence documenting the positive contribution that health can make to the economy in EU Member States. At the same time we have shown that it is a highly under-researched area, a factor that simultaneously reflects and promotes an inadequate recognition that health can also be good for the economy in rich countries. Our conclusions can be summarised as follows.

1. There is a sound theoretical and empirical basis to the argument that human capital matters for economic growth, but for the most part human capital has traditionally been rather narrowly defined as education.
2. The idea of health representing — in addition to education — an important component of human capital was introduced most prominently by Grossman in 1972 already, but has only recently been acknowledged more widely.
3. Since human capital matters for economic outcomes and since health is an important component of human capital, health does matter for economic outcomes, too. At the same time, economic outcomes matter for health.
4. The work of the Commission on Macroeconomics and Health (CMH 2001) has made an important contribution to making the economic case for health in developing countries. However, as it stands, the work is of limited relevance to the EU countries that are facing a very different health pattern with potentially very different economic implications that need to be worked out separately.

Review of existing empirical evidence

5. There are numerous cost-of-illness studies in high-income countries. The studies estimate the quantity of resources (in monetary terms) used to treat a disease as well as the size of the negative economic consequences (in terms of lost productivity) of illness that are incurred by society. They represent a useful first step in developing an idea of the economic burden of ill health and they show that the magnitude of the economic consequences is substantial. At the same time



they are limited by certain methodological problems and by their failure to differentiate the direction of causality in the relationship between health and economic outcomes. This is why we subsequently look at more ‘structural’ analyses.

6. A significant amount of evidence exists to support the economic importance of health in the labour market in rich countries. We present evidence that health matters for a number of economic outcomes: wages, earnings, the number of hours worked, labour force participation, early retirement, and the labour supply of those giving care to ill household members. In addition we reviewed the comparatively scarce evidence of the effect of health on education and on savings in developed countries. The impact of health on education — an issue widely researched and supported in the developing country context — has received much less attention in the high-income country context. The impact of health on savings has likewise only received limited attention in rich countries, despite the highly policy-relevant insights that could potentially be gained from studying these relationships.
7. Several studies from high-income countries show that poor health negatively affects wages and earnings. The magnitude of the impact obviously differs across studies (given different health proxies and methodologies) and direct cross-country comparability of results is therefore limited. While a significant number of studies have analysed the impact of health on earnings and wages in high-income countries, overall there appears to be comparatively less direct evidence from EU countries.
8. A number of studies find a significant impact of physiological proxies for health (e.g. height or body mass index) on earnings and wages not only in developing but also in some high-income countries. Height tends to positively affect these labour market outcomes, while a higher body mass index (linked to overweight and obesity) appears to depress wages and earnings more for women than for men. It is likely that some of the link between these physiological measures and labour market outcomes can be accounted for by social perception of height, and by social stigma in the case of obesity, rather than by a direct productivity effect.
9. An extensive empirical literature, mainly from the USA but recently also from Europe, confirms that health increases the probability of participating in the labour force. Again there is no consensus about the magnitude of this effect and comparison of results from different studies is difficult, as they use different measures of health, model forms and estimation techniques.
10. A relatively large number of studies from high-income countries find a significant and robust role for ill health in anticipating the decision to retire from the labour force. The relationship has been more extensively researched in the USA than in Europe. When interpreting the results from different countries one should keep in mind that they are likely to be very sensitive to the institutional framework (e.g. pension rules, availability of disability benefits, occupational insurance arrangements).
11. Ill health matters not only for the labour market performance of the individual directly concerned but also for that of the household members, who have been found to adjust their labour market behaviour in response to another household member’s illness. In the studies reviewed, men appear to reduce their own labour supply by substantial amounts in the event of their wives’ illness, while in the reverse case women tend to increase their labour supply. This can partly be explained by the unequal distribution of gender roles within the family. Access to health insurance can critically affect the response to a spouse’s health condition.
12. As in most empirical research in the social sciences there are methodological challenges involved in the attempt to detect a causal impact of health on labour market outcomes. Empirical

- methodologies — widely applied in other fields — have been used in the literature reviewed in order to ‘purify’ the effect of health on economic outcomes from a potential simultaneous impact from economic outcomes on health. Some specific challenges regarding the most appropriate way to measure health in surveys remain for a future research agenda.
13. Human capital theory predicts that more educated individuals are more productive (and obtain higher earnings). Good health in childhood enhances cognitive functions and reduces school absenteeism and early drop-outs. Hence, children with better health can be expected to achieve higher educational attainments and be therefore more productive in the future. Moreover, healthier individuals with a longer lifespan ahead of them have higher incentives to invest in education and training, as they can harvest the associated benefits over a longer period. While theoretically plausible and empirically supported in the case of developing countries, there has been relatively little work exploring and confirming this link in high-income countries. More research is needed.
 14. It is highly plausible that savings will increase with the prospect of a longer and healthier life. The idea of planning and, hence, saving for retirement would be expected to occur only when mortality rates become low enough for retirement to be a realistic prospect. Some work confirms the existence of such an effect in developing countries. In the high-income country context, our review found comparatively little published research in this area.
 15. Turning to the effect of health in the long term, historical studies exploring the role of health in a specific country over one or two centuries have shown that a large share of today’s economic wealth in industrialised countries is directly attributable to past achievements in health.
 16. Health — typically measured as life expectancy or adult mortality — emerges as a very robust and sizeable predictor of subsequent economic growth in virtually all studies that have sought to explain differences in economic growth between rich and poor countries. Researchers have focused much less on investigating the specific role of health in economic growth in high-income countries only, and in the few cases in which this was done, health was not always found to be positively related to subsequent economic growth, and in some case there was even a negative relationship. We attribute these results partly to the use of health indicators that imperfectly capture existing health differences between high-income countries. This is confirmed by a very recent analysis showing that if cardiovascular disease mortality is used as a health proxy, health does matter significantly for subsequent economic growth in high-income countries. The institutional policy framework in high-income countries, in particular through the current choice of retirement age, might also prevent health, in particular of the elderly, from having its full beneficial impact on economic growth in high-income countries.
 17. The use of a welfare or ‘full income’ measure, that takes health into account, gives an even stronger illustration of the ‘true’ economic importance of health. This approach starts from the uncontroversial recognition that GDP is an imperfect measure of social welfare because it fails to incorporate the value of health. The true purpose of economic activity is the maximisation of social welfare, not simply the production of goods by themselves. Since health is an important component of properly defined social welfare, measuring the economic cost of ill health only in terms of foregone GDP excludes a potentially major part of its ‘full income’ impact, defined as its impact on social welfare. Most of the existing studies in this domain have focused on the USA.
 18. While there is a direct effect of health on the economy, as noted above, the health system has an impact on the economy irrespective of the ways in which the health system affects health. The

health sector ‘matters’ in economic terms simply because of its size. It represents one of the most important sectors in developed economies, representing one of the largest service industries. Currently its output accounts for about 7 % of GDP in the EU-15, larger than the roughly 5 % accounted for by the financial services sector or the retail sector. Through its sheer accounting effect, trends in productivity and efficiency in the health sector will have a large impact on these performance measures in economies as a whole. Moreover, the performance of the health sector will affect the competitiveness of the overall economy via its effect on labour costs, labour market flexibility and the allocation of resources at the macroeconomic level.

Investing in health

19. The most important, if general, policy implication of the evidence synthesised in this book is that policy-makers interested in improving economic outcomes would have good reasons to consider health investment as one of their options by which to meet their economic objectives.
20. It is beyond the scope of this book to define which health and healthcare policies should be implemented. What is important is for governments to establish an integrated policy framework by which they can assure themselves that what is being done to achieve good health is appropriate and effective. This book argues the case for mechanisms that will permit the assessment of the health needs of a population, the identification of effective interventions to respond to those needs, and the monitoring of the results achieved. This will enable resources to be targeted most effectively.
21. The fact that the disease burden in developed countries is mainly due to non-communicable diseases, whose levels are largely determined by lifestyle-related factors and that, consequently, health, education and culture are intimately related, implies that health investment must inevitably involve actions and measures addressing issues lying outside the reach of the traditional healthcare systems. Health investment therefore requires action across government.

