



Growth and welfare effects of health care in knowledge-based economies



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ABSTRACT

We study the effects of labor intensive health care within a research and development (R&D) driven growth model with overlapping generations. Health care increases longevity, labor participation, and productivity, while it also diverts labor away from production and R&D. We examine under which conditions expanding health care enhances growth and welfare and establish mild conditions under which the provision of health care beyond the growth-maximizing level is Pareto superior.

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1. Introduction

According to recent employment data, health care has turned into a major industry within most industrialized economies, including the US and many European countries.¹ Notably, the trend of employment growth in health care that goes back to the 1980s has not been broken during the recent economic crisis.² In the US and many European countries these trends have fueled a controversial debate about whether the large and expanding health care sectors are still generating enough value to justify the resources they absorb or whether they have turned into an impediment to economic growth. Proponents of health care argue that an expansion of

health care as a luxury good may well be justified as long as income continues to increase (Hall and Jones, 2007) and that even in industrialized countries there may be considerable positive productivity effects from improvements against non-communicable diseases (Rivera and Currais, 2004; Suhrcke and Urban, 2010). Opponents claim that the ongoing increase in spending and the inefficiencies associated with the provision of health care at such high levels outweigh any benefits.

The aim of our paper is to contribute to this debate by formalizing the growth effects of a health care sector that contributes toward lowering mortality as well as raising labor productivity and the ability of individuals to work into high ages, but also diverts economic resources – in particular, labor inputs – away from other productive activities. Our focus lies on modern industrialized economies. These economies have well-developed health care systems that absorb considerable quantities of resources from other sectors, while they are subject to distinct drivers of economic growth, with research and development (R&D) being of prime importance (see for example Romer, 1990; Grossman and Helpman, 1991; Aghion and Howitt, 1992). For such economies, one would expect that changes in the sectoral make-up play a particularly important role. Against the backdrop of the ongoing expansion

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¹ In 2012, the employment share of the health care sector broadly amounted to 8.3% in the US (May 2012; Bureau of Labor Statistics, 2012) and to around 7% in a number of large EU countries (France, Germany, UK; EUROSTAT, 2012).

² In the period 2008–2012 US health care employment, for instance, has experienced growth rates of around 2% per annum, as compared to a decline by 1.1% per annum in non-health employment (Altarum Institute, 2012).

of US health care employment, [Pauly and Saxena \(2012\)](#) highlight the importance of understanding the nature of the shift of employment from other sectors of the economy into the health care sector. They raise the question as to “what is the correct story: does medical spending growth divert real labor resources away from more valuable uses into health care, or is health care employment growth, [...], the shining exemplar of high tech job creation? Or could both be true?” (quoted from [Pauly and Saxena, 2012](#)).

Our paper aims at providing an answer to these questions by shedding light on a channel through which the provision of health care and the resulting improvements in longevity and morbidity could potentially impact upon long-run economic prosperity, namely the incentives to invest in R&D and the resulting change in R&D employment. Building on [Prettnner \(2013\)](#) who shows that population aging matters for the R&D intensity of modern knowledge-based economies, we consider an R&D-based endogenous economic growth model of the [Romer \(1990\)](#) type into which we introduce (i) an overlapping generations structure in the vein of [Blanchard \(1985\)](#); and (ii) a labor-intensive and tax-financed health care sector, the output of which improves survival, labor participation, and productivity.

The impact of health care on R&D activity and ultimately on economic growth crucially depends on two factors: (i) whether or not health care leads to an absorption of labor that would otherwise be available for R&D and production, and (ii) whether or not health care stimulates the accumulation of wealth. If it does, then the ensuing drop in the interest rate provides a stimulus for R&D activities at the expense of final goods production. An expansion of the health care sector is then, at least to some extent, accompanied by an increase in productivity, implying that a growth-maximizing health care sector already absorbs more labor than it generates. This, however, is true if and only if the impact of health care on mortality dominates its impact on morbidity. If and only if individuals expect to survive longer without being able to increase their lifetime supply of labor will they have an incentive to accumulate more financial wealth. If, in contrast, the impact of health care on morbidity dominates, then the ensuing increase in lifetime labor supply will stifle the incentive to save for “retirement” and thus reduce the accumulation of financial wealth. In this case an expansion of health care tends to boost the interest rate and, thus, leads to a reallocation of labor from R&D into final goods production. An increase in health care would, thus, trigger a decrease in R&D activities.

