Managing the Healthcare System

The Impact of Demographic Change on Healthcare Expenditure[1]

Stefan Felder*

Introduction

Men and women in the developed world have experienced a significant increase in life expectancy over the last 50 years. At the same time per capita healthcare expenditure has increased dramatically. This joint trend led the OECD (1988) and others (e.g. Mendelson and Schwartz 1993) to blame population ageing for the increase in healthcare expenditure. Since healthcare expenditure is a rising function of age – from the age of 60 onwards it takes the form of an almost exponentially rising curve – part of the increase in healthcare expenditure may, in fact, be due to population ageing. Nonetheless, Zweifel, Felder and Meier (1999) found that age has no effect on healthcare expenditure after controlling for proximity to death. More recently, Shang and Goldman (2007) find that age has little additional predictive power on healthcare expenditure after controlling for remaining life expectancy and even the predictive power of life expectancy declines when health status controls are included in the analysis. This result is consistent with previous findings suggesting that the expected cumulative health expenditure for healthier elderly individuals, despite their greater longevity, is similar to that for less healthy persons (Lubitz, Beebe and Baker 1995).

In the next section (*The red herring hypothesis*) this article surveys the growing body of literature on the relationship between population ageing and healthcare expenditure, in particular on the red herring hypothesis (Zweifel et al. 1999), claiming that population ageing is even neutral with respect to the increase in healthcare expenditure. The third section (*Forecasting future health expenditures*) deals with predictions of future healthcare expenditure. The fourth section (*The role of increasing life expectancy*) emphasises the dynamic effects of increased life expectancy on healthcare expenditure, and the fifth section (*Ageing and health technologies*) addresses the relationship between population ageing and health technology. The final section offers some concluding remarks.

The red herring hypothesis

As soon as it became apparent that the OECD countries would experience severe population ageing, researchers and policy analysts advising politicians started warning of the threat of exploding expenditure for healthcare, because in a cross-section, higher age is associated with greater healthcare utilisation. Victor Fuchs was the first to observe that "healthcare spending among the elderly is not so much a function of time since birth as it is a function of time to death. The principal reason why expenditure rises with age in a cross-section (among persons aged 65 and over) is that the proportion of persons near death increases with age" (1984, pp. 151f.). But it took one and a half decades for this relationship to be explored more thoroughly using modern econometric techniques. In their pioneering study, Zweifel et al. (1999) analysed the expenditure of roughly 1,000 persons who had died in Switzerland in the period 1983 to 1992 and found that among those who died beyond age 65, healthcare expenditure in the last eight quarters of life did not depend significantly on calendar age, whereas it increased significantly with proximity to death. The authors also failed to find an age effect in years five to two before death and thus concluded: "Exclusive emphasis on population ageing as a cause of growth in per capita healthcare expenditure runs the risk of creating a red herring by distracting from the choices that ought to be made …" (p. 494).

The 'red herring hypothesis' was born. It was in perfect agreement with the compression-of-morbidity thesis by Fries (1980), which stated that the onset of disability is postponed and the time span of severe

* University of Basel and CINCH Essen.
[1] The article borrows from a recent survey by Breyer, Felder and Costa I Font (2011).

illness leading to death shrinks when life expectancy increases. While the Zweifel et al. (1999) study suffered from the weakness of concentrating on patients in their last two years of life, subsequent studies by several authors mainly confirmed the red-herring hypothesis. Felder, Meier and Schmitt (2000) analysed a subsample of the data set used by Zweifel et al. (1999) and demonstrated that for persons over 65 years of age, holding time to death constant, healthcare expenditure even decreased with age. Seshamani and Gray (2004a) showed that hospital costs in Britain start rising as early as 15 years before death, whereas the relationship between age and hospital costs is inversely U-shaped and peaks at age 80. Similarly, Seshamani and Gray (2004b) found that age has a small positive effect on hospital costs. O'Neill et al. (2000) found no age effect on the general practitioners' cost associated with nursing home patients when controlling for proximity to death.

Salas and Raftery (2001) argued hat proximity to death may be endogenous if healthcare interventions have a positive effect on the patient's health. Felder, Werblow and Zweifel (2010) addressed the endogeneity issue in an extended empirical study and showed that this does not change the main result: proximity to death and not calendar age is the crucial determinant of healthcare expenditure.

A further refinement of the analysis of age and healthcare expenditure was achieved in Werblow, Felder and Zweifel (2007). They decomposed expenditure into several components and found that the age pattern of expendiure not only differed considerably between survivors and decedents, but even more strongly between users and non-users of long-term care: while the age profile for deceased non long-term-care users was monotonically declining, surviving non-users had a hump-shaped profile peaking at age 80. On the other hand, users of long-term care had an increasing age profile even for acute healthcare expenditure, which is more pronounced for survivors than for decedents. These findings confer with those of Spillman and Lubitz (2000) who analysed the healthcare expenditure of the US Medicare population, i.e. individuals aged 65+. They report a convex (from below) age profile for both nursing home care and (less accentuated) for home care. By contrast, services covered by Medicare and prescription drugs exhibit a decreasing age profile. This implies a continuing shift from acute to long-term care late in life. Spillman and Lubitz conclude that population ageing will be an important driver of demand for long-term care, leaving the acute sector unaffected.