Filling the evidence gap

The following priorities for future research emerged from the review of the existing evidence.

22. There are few microeconomic studies that compare the effect of (ill) health on the labour market in different EU countries. Existing data sources, such as the European Community Household Panel, could be usefully exploited to this effect. However, there is also a need for substantial investment in the collection of comparable data sets from all Member States similar to that available in some other industrialised countries, linked to investment in primary research on the relationship between health and the economy in Europe. This has implications for the work of Eurostat as it seeks to harmonise the data collected in Member States. These investments will anyway be important to assess progress towards achievement of the Lisbon agenda.
23. There are gaps in our understanding of the relationship between health and education in EU Member States. The increasingly popular educational performance surveys could be complemented by questions that capture the health status of the child, in order to allow this relationship to be analysed.
24. The effect of ill health or of the prospect of ill health on savings appears not to have been studied at all in the EU context. There is reason to believe that the incorporation of health in models of savings has much to offer in understanding patterns in household savings and consumption behaviour.

25. Both at the macro and micro level, there is a need to improve the quality of health indicators to permit better discrimination of the diversity of health in developed countries. This requires the testing and development of more contextually appropriate health indicators than those commonly used in the worldwide cross-country regressions. Research in this area should also investigate further how far and in what ways the 'welfare state', imperfectly proxied by health (and other social) expenditures in some studies, contributes to economic growth.
26. Given that many of today's health issues are driven by lifestyle factors, there is a need to establish more explicitly the economic case for governments to intervene in areas that *prima facie* might be seen as issues of individual choice. There is much to suggest that a case for doing so can be made using sound economic reasoning. If so, this could provide a similar rationale for investing in health as already exists for investment in road infrastructure or public schools.
27. As the key next step in developing further the economic argument, more research is needed to assess the costs and benefits in particular of broader public health interventions. This would represent the ultimate and necessary step in order to make a direct comparison of the returns to health investment with alternative uses of the money involved. In doing so, it would further facilitate the integration of health investment into overall national economic development plans.

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Annex 1 – Health indicators

Indicators of health

As with indicators in other sectors, those that have been advocated often reflect more what is already available rather than what is important. Thus, Sharpe (2001) proposes a framework for indicators of human capital in which he identifies two categories: outcome and input indicators. In addition to healthy life expectancy, discussed later, the former include a wide range of cause-specific death rates, incidence of diseases, or absence from work. The latter include five broad categories that measure:

- quality of care;
- accessibility to the health system;
- advancement of medical knowledge;
- environmental determinants of health;
- individual lifestyles.

Any value that input indicators might have is dependent on the premise that the expenditure of greater resources on health, as captured by these summary indicators, will improve health outcomes. This is not always the case as resources may be deployed ineffectively or because there is no true link between the health inputs and health outcomes ⁽¹⁰⁹⁾.

Paradoxically, the most frequently used measure of the health of a population is actually the death rate (or adult survival rates) in that population. By applying death rates to the age structure of a population, these values can be converted into a summary measure of life expectancy. However, they only imperfectly reflect the actual health of a population. Specifically, they underestimate the burden of disease that is attributable to chronic disabling disorders, such as mental health problems and the increasing number of physical diseases for which healthcare has postponed death but failed to restore normal functioning (Murray and Lopez 1997). As this book has indicated, these disabling conditions are of considerable importance when assessing the economic consequences of ill health, whether through the loss of productivity they entail or the cost of caring for those who suffer from them. They are also important in assessing the ability of policies not only to reduce mortality but also to compress morbidity, reducing the proportion of his or her life that an individual can expect to spend in poor health.

Thomas and Frankenberg (2000) distinguish between two classes of health measures: self-reports (or ‘subjective’ measures) and physical assessments (or so-called ‘objective’ measures). Both types of measure offer potential benefits; the choice will depend largely on the question being asked. One is not intrinsically superior to the other.

⁽¹⁰⁷⁾For example, the United States devotes a far greater proportion of GDP to health than other developed countries yet has average life expectancy significantly below many of these countries

Subjective measures of health

These include self-reported measures of health, which can be combined with data on mortality to generate a measure of health expectancy, in which overall life expectancy is partitioned into periods lived at different levels of health. The most common methods divide life expectancy into disability-free life expectancy and time lived with disability (Robine et al. 1999).

With increasing proportions of populations in older cohorts, there is need for more information about the consequences of non-fatal diseases for health and quality of life. In this regard, self-reporting data on general morbidity are being collected increasingly by national health surveys; examples of such data include perceived health status, physical and mental functioning, and multidimensional concepts of health. However, as Jee and Or (1997) point out, there is a significant lack of consensus on the appropriate concepts and methodologies for these surveys.

Fukui and Iwamoto (2003) have shown that subjective measures, such as reduced ability to work or self-rated health status, are more closely related to earnings and labour force participation than objective ones (such as presence of a disease or reporting a specific symptom), and that equations with subjective measures generate more robust estimates of future earnings losses.

Measures of self-rated health, as well as derived measures such as health expectancy, thus offer a way of moving beyond the traditional measures of death rates and life expectancy when exploring the relationship between health and economic growth. However, many unresolved issues remain (Murray et al. 2000). The first issue is the relative lack of comparable data on disability, compared with the universal system for monitoring mortality within EU Member States. The landmark 'Global burden of disease' (Murray and Lopez 1996), which assessed the impact of selected diseases and risk factors on disability adjusted life years, largely applied standard disability weightings to data on disease incidence and prevalence (Murray and Lopez 1997), and in many parts of the world these data were themselves estimated from other parameters (Murray and Lopez 1994).

A second issue is the comparability of measures. The calculation of healthy life expectancy can be expected to depend on the measure of health chosen and the dividing line between health and ill health that is used. However, a study in Finland examined differences in health expectancy by level of education and by gender using two cut-off points each on three scales of limiting long-standing illness, functional disability, and poor self-rated health (Andreev et al. 2002). As expected, the precise figures for healthy life expectancy in each category varied but the pattern was consistent. Furthermore, self assessment of health seems to be robust in relation to the specific type of question asked, in terms of the number of response categories or whether respondents are asked to compare their health with others of the same age (Eriksson et al. 2001).

A third issue is whether the measure of health or disability being used is interpreted in the same way by different subgroups within a population. This is a very difficult issue to resolve, as there is no gold standard against which to assess it. The ability of poor self-rated health to predict mortality is known to vary between countries. For example, it was less predictive of mortality in Lithuania than in the Netherlands (Appels et al. 1996). In the United States its predictive power among the Hispanic population was correlated with the degree of acculturation (Finch et al. 2002). However, research on ethnic groups in the United States has shown that a simple baseline comparison may underestimate predictive power because of different trajectories of illness over time (Ferraro and Kelley-Moore 2001). Thus, some disease processes, such as heart disease, may lead to ill health over many years but others, such as death from violence, would not. Where the latter is a more common cause of death, the ability to predict mortality will clearly be reduced. Hence, the differing ability of self-rated health to

predict mortality in Italy and Finland could be explained largely by differences in markers of disease (Jylha et al. 1998).

A fourth issue is whether self-rated health correlates with more ‘objective’ measures. Research from the United Kingdom has found that self-rated health behaves in the same way among different ethnic groups in relation to the presence of chronic disorders (Chandola and Jenkinson 2000). A study from Russia found that, when self-rated health was replaced by ‘more objective’ measures of health, there was no significant change in estimates of healthy life expectancy.

Taken together, therefore, the available evidence suggests that health expectancy does offer a robust means of moving beyond life expectancy to assess the health of a population and thus the contribution that it makes to, and in turn the impact on it, of economic growth.

Physiological measures as indicators of health

The second set of health measures are labelled objective. Among these, the anthropometric measures of height and weight have proven to be powerful predictors of economic development. There are also a very large number of condition-specific objective measures, such as blood pressure or indicators of functioning of particular body systems, although these have rarely been used in studies of the contribution of health to economic development.

Height and weight have traditionally been used as predictors of morbidity and mortality risk among children and, more recently, adult height and body mass index (BMI) have been put forward as indicators of the probability of dying or of developing chronic diseases at middle and late ages (Fogel 1994, Schultz and Tansel 1996, Steckel 1995, Strauss and Thomas 1998).

