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Ageing, Health, and Productivity

The Economics of Increased Life Expectancy

Edited by
Pietro Garibaldi,
Joaquim Oliveira Martins,
and Jan van Ours

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A REPORT FOR THE FONDAZIONE RODOLFO DEBENEDETTI

Ageing, Health, and Productivity

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With
Axel Börsch-Supan, Brigitte Dormont, Vincenzo Galasso,
Pekka Ilmakunnas, Enrico Moretti, Florian Pelgrin,
Vegard Skirbekk, Marc Suhrcke, Etienne Wasmer,
and Matthias Weiss

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Introduction

Pietro Garibaldi

The increase in life expectancy is arguably the most remarkable by-product of modern economic growth. In the last 30 years we have been gaining roughly 2.5 years of longevity every decade both in Europe and in the United States. This progress outpaced the most optimistic scenarios and documented that demographic projections are no more reliable than economic forecasts. The progress may also turn out to be resilient in the years to come. The sharp reduction in the number of childbirths per woman, a phenomenon somewhat parallel to the increase in longevity, implies population ageing. Successfully managing ageing and longevity over the next 20 years is one of the major structural challenges faced by policy-makers in advanced economies, particularly so in the area of health spending, social security administration, and labour market institutions. This book looks closely into those challenges, raising a few fundamental issues at both the macroeconomic and microeconomic levels. Among these: is it possible to turn the challenges faced by ageing and longevity into a long-term productive opportunity? Can advanced economies engineer a healthy ageing scenario with long-term spillovers in terms of enhanced technological progress and acceleration of long-term growth? What is the microeconomic relationship between ageing and productivity, and how can specific policies postpone any age-related decay in productivity at the firm and individual levels?

Over the last two decades, economic research demonstrated theoretically and empirically that human capital accumulation is a key catalyst for sustained economic growth. In real life economies, a given endowment of human capital can generate the appropriate returns as long as it is embodied in healthy operating individuals. In this respect, the average

health conditions of an ageing population play a first-order effect in a macroeconomic perspective, and will represent a key factor for economic growth in the 21st century. The first half of the book studies the macroeconomic relationships between health spending, technological progress in medical related sectors, economic growth, and welfare state reforms.

In the popular press, longevity and population ageing are typically perceived as a tremendous burden, and the idea of a 'demographic time bomb on advanced economies' is the most picturesque image of this perception. At a more scientific level, the staggering increase in the dependency ratio of the elderly population over the next 50 years is indeed a worrying summary statistics. These projections are nevertheless based on a constant set of policies in the area of labour market and social security. With a proper set of reforms, conversely, advanced economies have the option of transforming the enormous challenge posed by longevity into a long-term opportunity to boost aggregate outcomes. The argument runs as follows. With properly designed market incentives to remain on the job, healthy elderly workers would provide an increase in average labour market participation, with potential positive effects on a country's gross domestic product. Current policies do not provide such incentives. As a result, the basic prerequisite of a healthy ageing scenario is a substantial structural reform in social security and in labour market institutions.

In addition to social security reform, the healthy ageing scenario inevitably requires further improvements in the average health condition of the elderly population, in a way consistent to what happened over the last century. These improvements in health conditions, if biologically feasible, will not come up as a free lunch. Health is indeed very costly, and today most advanced economies already devote some 6–15% of their gross domestic product to finance health expenditures. Since the importance of health is bound to increase, it is crucial to study in detail the determinants of per capita health expenditures. Is health expenditure driven by demographic factors, consumer demand, and/or by technological progress? Health expenditure is largely a normal good, with an elasticity with respect to income not very different from one. However, the key determinants of per capita health expenditures are changes in medical practices: new, more sophisticated, and more costly ways of treating similar diseases. Since these trends will continue over the next 50 years, the book envisages a further increase of health expenditure of at least 5% of GDP.

If the medical sector is going to absorb some 11–20% of gross domestic product, can such expenditure, through its effect on technological progress, be a catalyst for economic growth? This is indeed one of the key

questions. New growth theory and models of semi-endogenous growth suggest that is indeed the case. Nevertheless, empirical evidence of the long-run impact of health expenditure on growth is rather limited. The interpretation given in the book is that incentives to retire early in Europe work as an obstacle to the potential growth-enhancing spillovers of health expenditure. This is a key reason for understanding the link between social security reforms and long-run growth. These technological spillovers could generate a *growth* effect in income, a much more powerful instrument than the *level* effect obtained by simply keeping more people in production. Reforms in the goods market are also part of the story, since health expenditure is mainly related to the service sector, an area where Europe's structural rigidity emerges. Overall, the healthy ageing scenario requires a complementary approach to reform in the area of social security, labour market institutions, and product market regulation.