When considering only the implications of health care on economic growth, we would, however, miss the crucial point that changing life expectancy has important welfare effects on its own. Indeed, we are able to show that a comparative static expansion of health care beyond its growth maximizing level leads to a Pareto superior balanced growth path under relatively mild conditions. In as far as a first-order increase in life-cycle utility from lower mortality offsets a second-order loss from a reduction in economic growth, this appears intuitive. However, our analysis shows that the tradeoff is more complex and Pareto superiority is by no means a foregone conclusion. A reduction in mortality may well imply a reduction in life-cycle consumption as individuals need to stretch their resources over an expanding life course. This amounts to the familiar tradeoff between quantity and quality of life (cf. [Murphy and Topel, 2006](#); [Hall and Jones, 2007](#)). A reduction in life-cycle consumption then constitutes a first-order utility loss that would need to be offset by the direct benefits from extended life time. We show for the Romer–Blanchard–Yaari setting with logarithmic utility from consumption that individuals drawn from all cohorts would prefer the balanced growth allocation of an economy with health care (marginally) beyond its growth-maximizing level if (i) the cohort that is born at a benchmark year at which the two economies attain the same level of GDP is the

one with the lowest propensity to benefit from a greater provision of health care, if (ii) labor participation is not increasing by too much, and (iii) if the growth rate is sufficiently high to begin with. Notably this includes both individuals who are already alive and holding positive wealth at the reference point at which the two economies attain an equal level of GDP, as well as individuals yet unborn.

A numerical assessment of our model for the Euro area indicates that member countries' health sectors are, on average, too large from a growth-maximizing point of view. Nevertheless, both the loss in growth by 0.0017 percentage points and the gain in life expectancy by about one and a half months are modest. Our welfare analysis suggests that when offering individuals a choice between the balanced growth outcomes under a Euro area health care sector and those under a growth maximizing health care sector, with income being identical for a reference year, all individuals born up to 100 years before the reference year and all individuals born up to 100 years after would attain a greater level of life-cycle utility with the Euro-area-sized health care system.

The following papers are related to our analysis:³ [Aísa and Pueyo \(2004\)](#), [Aísa and Pueyo \(2006\)](#), and [Schneider and Winkler \(2010\)](#) also develop a hump-shaped relationship between the provision of health care and endogenous growth within an overlapping generations (OLG) economy.⁴ In their models, however, growth is driven by capital spillovers a la [Romer \(1986\)](#). This implies that (a) the role of the R&D sector for generating knowledge, and (b) the role of an endogenous formation of the interest rate, which turns out to be important for the allocation of workers across sectors, cannot be analyzed. Both of these aspects are included in our model as a basis for a deeper and more differentiated explanation of the mechanisms underlying the health-growth nexus. In addition, these models only feature an impact of health care on mortality but not on the propensity to supply labor into higher ages. Thus, they unequivocally imply that health care stimulates capital accumulation. As our analysis shows, this is far from being a foregone conclusion.

While [Aísa and Pueyo \(2004\)](#) and [Aísa and Pueyo \(2006\)](#) do not analyze the optimality of health provision, [Schneider and Winkler \(2010\)](#) focus on the individually optimal choice of health care. By contrast, we examine how an increase in the provision of health care beyond its growth-maximizing level affects the life-cycle utility of different cohorts and under which conditions it constitutes a Pareto improvement. Again, the reduction of the interest rate in response to an increase in longevity turns out to be important:

³ There is a long-standing debate on whether health, in general, and longevity, in particular, have a positive impact on economic development. For an affirmative view, see e.g. [Barro \(1997\)](#), [Shastri and Weil \(2003\)](#), [Weil \(2007\)](#), [Lorentzen et al. \(2008\)](#), [Cervellati and Sunde \(2011\)](#), and [Cervellati and Sunde \(2013\)](#). For a more skeptical view, see, e.g. [Hazan and Zoabi \(2006\)](#), [Acemoglu and Johnson \(2007\)](#), and [Hazan \(2009\)](#). The channels through which health is deemed to exert a positive influence on economic development are summarized in [Bloom and Canning \(2000\)](#) as (i) healthier workers are more productive (see e.g. [Bloom and Canning, 2005](#); [Prettnner et al., 2013](#)), (ii) healthier people invest more in human capital which again increases their productivity (see e.g. [Kalemli-Ozcan et al., 2000](#); [Boucekkine et al., 2002](#); [Chakraborty, 2004](#); [Cervellati and Sunde, 2005](#)), (iii) improvements in longevity increase incentives to invest in physical capital (see e.g. [Reinhart, 1999](#); [Futagami and Nakajima, 2001](#); [Aísa and Pueyo, 2006](#); [Azomahou et al., 2009](#); [Schneider and Winkler, 2010](#); [Heijdra and Mierau, 2011, 2012](#)), and (iv) decreases in mortality and morbidity can induce a transition to low fertility and thereby create a demographic dividend (see e.g. [Bloom et al., 2003, 2015](#)).

⁴ [van Zon and Muysken \(2001\)](#) consider health production within a [Lucas \(1988\)](#) type endogenous growth model. Similar to our model, the health care sector competes for labor with the final goods sector and the human capital sector. [van Zon and Muysken \(2001\)](#) also find a hump-shaped relationship between health care and economic growth. However, as they consider the planner solution for a representative agent economy, the transmission channels are very different.

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