Measures such as height, leg length, or age at menarche can be obtained from adults and used to infer information about those individuals’ childhood conditions, making possible the introduction of a time element into cross-sectional studies. Moreover, there is now considerable evidence that conditions in early life exercise a substantial impact on many aspects of adult health, acting through a range of mechanisms including programming of blood pressure, and thus the risk of diseases such as stroke, development of lung function, and the risk of acquiring infections whose impact is felt later in life (such as stomach cancer following infection with *Helicobacter Pylori*). In addition, some physiological parameters have a more direct influence on health, such as body mass index, a measure of obesity. However, the relationship between these physiological parameters and health, and ultimately on functioning, is complex and non-linear. As Strauss and Thomas (1998) note, higher calorie intakes have a beneficial effect in situations of malnutrition yet an adverse effect in situations of obesity. In practice, it seems that the choice of measures used has often been driven primarily by the availability of data, especially in studies that have used height, a measure that is often available historically from, for example, records of military recruits.

Height

Height is determined by genetic make-up and realised in part through satisfactory nutrition and health-related care and conditions. Schultz (2002) points out that height is a latent indicator of early nutrition and lifetime health status and is observed to increase in recent decades in populations where per capita national income has increased and public health activities have grown.

Steckel (2002) shows that significant differences in health and quality of life are associated with height. A comparison between the United States and Europe shows that, unlike in the USA, height

and life expectancy have continued to grow in Europe, which has the same genetic stock from which most Americans descend. By the 1970s, several American health indicators had fallen behind those in Norway, Sweden, the Netherlands and Denmark. While the trend in American heights was essentially flat following the 1970s, heights continued to increase significantly in Europe ⁽¹⁰⁾. Dutch men are now the tallest in Europe, averaging six feet (1.83 m), about two inches (5 cm) more than American men. These trends are consistent with other evidence of some worsening health outcomes in the USA (McKee and Nolte 2004).

In the view of Steckel, it is doubtful that lack of resource commitment to healthcare is the problem because America invests far more than the Netherlands. Greater inequality and less access to healthcare could be important factors in the difference. But access to healthcare alone, whether due to low income or lack of insurance coverage, may not be the only issues — health insurance coverage must be used regularly and wisely. In this regard, Dutch mothers are known for regular pre-and post-natal checkups, which are important for early childhood health. The comparisons made by the author are not part of an odd contest that emphasises height, nor is big per se assumed to be beautiful. Instead, he emphasises the well-known fact that, on average, stunted growth has functional implications for longevity, cognitive development, and work capacity. Children who fail to grow adequately are often sick, suffer learning impairments and have a lower quality of life. Growth failure in childhood has a long reach into adulthood because individuals whose growth has been stunted are at greater risk of death from heart disease, diabetes, and some types of cancer.

The use of height as a measure of health in the analysis of the relation between health and economic performance is in any case problematic. Height lies in the genotype and, therefore, reflects family background. Moreover, since height is largely determined in early childhood, it reflects investments made by parents when the worker was a young child, including not only investments in nutrition but also broader health and human capital investments. Therefore additional measures should be applied when analysing the relation between health and economic performance.

Body mass index

In contrast with height, body mass index varies throughout life. BMI is related to energy intake, net of output. It has also been shown to be related to maximum oxygen uptake during physical work (VO_{2max}), which in turn is related to aerobic capacity and endurance, independent of energy intake (Martorell and Arroyave 1988, Spurr 1983, 1988). Whether this is an important pathway through which health may influence productivity in the European context is not obvious since many jobs do not require sustained physical effort.

BMI at any point in time partly reflects previous health and human capital investments. Thus a correlation between BMI and productivity may be capturing the influence of those prior investments. The dynamic relationship between BMI and productivity is complicated because BMI has both stock and flow dimensions and thus reflects both contemporaneous changes in prices and incomes as well as prior influences. In addition, there may be complex lags in the translation of BMI into aerobic capacity and endurance, and ultimately into diabetes and cardiovascular diseases. The fact that weight can be drawn down in times of need to convert energy further complicates the dynamics.

In the context of developed countries, however, obesity can be used as an indicator of risk of morbidity. According to Fogel (1994) using data for Norwegian and American adults, an increase in BMI

⁽¹⁰⁾There are now clear signs that Americans in their teens and 20s are smaller than those in the age groups 30–39 and 40–49 (Komlos and Baur 2004).

from, say, 28 to 29 (or just 3.6 %) will increase the risk of morbidity by around 10 %. Fogel uses the Waaler (1984) diagnosis to illustrate that during most of the 20th century in developed countries (France and the USA) the BMI moved from being suboptimal to the optimal combination of height and weight. Recent studies of biometric developments and BMI would suggest that in several developed countries the BMI is now considerably above the optimal level. This, if not halted, might cause a considerable increase in morbidity during the coming years.

Age at menarche

The age at which menarche occurs falls with improved childhood nutrition. It is therefore a valuable measure of social circumstances in childhood as it is accurately recalled by adults many years later and thus can be used to provide a historical element to cross-sectional surveys looking at adult employment and income. However, as Knaul (1999) argues, age at menarche measures only a few of many dimensions of health.

Knaul summarises the scientific achievements which demonstrate improvements in health measured by age of menarche. These improvements are likely to be closely related to increased nutritional standards. Marshall (1978) and Trussel and Steckel (1978) evaluate a group of studies of age at menarche and conclude that, despite differences in data quality, they are remarkably consistent in illustrating an average decline of three to four months per decade over the past 100 years. The secular decline is also evident over the past 100 to 150 years in a variety of developed countries based on aggregate trends (Wyshak and Frisch 1982). The estimated rate of decline is between two and three months per decade. Brundtland and Walløe (1973) cite evidence from North America, Japan and Europe to show that girls have been maturing faster over the past 50 years at a rate of about four to five months per decade.

More recent studies have confirmed this tendency for well-nourished women in the United States born since 1920 (Wyshak 1983), Denmark since the 1940s (Manniche 1983), Flemish women in the 19th century (Wellens et al. 1990), Poland since approximately 1950 (Hulanicka and Waliszko 1991) and Norway among school children since the 1920s (Brundtland and Walløe 1973, Liestøl and Rosenberg 1995). Further, these studies suggest that the trend is coming to a halt among some well-nourished groups of high economic status in developed countries coincident with a threshold age at menarche (Brundtland and Walløe 1973).

Aggregating and valuing measures of health

There are two key issues in the field of indicators research which are related to aggregation and monetarisation. First, should the indicators selected as most appropriate be aggregated or rolled up into one composite indicator/index or left as a set of indicators? Second, if a composite indicator or index is to be constructed, should the aggregation be made in terms of a common measure such as monetary units or should the indicators be aggregated by means of a weighting procedure? This is not necessarily an either/or decision as an index can combine the two approaches. This is the approach adopted by the index of economic well-being developed by Osberg et al. 1998.

In relation to the question of aggregation, the great advantage of the composite indicator or index approach is that it produces a bottom line that can capture public attention. In addition, since no information is lost through the aggregation procedure, one can easily identify the variables that are driving the index since any policy response to trends in the index most focus on specific variables. In terms of the second issue, there are advantages and disadvantages of both approaches. The major

advantage of the monetary unit approach to aggregation, in addition to its transparency, is that under competitive conditions the valuation (whether market or imputed) placed on the various variables in theory correspond to the valuation society places on them. The major disadvantage of this approach is that for many variables there is no market value and it is difficult to impute a monetary value.

The major advantage of the weighting approach to aggregating a set of indicators into an index is its simplicity. The major disadvantage can be the subjective nature of the weighting scheme, which may reflect the biases of the constructors of the index. This problem can be overcome by developing a set of weights that reflect societal values and preferences through surveys.

It is in theory possible to impute monetary values on the indicators to track the economic sustainability of human capital in health areas. However, it is not clear that it is necessarily appropriate to do so because of the conceptual and data problems associated with estimating these values. It is difficult to place a total value on health-adjusted life expectancy (HALE) just as it is difficult to place a value on life. It is easier to put a value on changes in the HALE. By the use of contingent valuation techniques or other methodologies, one can value how much people would be willing to pay for an additional year of healthy living. Equally, these techniques can be used to value changes in self-reported health status. There has also been a growing interest in developing composite measures that integrate both mortality and morbidity in a single index (the more widely used measures are health expectancies, health-adjusted life expectancy, and disability adjusted life years).