The second part of the book looks closely at the microeconomic relationship between population ageing and productivity, both at the individual and at the firm levels. There is surprisingly little research on such key questions. The book contributes to this debate along two dimensions. First, it presents a detailed analysis of the determinant of productivity, with a focus on both long-run historical evolution and cross-sectional changes. Second, it uses econometric analysis to look into the determinants of the various dimensions of individual productivity.

Individual productivity is a multidimensional phenomenon, and age has a different effect on its physical and its cognitive dimensions. As a result, the relationship between ageing and productivity depends on the relative weights at the job level of the different dimensions of productivity. In as much as jobs require physical effort, productivity is adversely selected by age. Conversely, cognitive ability depreciates more smoothly and appears to have a long-lasting effect on individual productivity. Over the last century, the structure of the representative job has changed dramatically toward the service sector, and thus the relationship between age and productivity has reduced the importance of the physical dimension.

The relationship between age and productivity can be studied with a variety of data, and the book conceptually distinguishes between an extensive and an intensive margin of productivity. The extensive margin can be proxied by absenteeism data. The intensive margin requires some observation (in specific jobs) of individual productivity.

Absenteeism data suggest that younger workers take more days off as sick leave than older workers on average. However, each spell of absence lasts longer for the older worker. The book finds a non-linear relationship

between age and productivity: absence due to sickness increases up to the age of 45, and decreases thereafter. In a medium-run perspective, the shift of older workers towards occupations that require less physical effort is likely to reduce absenteeism and boost the extensive margin of individual productivity. This is a very basic but nevertheless important message. Technological progress and structural change in the labour market do work in the right direction.

On very specific cases, one can directly observe a measure of productivity in the workplace, and thus focus on the intensive margin of the relationship. Based on real productivity data on a car manufacturing plant, individual productivity at the workplace is seen to decrease monotonically with age. But the role of experience works in the opposite direction. Since older workers are more experienced on average, the relationship on the intensive margin is thus ambiguous, since it is the result of a composition effect between a pure age effect and an experience effect. In any event, there is clear evidence that human capital investment acts to smooth the adverse pure age effect of productivity. This is yet another piece of evidence on the effects of human capital investment at the microeconomic level.

Individual decisions on how to allocate the human capital across occupation, as well as managerial decisions as to how to optimally exploit the available human capital in the workplace appear to be much more important determinants of individual productivity than demographic trends. This is good news, since there is ample room for various policies to engineer productive longevity. More flexibility in retirement, properly designed personnel policies, flexible wage setting and employment protection legislation can jointly act to boost the productivity of elder workers. In light of the large heterogeneity across workers, flexibility is really the key word, and should be taken seriously by policy-makers. The message seems to be that the complex relationship between population ageing and longevity is not written in stone, and can be modified by properly designed choices.

Part I

Health Expenditures, Longevity, and Growth*

Brigitte Dormont, Joaquim Oliveira Martins, Florian Pelgrin, and Marc Suhrcke

* Presented at the Ninth Annual Conference of the Fondazione Rodolfo DeBenedetti on Health, Longevity and Productivity, held at Limone sul Garda in May 2007. The authors would like to thank Tito Boeri, Axel Borsch-Supan, Vincenzo Galasso, Pietro Garibaldi, and an anonymous referee for comments and suggestions on earlier versions of this chapter. We also thank Christine de la Maisonneuve for useful remarks and input. The usual disclaimer applies. The views expressed are those of the authors and do not reflect those of the OECD or its member countries.

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Introduction

Several arguments contribute to the idea that health matters for growth and productivity. Better health positively impacts labour supply, notably through a longer life expectancy, and healthier individuals can reasonably be assumed to produce more per hour worked. According to human capital theory, a longer life span will also encourage people to acquire more education. Good health results in more educated and productive people. Healthier individuals (or the total population) are more willing to undertake investment, which in turn promotes growth. Finally, a substantial share of health spending being devoted to finance R&D, it contributes to innovation and growth.