Forecasting future health expenditure

While the studies summarised above all try to explain the relationship between age and healthcare expenditure in past data, it may be argued that the true purpose of these exercises is to derive more solid predictions of the future development of healthcare expenditure. Indeed, it was shown in several studies that, taking time to death into account, expenditure forecasts become less dramatic. Stearns and Norton (2004) compared predictions of Medicare expenditure for the year 2020 on the basis of observed expenditure data from the period 1992 to 1998, which were inferred from different regression models. They found that neglecting time to death in the regression model leads to an overestimation of the expenditure increase by 15 percent. Polder, Barendregt and van Oers (2006) for the Netherlands found that including time to death led to a ten percent reduction in the growth rate of future health expenditure compared to conventional projection methods.

Breyer and Felder (2006) applied the estimated regression coefficients derived by Zweifel, Felder and Werblow (2004) to the projections of the age structure and mortality rates for the German population between 2002 and 2050 as published by the Federal Statistical Office. They found that compared to a 'naïve' projection, which uses the unadjusted age-expenditure profile, distinguishing explicitly between survivors' and decedents' healthcare expenditure dampens the projected increase up until 2050 by roughly 20 percent. Adding a 'compression-of-morbidity' assumption – stating that if life expectancy increases between 2002 and 2050 by x years, then, for example, a 65-year-old person in 2050 will be as healthy as a 65-minus-x-year-old in 2002 – lowers the expenditure projection by another 20 percent. The surprising result of this exercise is that, even accepting the 'red-herring' assumptions, there will still be a sizeable demographic effect on healthcare expenditure. This result was confirmed by Steinmann, Telser and Zweifel (2007), who calculated that taking the mortality effect into account lowers the forecast of the purely demographic effect on healthcare expenditure in Switzerland between 2000 and 2030 from an annual growth rate of 0.7 percent to 0.5 percent. The analysis nevertheless agrees that popula-

tion ageing has a positive effect on heath care expenditure.

The role of increasing life expectancy

An important weakness of almost all studies in the literature is their reliance on cross-section expenditure data. Therefore, in drawing inferences from these studies for the development of healthcare expenditure over time, proponents of the 'red-herring' hypothesis are subject to the same error of which they accuse their opponents (i.e. those who believe that ageing increases health spending because per-capita expenditure increases with age). In particular, they overlook the fact that increasing longevity not only means that 30 years from now the average age at death will be higher, but also that people at a certain age (say, 75) will on average have more years to live than current 75-year olds. As a consequence, future physicians will look at 75-year old patients with different eyes than those of present physicians, because the notion of a 'normal life-span' will have shifted upwards. This effect is consistent with the ethical justification of age-based rationing of healthcare services (Callahan 1987; Daniels 1985), and with the corresponding empirical literature, which shows that some physicians do indeed use age as a criterion in allocating scarce healthcare resources (for an overview see Strech et al. 2008).

Thus, to address the crucial question of how healthcare expenditure will react to population ageing, (i.e. an increase in life expectancy?), an econometric estimation of the determinants of expenditure has to be modified in two directions: firstly, by looking at panel rather than cross-section data, and secondly, by including a direct measure of remaining life expectancy as a regressor. Of course, this cannot be done with individual data, but requires an estimation with population group averages as units of observation. This approach has only been followed by two studies. The first one is Zweifel, Steinmann and Eugster (2005), which addresses the 'Sisyphus Syndrome' in healthcare, i.e. the mutual reinforcement of population ageing and public spending on healthcare of the elderly, by looking at a panel of OECD countries for the period 1970 to 2000. Remaining life expectancy weighted with the share of the population older than 65 turns out to be a significant and positive determinant of health expenditure as a share of GDP. This confirms the hypothesis that population ageing increases healthcare expenditure. Only the interpretation differs from the naïve one discussed above: it is not medical need, but rather political weight that explains why an older population demands a higher public spending on healthcare.

In a recent unpublished paper, Breyer, Lorenz and Niebel (2012) used data for a pseudo-panel of all German sickness fund members (grouped by age and gender) over the period 1997–2008. In a fixed-effects regression, they found that age, mortality rate and the remaining life expenctancy of persons over 60 have a positive impact on per capita healthcare expenditure. They then simulated future healthcare expenditure in Germany on the basis of an official population forecast including life expectancy and discovered that demographic change itself is associated with an annual growth rate of roughly 0.5 percent.

Ageing and health technologies

An important question in this context is whether medical progress predominantly benefits the aged. If this is the case, then the findings of the previous sections (that population ageing affects health care expenditure only weakly) must be regarded with great caution. One popular method to test this proposition is to look at whether age-expenditure profiles become steeper over time. A number of papers have addressed this question, but the answers are diverse and therefore inconclusive.