Indicators of health system performance

Another set of indicators relates to the performance of the healthcare system. This is a subject that was given a considerable impetus by the publication by the World Health Organization of its controversial report *Health systems: Improving performance* in 2000, which propelled international health system comparisons to the forefront of high-level political discussions, highlighting the potential role and pitfalls of such comparisons (Welte et al. 2000, WHO 2000). Since then, many countries have used international performance comparisons as a basis for guiding national health policy priorities ⁽¹¹⁾.

It is beyond the scope of this book to produce a comprehensive overview of this subject, which has been covered elsewhere recently (see Wait and Nolte (2005) for an extended review). It is, however, relevant to examine some of the most widely used systems of indicators to assess their strengths and weaknesses.

The OECD has pioneered measurement of the performance of healthcare systems since the 1980s. Its 1985 publication, *Measuring healthcare, 1960–1983 expenditure, costs and performance*, was the first in a series of international studies designed to provide an empirical basis for a comparative understanding of the differences and similarities between OECD countries' health systems (OECD 1985, Schieber 1987). The importance of cross-national comparisons was seen as their potential to capture a range of different approaches to the organisation and delivery of healthcare, each with differing levels of success in achieving core goals, so allowing the experience of each country to provide 'an experimental laboratory for others' (OECD 1990). This effort was extended further by means of the OECD health data set, first published in 1993 and subsequently developed into a comprehensive data set that now includes data from 30 countries covering over 1 200 indicators. Whilst the

⁽¹⁰⁹⁾The most illustrative example is perhaps that of the UK, where evidence of poor relative cancer survival outcomes compared with other European countries (Berrino et al. 1995), coupled with the fact that Britain spends less of its GDP on health than most other Western nations, prompted the Labour government to inject significant funds into the National Health Service (NHS) in 2000

main focus of the data is on healthcare resources, financing and expenditure, other key aspects of healthcare systems, such as utilisation of healthcare services, social protection (e.g. healthcare coverage), the pharmaceutical market (e.g. consumption of medicines), as well as general demographic indicators and indicators of population health and health behaviour, are also covered (OECD 2003).

A different perspective of international assessment was introduced with the adoption of 38 health targets by the WHO European region in 1984 within the WHO ‘Health for all by the year 2000’ strategy, subsequently modified into ‘Health 21’ with the approval of 21 targets for Europe for the 21st century (WHO/EURO 2003). Because the health targets emerged from a population health perspective, with an emphasis on prevention and intersectoral action, their focus was mainly on public health achievements with few links to management and financing of healthcare. A number of targets were quantitative and countries agreed on a process to monitor progress towards them using over 200 health indicators (Ritsatakis 2000). This indicator set subsequently gave rise to the extensive ‘Health for all’ (HFA) database, allowing benchmarking of health trends between the 51 countries of the European region over time (WHO/EURO 2003).

The WHO 2000 report aimed to set out ‘new concepts and measures which lay the empirical basis for assessing health system performance’ (WHO 2000). Overall health system performance was assessed as a composite measure that included the level and distribution of health attainment, level and distribution of health system responsiveness, and degree of fairness of financing. This aggregate measure was then compared with what might be expected given the country’s level of economic and educational development, thus producing two measures of performance, or efficiency, one at the health level and one on overall performance. The 191 WHO member countries were then ranked based on these performance measures, producing the highly controversial league table of the world’s health systems.

This approach has been the subject of intensive debate, with some criticising the implied values underlying the approach taken (see, for example, Musgrove (2003), Navarro (2000), Richardson et al. (2003) and Williams (2001)) while others have focused on technical matters related to specific measures (Almeida et al. 2001). Nonetheless, the 2000 report played an indisputable role in raising awareness of the potential impact of international benchmarking of healthcare systems, and the stream of criticism that it engendered stimulated an unprecedented interest in the methodological challenges inherent in conducting and interpreting international comparisons.

The 2000 World Health Report attracted enormous global media attention. The ability to write that a particular healthcare system was the best in the world, or that the system in one country was better than in another where the two countries had been the focus of long-term cultural rivalry was too great a temptation for the media to resist. Yet at the same time, the reaction by both scientists and policy-makers to the simplistic comparisons (despite the many caveats expressed by the report’s authors) has discouraged others from engaging in the pursuit of composite measures of the performance of health systems, which are increasingly recognised as being extremely complex.

Instead, the thrust of current work is based on the recognition that, in any healthcare system, there will be multiple, often competing goals, frequently involving choices and trade-offs. Furthermore, while it is possible to infer the existence of the World Health Report’s three goals, improving health attainment, enhancing responsiveness of services, and ensuring fairness of financing, in most health systems, when these are studied in more detail, differences often emerge.

This has stimulated a quest to develop portfolios of indicators, each assessing a particular aspect of a healthcare system. For example, immunisation levels could be seen as an indicator of the organisation and delivery of collective health services. Cancer survival rates might be considered an indica-

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tor of the performance of the system for diagnosis and treatment. Ultimately, the choice of indicator is potentially almost limitless and is driven primarily by the question being asked.

Annex 2 – Methodology for the selection of studies on the impact of health on the economy

Because of our interest in developed countries and time constraints, some relevant studies have not found a place in this book. The book does not, for example, present the richness of all the published literature concerning the influence of health on economic growth in developing countries.

At the beginning of the research, the team reviewed the key reports and articles published by the World Health Organization and its Commission on Macroeconomics and Health (CMH) as well as several literature reviews (references in the tables attached in Annex 3). References to other studies were taken from these reviews and reports.

We have drawn extensively on the academic literature and on publications of the major international organisations: World Health Organization (WHO) and its CMH, European Observatory on Health Systems and Policies, World Bank, Organisation for Economic Co-operation and Development, European Commission, International Monetary Fund, etc. The websites of several universities have been checked for appropriate references, e.g. London School of Economics, London School of Hygiene and Tropical Medicine, University of York, Harvard University, etc.

The search engine Google and the following databases have been checked for articles and working documents:

- social science research network (www.ssrn.com);
- RePEc: research papers in economics (<http://econpapers.repec.org/>);
- National Bureau of Economic Research (www.nber.org) and its subsections health, labour, economic growth;
- sources listed in the health economics core library project (2003) (www.academyhealth.org).

The key words on which the selection has been made are: ‘health and economy’; ‘health and economic growth’; ‘health and labor productivity’; ‘health and labor supply’; ‘health and retirement’; ‘health and employment’; ‘health and education’; ‘health and earnings’; ‘health and wages’; ‘health and human capital’; ‘health and sustainability’; ‘health status in Europe’; ‘health and developed countries’; ‘investing in health’; ‘investment in health and economic growth’.

The articles that have been used as a main source of empirical evidence on the effect of health on economic growth, productivity, labour supply and education, mainly in developed countries, are listed in the tables in Annex 3.