Ageing, on the contrary, is expected to induce a drag on potential growth and make social security systems unsustainable in many developed countries. Inspired by the seminal work of Auerbach and Kotlikoff (1987), recent models have quantified such an adverse impact from the projected change in population structure, the subsequent decline in the labour force, and different reform scenarios in pensions systems and labour markets (e.g. Ingenue, 2001; Börsch-Supan *et al*., 2002, 2006). Their broad conclusion is that ageing trends are unlikely to be fully compensated by economic factors, like higher capital intensity, migration, or productivity.

Nonetheless, this literature had mostly addressed the impact of the fall in fertility rates from post-World War II levels. Less attention has been devoted to the issue of *longevity without incapacity* and how to benefit from it. Contrary to common views about ageing, healthy longevity should not be perceived as a negative shock. Rather, it is good news about individuals able to live and work longer, provided they are not hampered by a premature retirement decision. Several studies (e.g. Duval, 2003; Börsch-Supan, *et al*., 2005) have shown that the decision in favour of early retirement is much less a matter of individual preferences for leisure than the result of

perverse incentives created by current institutional arrangements in pension systems and labour markets.

Therefore, there could be a possible path taking advantage of both the improved health status of the population and the extended duration of active life, which could promote the growth potential of economies faced by ageing trends. Such active 'healthy ageing' scenario would critically depend on political support of mechanisms linking the duration of active lives to longevity gains (see Galasso, 2006). In this scenario, the growth potential could dramatically improve compared with a situation where a large amount of labour resources are 'wasted' by a premature exit from an active life, notably in European economies (see Oliveira Martins *et al.*, 2005).

Against this background, this part aims to understand the links between health spending, medical innovation, health status, growth, and welfare.[1] The objective is to identify the conditions under which a healthy ageing regime could develop and what its impacts on the economy might be. The different links are illustrated in Figure 1. Health spending is supposed to trigger technological progress in the health sector, which in turn impacts on expenditures. Both health spending and technological progress are a potential source of better welfare outcomes in terms of longevity and health status at every age. The latter has a feedback on expenditures and is an indirect source of growth through an improvement in human capital. This contributes to gross domestic product (GDP) per capita, mainly through higher participation of the population in the labour force and higher labour productivity levels. Growth GDP also benefits from innovation in health services and bio-tech industries. Closing the loop between health and growth, more aggregate income induces an increase in health expenditures, as richer countries tend to have a higher share of health goods and services in GDP.

A key policy driver for the analysis presented here relates to the sustainability of health expenditure growth. As a share of GDP, total spending on health care[2] has risen steadily over the past 30 years and has roughly doubled since the early 1970s (Figure 2). Policy-makers are rightly concerned that ongoing population ageing may exacerbate these

[1] Data and empirical evidence covered here focus on three main developed regions: the US, European Union (EU) (mostly the EU-15), and Japan.

[2] Note that for data availability reasons, total health spending displayed in the figure includes both health and long-term care expenditures. But given the still low share of long-term care in total spending (on average below 1% by 2005 for OECD countries), the qualitative picture is not changed by this approximation.

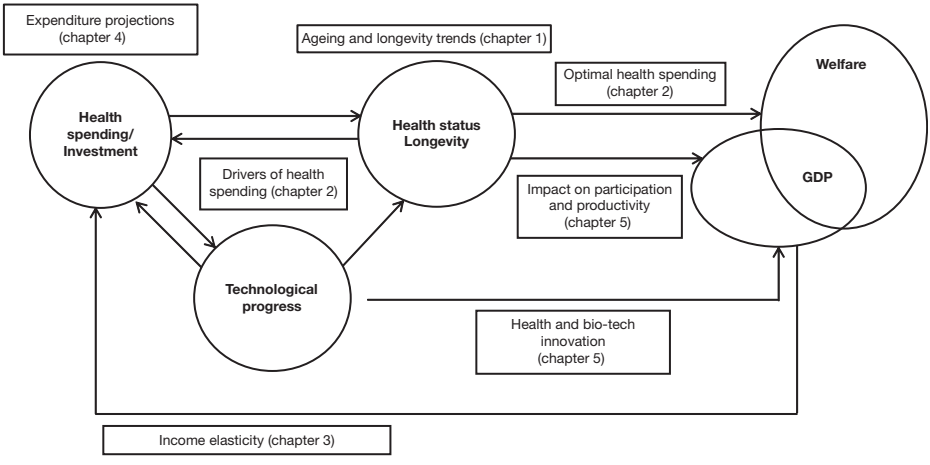

Figure 1. Links between health spending, technological progress, longevity, and GDP

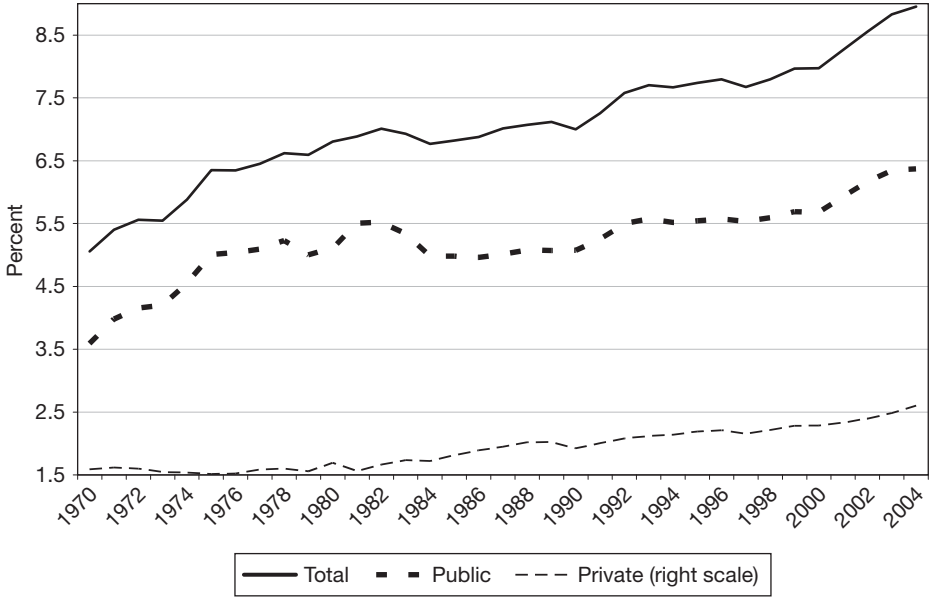

Figure 2. Evolution of total, public, and private OECD health spending (in % of GDP)

Note: Unweighted average of available OECD countries, including long-term care expenditure.

Source: OECD Health Database (2005a)

expenditure trends. Notably, as they cumulate with other social spending, such as pensions, as well as exceptional pressures on public debts in the context of the 2008 financial crisis.

However, both micro- and macro-level evidence presented below shows that the impact of ageing *per se* on health care is small. In contrast, the role of preferences and technology are crucial. Confirming other studies, we provide empirical evidence that health expenditures tend to grow roughly in line with aggregate income. On top of this income effect, the diffusion of new medical technology explains the growing share of health spending relative to GDP. Drawing on this analysis, we carry out several projection exercises suggesting a substantial increase in health expenditure shares by 2050.

Although increased health spending, through a better health status, is expected to positively influence aggregate productivity and growth, evidence on this link is somewhat inconclusive, at least for high-income countries. While we discuss the reasons for this puzzling result, we also analyse the growth potential related to health research and development (R&D) and innovation activities.

To simplify what is an already complex web of interrelated factors, we decided not to include long-term care in the picture.[3] Indeed, in contrast to health care, long-term care corresponds to rather low-productivity basic services and spending is mainly related to demographic developments, in particular the growing share of very old and frail individuals in the total population. Long-term care will certainly contribute to public expenditure pressures over the next decades, but can hardly enhance growth prospects.

The policy implications of the analysis are manifold. Over the next decades, pressures for public expenditure are likely to be large in health systems. These challenges require an integrated and complementary package of policies. Reforms in pension systems, the health sector, labour, product and financial markets are deeply interrelated. While only a subset of these policy linkages are dealt with in this part, to our knowledge, it is one of the first comprehensive attempts to cover these links. Further research in this area is much needed.

Figure 1 provides a reader's guide to the mapping between the different links analysed in the chapters in this part of the book. The first chapter deals with demographic facts. Chapter 2 analyses the links between healthcare expenditures, technology, and health status from a micro-level

[3] For a comprehensive discussion on long-term care, see e.g. Norton (2000) and OECD (2005b).

perspective. Chapter 3 investigates the relationship between GDP growth and health expenditures empirically. Chapter 4 develops a projection method to assess the size of aggregate expenditures (both public and private) that could be channelled to the health sector. In Chapter 5, we assess the impact of health expenditures and better health status on potential growth and productivity. We carry out some 'thought experiments' on the indexation of active life on longevity and the impact of ageing on aggregate productivity. Chapter 6 summarizes and draws policy conclusions.