Annex 3 – Tabular compilation of the main literature reviewed

Health and economic growth

Author/s	Title	Year	Proxy for health	Proxy for economic performance	Type of paper	Category of countries developed/developing	Observation	Publication
Arora, S.	Health, human productivity, and long-term economic growth	2001	LE at birth, at 5, at 10, at 15/20 and stature at adulthood	GDP	Cross-country analysis	10 industrialised countries over the course of 100–125 years: Australia: 1881–1994; Denmark: 1870–1922; Finland: 1881–1992; France: 1870–1994; Italy: 1875–1992; Japan: 1891–1994; Netherlands: 1880–1992; Norway: 1870–1992; Sweden: 1870–1994; UK: 1871–1992	Changes in health increased the pace of growth in these countries by 30 to 40%.	<i>Journal of Economic History</i> , Vol. 61, No 3, September
Barro, R.	Health and economic growth	1996	LE	GDP/per capita	Cross-country analysis	1960–90: three periods: 1965–75; 1975–85; 1985–90, cross-country analysis (100 countries), PWT data set (developing and developed countries)	A rise in life expectancy from 50 to 70 years (i.e. by 40%) would raise the growth rate on impact by 1.4 percentage points per year.	PAHO: Programme on public policy and health, health and human development division (http://www.paho.org/English/hdp/hdd/barro.pdf)
Beraldo, S., Montolio, D. and Turati, G.	Healthy, educated and wealthy: is the welfare state really harmful for growth?	2005			Cross-country analysis	19 OECD countries for the period 1971–98; production function approach	The role of spending on health to explain a much larger share (between 16 and 27%) of growth rates than expenditures on education (around 3%)	<i>Working Papers in Economics</i> 127. Barcelona: Universitat de Barcelona. Espai de Recerca en Economia
Bhargava, A., Jaminson, D., Lau, L. and Murray, C.	Modelling the effect of health on economic growth	2001	LE + ASR	GDP	Cross-country analysis	Data — PWT, and WDI (Summers and Heston 1991, World Bank 1998); six time observations — approximately 92 countries at five-year intervals (in 1965, 1970, 1975, 1980, 1985 and 1990)	Significant effects of adult survival rates (ASR) on economic growth rates for low income countries. For the poorest countries, a 1% change in ASR rate was associated with an approximate 0.05% increase in the growth rate. For highly developed countries, such as the USA, France and Switzerland, the estimated effect of ASR on growth rates is negative.	<i>Journal of Health Economics</i> 20, pp. 423–440

Author/s	Title	Year	Proxy for health	Proxy for economic performance	Type of paper	Category of countries developed/developing	Observation	Publication
Bloom, D., Canning, D. and Sevilla, J	The effect of health on economic growth: theory and evidence	2001 2004	LE	GDP	Review + cross-country analysis	Panel data for 104 countries, observed for every 10 years from 1960 to 1990; GDP — Penn World Tables, data on active labour force (ILO 1997). Life expectancy data (United Nations 1998)	A one-year improvement in a population's life expectancy contributes an increase of 4 % in GDP. The estimates of the effect of life expectancy capture only its direct effect on labour productivity.	NBER Working Paper 8587, National Bureau of Economic Research, Cambridge (www.nber.org/papers/w8587) <i>World Development</i> , Vol. 32, No. 1, pp. 1–13
Bloom, D., Canning, D. and Jamison, D. T.	Health, wealth, and welfare	2004	LE	GDP	Review			<i>Finance and Development</i> , March (http://www.imf.org/external/pubs/ft/fin/2004/03/pdf/bloom.pdf)
Brinkley, G.	The macroeconomic impact of improving health: investigating the causal direction	2001	Four health variables: LE, IMR, crude death rates, and investment in medical research	GNP	Country analysis USA	Data since 1900	For all four health variables, the causal pathway runs from health to wealth. Governmental intervention should not focus on pro-growth but rather on health-enhancing policies.	http://rc.ucdavis.edu/gbrinkley/Does/Causal.pdf.
Fogel, R.	Economic growth, population theory, and physiology: the bearing of long-term process on the making of economic policy	1994	LE	GDP	Historical (time series) study country analysis, UK	Britain, 1780–1980	Health and nutrition improvements have accounted for about 30 % of Britain's income growth rate or about 1.15 % per capita per annum in the 200-year period from 1780 to 1980.	<i>American Economic Review</i> , Vol. 84, No. 3, June, pp. 369–395
Jamison, D. T., Lau, L. and Wang, J.	Health's contribution to economic growth in an environment of partially endogenous technical progress	2004	LE + ASR (males between 15–60)	Economic growth–labour supply	Cross-country analysis	More than 50 countries, for the period 1965–90 (developing + developed), data from PWT, version 5.6 subsequent analysis 1960–90, PWT version 6.1 for 48 out of 53 countries, mortality — WDI	Improvements in health led to 11 % of growth for the period (0.23 % per year — income growth from better health).	Working Paper No. 10, 'Disease control priorities project', Bethesda, Maryland: Fogarty International Center, National Institutes of Health, February (www.fic.nih.gov/depp)

Author/s	Title	Year	Proxy for health	Proxy for economic performance	Type of paper	Category of countries developed/developing	Observation	Publication
Knowles, S. and Owen, P.	Health capital in cross-country variation in income per capita in the Mankin-Romer-Well model	1995	LE	GDP	Cross-country analysis	The basic data set is the one used in MRW. The sample of 84 countries is used in the model.	Strong and relatively robust relationship between life expectancy as a proxy for health capital, and income per capita	<i>Economic Letters</i> , 48:99–106
Rivera, B. and Currais L.	Economic growth and health: Direct impact or reverse causation?	1999a	Health expenditures (%)	GDP	Cross-country analysis	OECD	Statistically significant impact of health expenditures on economic growth and on income levels	<i>Applied Economics Letters</i> , 6: 761–764
Rivera, B. and Currais L.	Income variation and health expenditure: Evidence for OECD countries	1999b	Health expenditures (%)	GDP	Cross-country analysis	OECD		<i>Review of Development Economics</i> , 3(3): 258–267
Suhreke, M. and Urban, D.	The role of cardiovascular disease in economic growth	2005	Cardiovascular disease (CVD)	Economic growth	Cross-country analysis	Period from 1960 to 2000 for a worldwide set of countries	When focusing on the sample of 26 high-income countries, CVD mortality (of the working-age population) turns out to be a robust predictor of subsequent economic growth. In one specification, a reduction of CVD mortality at working age of 10% is associated with an increase in the growth rate of per capita GDP by 1 percentage point.	Mimeo, WHO European Office for Investment for Health and Development, Venice
Weil, D.	Accounting for the effect of health on economic growth	2004	Height, ASR, age at menarche	GDP/per capita	Cross-country analysis	111 countries, 1960–98	Cross-country variance in income explained by variation in health range from 8% to 20%. Using the menarche method, health accounts for 7.7% of the variation in log GDP per worker, while using the ASR method health accounts for 19.1% of the variation in log GDP per worker.	Department of Economics, Brown University, preliminary paper (http://econ.ucsd.edu/seminars/Weil_F04.pdf)

Health and productivity (earnings and wages)

Author/s	Title	Year	Proxy for health	Proxy for economic performance	Type of paper	Category of countries developed/developing	Observation	Publication
Andren, D and Palmér, E.	The effect of sickness on earnings	2001	Spells of sickness (long and short term), health status — sickness diagnosis	Earnings — annual and hourly; sickness cash benefits	Review of literature + country analysis, Sweden	Sweden, Swedish National Social Insurance Board (1983–91, ages 16–64)	People who are healthy in the current year, but have long-term sickness in the previous five years have lower earnings than persons without long-term sickness.	<i>Working Papers in Economics</i> No 45, Department of Economics, Gothenburg University (http://www.handels.gu.se:81/epce/archive/0002222/01/gunwpe0045.pdf)
Averett, S. and Korenman, S.	The economic reality of the beauty myth	1996	BMI	Wages/income	Country analysis, USA	Sample of 23- to 31-year-olds drawn from the 1988 NLSY, USA	Obese women have lower family incomes than women whose weight-for-height is in the 'recommended' range. There is some evidence of labour market discrimination against obese women. The results for men are weaker and mixed.	<i>Journal of Human Resources</i> , Vol. 31, No 2, spring
Bartel, A. and Taubman, P.	Health and labour market success: the role of various diseases	1979	Doctor's diagnosis	Individual's wage rate, weekly hours, weeks worked	Country analysis, USA	Data from a twins' panel maintained by the National Academy of Science — National Research Council (NAS-NRC) — population of white, veteran, male twins born in the continental United States between 1917 and 1927. The study was performed in 1974 (with 2 500 pairs).	Health status has strong effect effects on earnings: — 20 % to 30 % reductions around age 50 of certain diseases (heart disease and hypertension, psychoses and neuroses, arthritis and bronchitis, emphysema and asthma) contracted during the last 10 years.	<i>Review of Economics and Statistics</i> , Vol. 61, No 1, pp. 1–8
Bartel, A. and Taubman, P.	Some economic and demographic consequences of mental illness	1986	Mental illness	Earnings	Country analysis, USA	NAS-NRC twin data	Mental illness reduces earnings initially by as much as 24 %, and negative effects can last for as long as 15 years after diagnosis.	<i>Journal of Labor Economics</i> , 4: 243-256
Bloom, D., Canning, D. and Sevilla, J.	Health, worker productivity and economic growth	2002	LE/ASR	GDP/worker productivity — log output per worker	Cross-country analysis	Panel cross-country analysis — 1960–95: data from PWT, ILO, UN	1 percentage point increase in adult survival rate (ASR) increases labour productivity by about 2.8 %, with a 95 % confident interval of 1.2 to 4.3 % (calibrated value of around 1.7 %).	School of Public Policy and Management, Carnegie Mellon University, Pittsburgh (http://equilibrium.heinz.cmu.edu/mgaynor/AHEC/bloom_%20final_%20paper2.pdf)

Author/s	Title	Year	Proxy for health	Proxy for economic performance	Type of paper	Category of countries developed/developing	Observation	Publication
Chirikos, T. and Nestel, G.	Further evidence on the economic effects of poor health	1985	Self-reported health status over the preceding 10-year period (1967–77)	Wages + annual hours worked	Country analysis, USA	USA, NLS Data: 1966–76 men 1966–77 women	The average reduction in earnings is roughly the same for men (white and black) and represents a loss of about 20% of the earnings reported by the continuously healthy. Those in continuous poor health have 36% lower wages (men) and 48% (women).	<i>Review of Economics and Statistics</i> , Vol. 67, No 1, pp. 61–69
Contoyannis, P. and Rise, N.	The impact of health on wages: evidence from the British Household Panel Survey	2001	Self-assessed health	Wages (hourly)	Country analysis, UK	British Household Panel Survey — six waves — annually from 1991, working sample of 1 670 individuals (859 males and 811 females, sub-set of fully employed)	Reduced psychological health reduces the hourly wages for males, while excellent self-assessed health increases the hourly wages for females. The gradient on self-assessed health is now more pronounced (and significant) for full-time employees compared with part-time employees.	<i>Empirical Economics</i> , 26: 599–622
Currie, J. and Madrian, B.	Health, health insurance and the labour market	1999	Mental health	Wages	Review of literature, country analysis, USA	USA	Poor health reduces the capacity to work and has substantive effects on wages, labour force participation, and job choice. However, the exact magnitudes of the estimated relationships are sensitive both to the choice of health measure and to identification assumptions. Impairment of mental health has been shown to have a major impact on earnings — psychiatric disorders affect workers at the peak of productive life.	<i>Handbook of Labour Economics</i> , Vol. III-C. O. Ashenfelter and D. Card (eds), Chapter 50, 3310–3415
Fukui, T. and Iwamoto, Y.	An estimation of earnings losses due to health deteriorations	2003	Self-assessed health, work limitations, patient, symptoms	Earnings	Country analysis, Japan	Japanese working-age (30–54) males by using data from Comprehensive Survey of Living Conditions for 1989, 1992 and 1995	1% of total earnings are lost due to deterioration of health.	International Forum for Macroeconomic Issues, Tokyo, 17–19 February 2003 (http://www.esri.go.jp/ij/ptj-re/macro/macro14/08hitotsubashii_12.pdf)

Author/s	Title	Year	Proxy for health	Proxy for economic performance	Type of paper	Category of countries developed/developing	Observation	Publication
Gambin, L.	Gender differences in the effect of health on wages in Britain	2004	Self-assessed health	Hourly wages	Country analysis, UK	Eleven waves of the British Household Panel Survey (1991–2001), 20 387 males and 20 653 females who are either full-time or part-time employees, and 19 739 males and 13 555 females who are full-time employees only	An indication of excellent health for males would increase the hourly wage from GBP 1.012 to GBP 1.042 per hour while for women the change would be from GBP 1.024 to GBP 1.056. For good health, ceteris paribus, there would be an increase of hourly wages of GBP 1.021 for men and from GBP 1.012 to GBP 1.025 for women. Therefore, the impact of health is found to differ slightly by sex and is more strongly related to women's wages than to men's.	Department of Economics and Related Studies University of York (http://www2.econ.york.ac.uk/~ecuity/public_papers/ECuity3wp20GambinGenderHealth.htm)
Gustman, A. and Stemmer, T.	A disaggregated, structural analysis of retirement by race, difficulty of work and health	1986	Short-term and long-term illnesses	Hourly wages	Country analysis, USA	US Retirement History Survey (RHS) and Panel Study of Income Dynamics for white males; years 1969–75	Illness occurred before 55: The long-term illness reduced the wages of full-time workers by 3.1 % and part-time workers by 4.9 %. Short-term illness had a smaller negative impact on full-time workers (0.7 %) but a larger negative impact on part-time workers — 12 % reduction in wages. Illness occurred after age of 55: The long-term illness reduced the wages of full-time workers by 8.4 % and part-time workers by 7.2 %. The short-term illness had a smaller negative impact on both full-time workers and part-time workers of 4.2 % and 3.7 %, respectively.	<i>Review of Economics and Statistics</i> , 68, 509–513.
Hansen, J.	The effect of work absence on wages and wage gaps in Sweden	2000	Work absence due to ill health	Wages	Country analysis, Sweden	Sweden, data from the Swedish National Social Insurance Board (for the period 1991–92) and household data from Statistics Sweden, covering approximately 7 000 households	Women's wages are significantly reduced by work absence caused by their own sickness. Absence to care for a sick child appears to have no significant wage effect. Women are more likely to be absent than men. For men, no significant effect of illness-related work absence on wages was found.	<i>Journal of Population Economics</i> , Vol. 13, No 1, March, pp. 45–55

Author/s	Title	Year	Proxy for health	Proxy for economic performance	Type of paper	Category of countries developed/developing	Observation	Publication
Heineck, G.	Up in the skies? The relationship between body height and earnings in Germany	2004	Height	Monthly gross earning/hourly wages	Country analysis, Germany	German Socio-Economic Panel data from 1991 to 2002 (including West and East Germany), ages between 21 and 50; sample: 33 247 persons full and part time, blue and white collar workers	Earnings premiums of about 1.3 % for East Germans and 1 % for West German males with an additional centimetre of height (using the continuous height indicator). This corresponds to some 3 % earnings gain of above-average-height males in both East and West Germany, while the penalties for having below-average height are somewhat differing: there is an almost 3 % earnings loss for West German males and even a 6 % penalty for East Germans. The results do not suggest for an effect of height on the earnings of female workers.	Department of Economics, University of Munich (http://www.econhist.de/heineck/gh-dateien/height-earn.pdf)
Judge, T. and Cable, D.	The effect of physical height on workplace success and income: preliminary test of a theoretical model	2003, 2004	Height	Earnings	Country analyses, USA and UK	USA and UK	Each one-inch increase in height results in an increase in annual earnings of, on average, an additional USD 789 per annum, after controlling for sex, age and weight. Height is also related to measures of social esteem, leader emergence and performance.	<i>Journal of Applied Psychology</i> , 89(3): 428–441 (2004) University of Florida (http://www.napa.ufl.edu/2003news/height_salary.htm . (2003))
Luft, H. S.	Impact of health status on earnings, incl. overall loss of earnings to the economy	1975	Measure of health status	Earnings	Country analysis, USA	USA, 1967	Comparison of components of earnings (labour force participation, hourly wage, and hours worked per week) of persons who were healthy with those in bad health — sizeable effect of bad health, accounting for a loss of 6.2 % of total earnings.	<i>Review of Economics and Statistics</i> , 57: 43–57