1

Transitory vs. Permanent Demographic Shocks: From Ageing to Longevity

Ageing trends are the result of two different and contrasted phenomena: the change from a high to a low fertility regime and the increase in longevity. The baby boom and subsequent fertility bust was a massive, but *transitory*, shock. In contrast, the smooth and steady increase in longevity does look like a *permanent* shock (Oeppen and Vaupel, 2002; EC, 2003; Barbi, 2003). Supporting this hypothesis, the frontier of longevity in different countries has increased almost linearly by 2.4 years per decade over the past century and a half (Figure 1.1). A similar trend was observed on average for the United States, Europe, and Japan over the past 40 years (Table 1.1), though with a wide cross-country dispersion.

During the 20th century, increased longevity has resulted from uneven developments in mortality rates across age groups. The first half of the century mainly experienced a reduction in child mortality. In the second half, the reductions in mortality were located in prime and old age groups. The role of health care was also different in the two periods (Vaupel, 2002; Yashin, 2003; Lichtenberg, 2003). The development of mass vaccination and antibiotics, together with improved hygiene and life style, helped eradicate infectious diseases (tuberculosis, pneumonia, flu, etc.). The latter were the main cause of mortality in the early 20th century, affecting in particular young children. But since then, the reductions in mortality have been associated with distinct factors, notably the treatment of cardiovascular diseases and cancer. The prevalence of these diseases is increasing in age and their treatment has triggered the development of medical innovation, as will be discussed below.

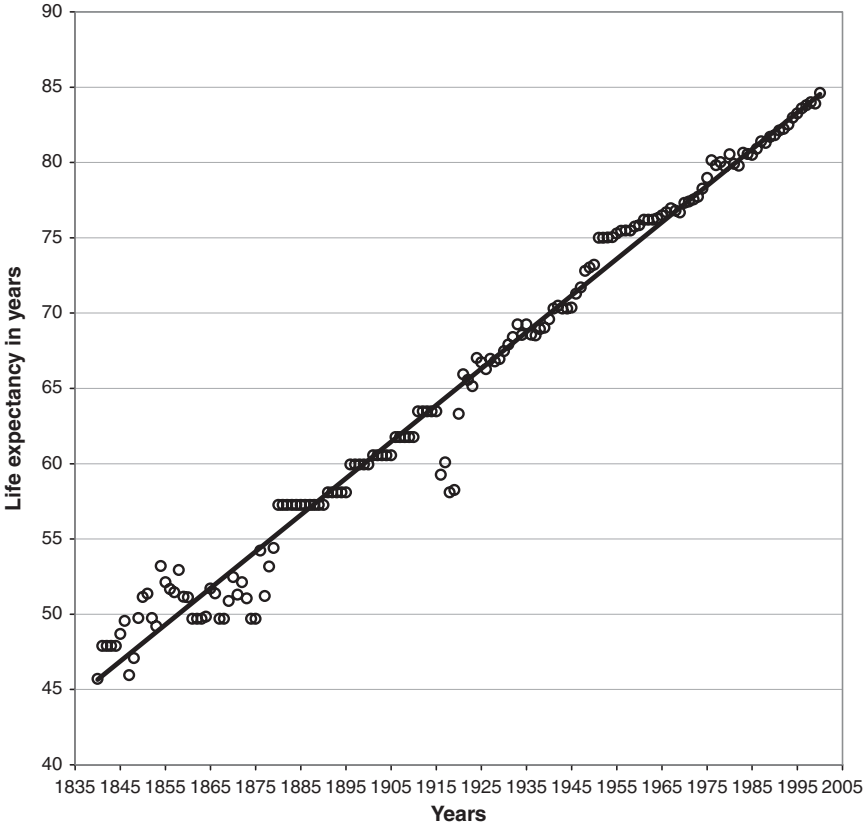

Figure 1.1. Historical trends in female life expectancy, 1840–2000[1]
Note: [1]Country with the highest life expectancy. The linear trend: slope = 2.43 and $R^2 = 0.98$.
Source: Oeppen and Vaupel (2002).

Accordingly, Oeppen and Vaupel (2002) argued that population projections need to take into account a steady progression of longevity gains. Notably, Cheung and Robine (2007) provided empirical evidence of a shift of the modal age of death in Japan, suggesting that currently there is no evidence that we are approaching an upper limit in human longevity. However, Olshansky *et al*. (2005) have put forward an opposite view. They noted that extrapolation of past trends cannot provide a good basis for long-term projections because longevity gains have been driven by improvements in environmental, economic, and social factors that may not last in the future. In particular, widespread obesity trends in many