Author/s	Title	Year	Proxy for health	Proxy for economic performance	Type of paper	Category of countries developed/developing	Observation	Publication
Peikowski, J. M. and Berger, M. C.	The impact of health on employment, wages, and hours worked over the life cycle	2004	Health history	Annual hours and hourly wages	Country analysis, USA	Health and Retirement Survey data — retrospective and current health information on the individuals; sample: men and women born between 1931 and 1941 residing in the United States (and not in institutional care). The first wave was conducted in 1992–1993. A total of 12 654 respondents from 7 703 households were interviewed.	Permanent health conditions have negative effects on labour market outcomes. Poor health has different consequences for males and females. Women face a slightly larger percentage reduction in wages than males as a result of permanent health conditions and have reductions in wages. Temporary health conditions have little impact on hourly wages or hours worked. Males: peak of health problems in their 40s; females: in their 30s — near the peak of their life-cycle earnings.	<i>Quarterly Review of Economics and Finance</i> , 44: 102–121
Perisco, N., Postlewaite, A. and Silverman, D.	The effect of adolescent experience on labour market outcomes: the case of height	2003	Height	Wages	Country analyses, UK and USA	Britain's National Child Development Survey (1979–85), National Longitudinal Survey of Youth (1979 youth cohort, sample size: 2 063 white, non-Hispanic males)	White British men: every additional inch of adult height is associated with a 2.2 % increase in wages. White males in the USA: every additional inch of height as an adult is associated with a 1.8 % increase in wage. Authors suggest that it is not adult height that affects labour market outcomes, but that it is tallness as a teenager that matters.	Penn Institute for Economic Research (PIER), Working Paper 03-036 (http://www.econ.upenn.edu/Centers/pier/Archive/03-036.pdf)
Schultz, P.	Wage gains associated with height as a form of health human capital	2002	Height	Hourly wages	Cross-country analysis, Ghana, Brazil and USA	Two developing countries: Ghana (1987–89, ages 25–54, source: GLSS) and Brazil (1989, ages 25–54, source: PNSN), and one developed country: United States (1989–93, ages 20–28, source: NLSY).	An additional centimetre in adult height is associated with wages being 1.5 % higher for men and 1.7 % higher for women in Ghana, 1.4 and 1.7 % higher in Brazil, respectively, and 0.45 and 0.31 % higher in the United States, respectively.	Yale University — Economic Growth Center, Yale Economic Growth Center Discussion Paper No 841 (http://www.econ.yale.edu/growth_pdf/cdp841.pdf)

Health and labour supply

Author/s	Title	Year	Proxy for health (or care-giving)	Proxy for labour supply	Countries	Publication
Bound, J.	Self-reported versus objective measures of health in retirement models	1991	Self-reported health limits to work, self-reported general health status relative to those of same age, date of death, an instrument for health limits (built using information on date of death), and an instrument for general health status (built using information on date of death)	Labour force participation	USA	<i>Journal of Human Resources</i> , Vol. 26, pp. 106–138
Bound, J., Schoenbaum, M., Stinebrickner, T. and Waidmann, T.	The dynamic effects of health on the labour force transitions of older workers	1999	Index of general health status built using information on self-reported general health status and on difficulties performing 17 ADLs and IADLs	Transition from employment to: different job, applied for disability insurance, neither employed nor applied for disability insurance, or remaining in same job	USA	<i>Labour Economics</i> , Vol. 6, pp. 179–202
Bound, J., Stinebrickner, T. and Waidmann, T.	Health, economic resources and the work decisions of older men	2003	General health status instrumented using information on self-assessed health status and on difficulties with 13 ADLs	Transition from employment to: different job, leaving work-force and applying for disability insurance, leaving work-force without applying for disability insurance, or remaining in same job	USA	Retrieved from http://socserv.socsci.mcmaster.ca/econ/sem2003/stinepaper.pdf
Charles, K. K.	Sickness in the family: Health shocks and spousal labor supply	1999	Self-reported health limits to work, self-reported general health status relative to other people. These two health indicators are also instrumented using information on functional limitations.	Employed for pay or not; annual hours of work	USA	Working Paper from the Gerald R. Ford School of Public Policy, University of Michigan, No 2000-011 (retrieved from: http://www.fordschool.umich.edu/research/papers/PDFfiles/00-011.pdf)
Chirikos, T. N. and Nestel, G.	Further evidence on the economic effects of poor health	1985	Four health categories are constructed: 'continuously healthy', 'continuous poor health', enjoying 'improving health', and being in 'deteriorating health'. Based on data on: self-reports of functional limitations or impairments, self-ratings of general health status, retrospective assignments of health as having improved, deteriorated or remained unchanged over various time periods, and self-reports of whether health affects work effort.	Annual hours of work	USA	<i>Review of Economics and Statistics</i> , Vol. 67, No 1, pp. 61–69

Author/s	Title	Year	Proxy for health (or care-giving)	Proxy for labour supply	Countries	Publication
Coile, C.	Health shocks and couples' labor supply decisions	2003	Health shocks defined as: acute health events (heart attack, stroke, new cancer), onset of new chronic illnesses (diabetes, lung disease, heart failure, and arthritis), accidental injuries or falls, important deterioration in functional health (limitations in four or more new ADLs), important reduction in the self-assessed survival probability (reduction of more than 20 % of probability to live to 75)	Hours of work supplied per year; exit from the labour force	USA	CRR Working Paper, No 8, May
Currie, J. and Madrian, B. C.	Health, health insurance and the labour market	1999	Literature review	Literature review	USA	In O. Ashenfelter and D. Card (eds), <i>Handbook of Labour Economics</i> , Vol. 3, Amsterdam: Elsevier Science Publishers, pp. 3309–3416
Deschryvere, M.	Health and retirement decisions: An update of the literature	2004	Literature review	Literature review	USA and Europe	ETLA Discussion Papers, No 932
Disney, R., Emmerson, C. and Wakefield, M.	Ill health and retirement in Britain: A panel data-based analysis	2003	A measure of 'health stock' is constructed using data on: general self-reported health status; registered as disabled or not; health limits ability to perform the following daily activities compared with most people of his/her age: doing the housework, climbing stairs, dressing oneself, walking for at least 10 minutes; presence or not of a series of health problems and disabilities	Transition from economic activity to inactivity	Britain	IFS Working Paper, No 03/02
Eitner, S. L.	The opportunity costs of elder care	1996	Whether the respondent lives with a parent with disabilities; whether the respondent cares for a parent living outside of the household	Weekly work hours	USA	<i>Journal of Human Resources</i> , Vol. 31, No 1, pp. 189–205
Gannon, B. and Nolan, B.	Disability and labour market participation	2003	Chronic illness or disability 'severely' hampering their daily activities; long-standing illness restricting 'to some extent' the kind of work the individual could do	Labour force participation	Ireland	HRB Working Paper, June (retrieved from http://www2.eur.nl/bmg/ecuity/public_papers/ECuity3wp8Gannon.pdf)

Author/s	Title	Year	Proxy for health (or care-giving)	Proxy for labour supply	Countries	Publication
Jiménez-Martín, S., Labega, J. M. and Martínez Granado, M.	Health status and retirement decisions for older European couples	1999	Self-reporting good health, self-reporting a chronic physical or mental health problem; having been admitted as an in-patient during the previous year; having visited a doctor between one and five times in the year; having visited a doctor more than five times in the year	Transitions from activity (employment or unemployment) to inactivity (not only those declaring themselves retired)	EU	Retrieved from: http://www.ceps.lu/riss/documents/riss-wp1.pdf
Kerkhofs, M., Lindeboom, M. and Theeuwes, J.	Retirement, financial incentives and health	1999	Self-reported work limitations for health reasons and the Hopkins Symptom Checklist	Transition from work into: early retirement, disability insurance scheme, or unemployment insurance	The Netherlands	<i>Labour Economics</i> , Vol. 6, pp. 203–227
Lechner, M. and Vázquez-Alvarez, R.	The effect of disability on labour market outcomes in Germany: Evidence from matching	2004	Disability status (officially registered as disabled with a degree of disability equal or greater than 30%)	Working/non-working status	Western Germany	Centre for Economic Policy Research, Discussion Paper No 4223, February
Lindholm, C., Bursström, B. and Diderichsen, F.	Does chronic illness cause adverse social and economic consequences among Swedes?	2001	Self-reported limiting long-standing illness	Economic inactivity (includes early retirement), unemployment, and long-term unemployment (more than five months within the last year)	Sweden	<i>Scand J Public Health</i> , Vol. 29
Pagán, R. and Marchante, A. J.	Análisis de las diferencias salariales por discapacidad en España: el caso de los varones	2004	Self-reported disability status	Paid employee working more than 15 hours per week or not	Spain	<i>Hacienda Pública Española/Revista de Economía Pública</i> , No 171, pp. 75–100
Peikowski, J. M. and Berger, M. C.	The impact of health on employment, wages, and hours worked over the life cycle	2004	Self-reported temporary conditions limiting ability to work (lasting three months or less), self-reported permanent health conditions limiting ability to work, and self-reported permanent health conditions by age of onset	Employment status, annual hours worked	USA	<i>Quarterly Review of Economics and Finance</i> , Vol. 44, pp. 102–121
Riphahn, R. T.	Income and employment effects of health shocks — a test case for the German welfare state	1998	Self-assessed level of health satisfaction	Labour force status (full-time employment, part-time employment, unemployment, and out of the labour force)	Western Germany	IZA Discussion Paper No 10, June

Author/s	Title	Year	Proxy for health (or care-giving)	Proxy for labour supply	Countries	Publication
Roberts, A. A.	The labour market consequences of family illness	1999	Diagnosed mental illness, ADL limitation, multiple mental illnesses, chronically physically ill or disabled, having a work-limiting health condition	Labour force participant or not, working or not, weekly hours of work	USA	<i>Journal of Mental Health Policy and Economics</i> , Vol. 2, pp. 183–195
Sammartino, F. J.	The effect of health on retirement	1987	Literature review	Literature review	USA	<i>Social Security Bulletin</i> , Vol. 50, No 2, February
Siddiqui, S.	The impact of health on retirement behaviour: Empirical evidence from West Germany	1997	The degree of disability based on a physician's assessment of the capacity to fulfil the job requirements; and a dummy variable indicating whether the person suffers from a chronic disease (self-assessed)	Self-reported age at 'retirement'	Western Germany	<i>Econometrics and Health Economics</i> , Vol. 6, pp. 425–438
Sickles, R. C. and Taubman, P.	An analysis of the health and retirement status of the elderly	1984	General perceived health status compared with others of the same age; data on death	Working full time/not working full time	USA	NBER Working Paper, No 1459, Cambridge, MA, September
Spieß, C. K. and Schneider, T.	Midlife care-giving and employment: An analysis of adjustments in work hours and informal care for female employees in Europe	2004	Weekly care-giving hours	Weekly work hours	EU	ENEPRI Occasional Paper, No 6, April
Strauss, J. and Thomas, D.	Health, nutrition and economic development	1998	Height, BMI	% of urban men not working	Developing countries (Brazil)	<i>Journal of Economic Literature</i> , Vol. XXXVI, pp. 766–817
Van de Mheen, H., Stronks, K., Schrijvers, C. T. M and Mackenbach, J. P.	The influence of adult ill health on occupational class mobility and mobility out of and into employment in the Netherlands	1999	Perceived general health status, health complaints (more than three out of a list of 13), chronic conditions (at least one out of a list of 23 conditions)	Paid employment/unemployed and economically inactive	The Netherlands	<i>Social Science and Medicine</i> , Vol. 49, pp. 509–518

Health and education

Author/s	Title	Year	Proxy for health	Proxy for education or cognitive development	Countries	Publication
Berger, M.C. and Leigh, J.P.	Schooling, self-selection, and health	1989	From the NLS: — measure of functional limitations, — measure of work-limiting disabilities. From HANES: — systolic blood pressure, — diastolic blood pressure.	Completed years of schooling	USA	<i>Journal of Human Resources</i> , Vol. 24, No 3, pp. 433–455
Cas, A., Ferrig, A. and Paxson, C.	The lasting impact of childhood health and circumstance	2004	Measures of prenatal and childhood health: low birth weight (less than 2,500 grams), indicators of how much the child's mother smoked during pregnancy (moderately, heavily, variable), the number of physician-assessed chronic health conditions observed at ages 7 and 16 (differentiating between physical impairments, mental and emotional conditions, and other 'systems' conditions), and height at age 16	Number of O-level exams passed at age 16	Great Britain (Scotland, England and Wales)	<i>Journal of Health Economics</i> , 2005, Vol. 24, pp. 365–389
Del Gaudio Weiss, A. and Fantuzzo, J.W.	Multivariate impact of health and caretaking risk factors on the school adjustment of first graders	2001	Health risks: low birth weight (less than 2,500 grams), lead poisoning (10 µg/dl of lead in blood), and the Apgar score (risk at scores ≤ 6)	School performance, school behaviour, grade retention, school attendance	USA	<i>Journal of Community Psychology</i> , Vol. 29, No 2, pp. 141–160
Edwards, L.N. and Grossman, M.	The relationship between children's health and intellectual development	1980	Birth weight, breast-fed, mother's age at birth, parental assessment of child's health at one year and at time of interview, sight problems, hearing problems, 'significant abnormality', height, weight, number of decayed teeth, accidents, excessive absence from school for health reasons	IQ measure and a measure of school achievement	USA	NBER Working Paper, No 213
Gregg, P. and Machin, S.	Child development and success or failure in the youth labour market	1998	Ever sick due to minor ailments in last school year, ever sick due to more serious ailments in last school year	School attendance in the autumn term of the last school year and probability of staying on at school after the compulsory school-leaving age	Great Britain	Centre for Economic Performance Discussion Paper, No 397, July

Author/s	Title	Year	Proxy for health	Proxy for education or cognitive development	Countries	Publication
Perri, T. J.	Health status and schooling decisions of young men	1984	Index of functional limitations	Completed years of schooling	USA	<i>Economics of Education Review</i> , Vol. 3, No 3, pp. 207-213
Shakotko, R. A., Edwards, L. N. and Grossman, M.	An exploration of the dynamic relationship between health and cognitive development in adolescence	1980	Periodontal index, obesity, presence of one or more significant abnormalities as reported by the examining physician, high diastolic blood pressure, parent's assessment of the youth's overall health, excessive school absence for health reasons during past six months	IQ measure and a measure of school achievement	USA	NBER Working Paper, No 454
Strauss, J. and Thomas, D.	Health, nutrition and economic development	1998	Height	Years of schooling	USA and Brazil	<i>Journal of Economic Literature</i> , Vol. XXXVI, pp. 766-817

List of abbreviations

ADA	American Diabetes Association
ADL	Activities of daily living
AGIR	Ageing, health and retirement in Europe
ASR	Adult survival rate
BHPS	British Household Panel Survey
BMI	Body mass index
CEA	Cost-effectiveness analysis
CEPS	Centre for European Policy Studies
CERRA	Centre for Economic Research on Retirement and Ageing (Dutch panel; survey)
CHD	Coronary heart disease
CHOICE	Choosing interventions that are cost-effective
CMH	Commission on Macroeconomics and Health
COI	Costs of illness
COPD	Chronic obstructive pulmonary disease
CPB	Netherlands Bureau for Economic Policy Analysis
CVD	Cardiovascular disease
DALY	Disability-adjusted life years
ECHP	European Community Household Panel survey
ENEPRI	European network of economic policy research institutes
EU	European Union
GDP	Gross domestic product
GNP	Gross national product
HALE	Health-adjusted life expectancy
HDI	Human development indicator
HES	Health Examination Survey (USA)
HFA	Health for all
HRS	Health and Retirement Survey
IDF	International Diabetes Federation
IMF	International Monetary Fund
IMR	Infant mortality rates
LE	Life expectancy

LSHTM	London School of Hygiene and Tropical Medicine
MDG	Millennium development goals
NAS	National Academy of Science (USA)
NCD	Non-communicable disease
NCDS	National Child Development Study (UK)
NHMRC	National Health and Medical Research Council (USA)
NHS	National Health Service (UK)
NICE	National Institute for Clinical Excellence (UK)
NLS	National Longitudinal Survey (USA)
NRC	National Research Council (USA)
OECD	Organisation for Economic Co-operation and Development
PPP	Purchasing power parity
PRSP	Poverty reduction strategy papers
PSID	Panel Study of Income Dynamics
PWT	Penn World Table(s)
RHS	Retirement History Survey
TAC	Traffic Accident Commission (USA)
UK	United Kingdom
UNDP	United Nations Development Programme
VSL	Value of statistical life
WB	World Bank
WHO	World Health Organization
WTP	Willingness to pay

European Commission

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Luxembourg: Office for Official Publications of the European Communities

2005 — 134 pp. — 17.6 x 25 cm

ISBN 92-894-9829-3

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