Buchner and Wasem (2006) analysed data from the largest private health insurer in Germany for the period 1979 to 1996 and defined three different indicators for a 'steepening' of the age-expenditure profile over time. In particular the increase in per capita healthcare expenditure of the 'old', using 65 as cut-off age, was significantly larger than the corresponding figure for the 'young'. Felder and Werblow (2008) challenged this result by looking at average expenditure data in the Swiss cantons over the period 1997 to 2006. In a panel regression with population averages as units of observation, the interaction effect of time and age group dummies was not consistently increasing in age. However, for all age groups between 65 and 90, this interaction effect was positive and significant at the 10 percent level. Thus even for Switzerland it cannot be ruled out that the increase in healthcare has recently been particularly large in those age groups that will rapidly increase in size over the next decades.

Conclusion

Population ageing is often blamed for the steady increase observed in healthcare expenditure in the Western world. Robert Evans (1985) suggested that the fixation on ageing provides an "illusion of necessity". By making it seem as though healthcare expenditure is inevitable in higher age, attention is diverted from the real causes of growth of the healthcare sector. These are technical progress in medicine, the secular increase in income, and wrong incentives for the providers and consumers of healthcare caused by government regulation and extensive social health insurance coverage. Rephrasing Evans, Zweifel et al. (1999) stated that blaming population ageing serves as a red herring, distracting from choices that ought to be made to curb steadily rising healthcare expenditure in the Western world.

Overall, empirical studies suggest that the impact of a longer life on future healthcare expenditure will be quite moderate because of the high costs of dying and the compression of mortality and morbidity in old age. If proximity to death, and not age per se, determines the bulk of expenditure, a shift in the mortality risk to higher ages will not significantly affect lifetime healthcare expenditure, as death occurs only once in every life. An exception to this rule is long-term care. As ever more people reach a very high age (beyond 85 or 90), the percentage needing long-term care in their last years of life increases.

A calculation of the demographic effect on healthcare expenditure in Germany up until 2050 that explicitly accounts for costs in the last years of life leads to a significantly lower demographic impact on per capita expenditure than a calculation based on crude age-specific health expenditure. The pure age-effect of population ageing on the annual growth rate of per capita healthcare expenditure does not exceed 0.5 percentage points, i.e. is much lower than the observed annual real growth rate of around two percent in the OECD.

References

Breyer, F. and S. Felder (2006), "Life Expectancy and Health Care Expenditures: A new Calculation for Germany Using the Costs of Dying", *Health Policy* 75 (2), 178–86.

Breyer, F., S. Felder and J. Costa I Font (2011), "Ageing, Health, and Health Care", *Oxford Review of Economic Policy* 26, 674–90.

Breyer, F., N. Lorenz and T. Niebel (2012), "Population Ageing and Health Care Expenditures: Is there a Eubie Blake Effect?", *DIW Working Paper* no. 1226, Berlin.

Buchner, F. and J. Wasem (2006), ""Steeping" of Health Expenditure Profiles", *The Geneva Papers on Risk and Insurance: Issues and Practice* 31 (4), 581–99.

Felder, S. and A. Werblow (2008), "Do the Age Profiles of Health Care Expenditure Really Steepen over Time? New Evidence from Swiss Cantons", *The Geneva Papers on Risk and Insurance: Issues and Practice. Special Issue on Health Insurance* 33 (4), 710–27.

Felder, S., A. Werblow and P. Zweifel (2010), "Do Red Herrings Swim in Circles? Controlling for the Endogeneity of Time to Death" *Journal of Health Economics* 29 (2), 205–12.

Felder, S., M. Meier and H. Schmitt (2000), "Health Care Expenditure in the Last Months of Life", *Journal of Health Economics* 19 (5), 679–95.

Fries, J. F. (1980), "Ageing, Natural Death, and the Compression of Morbidity", *New England Journal of Medicine* 303 (3), 130–36.

Fuchs, V. R. (1984), "Though Much is Taken: Reflections on Aging, Health and Medical Care", *Milbank Memorial Fund Quarterly/Health and Society* 62 (2), 143–66.

Lubitz, J., J. Beebe and C. Baker (1995),"Longevity and Medicare Expenditure", *New England Journal of Medicine* 332 (15), 999–1003.

Mendelson, D. N. and W. B. Schwartz (1993), "The Effects of Aging and Population Growth on Health Care Costs", *Health Affairs* 12 (1), 119–25.

OECD (1988), *Ageing Population: The Social Policy Implications*, OECD Publishing, Paris.

O'Neill, C., L. Groom, A. J. Avery, D. Boot and K. Thornhill (2000), "Age and Proximity to Death as Predictors of GP Care Costs: Results from a Study of Nursing Home Patients", *Health Economics* 9 (8), 733–38.

Polder, J. J., J. J. Barendregt and H. van Oers (2006), "Health Care Costs in the Last Year of Life – The Dutch Experience", *Social Science and Medicine* 63 (7), 1720–31.

Salas, C. and J.P. Raftery (2001), "Econometric Issues in Testing the Age Neutrality of Health Care Expenditure", *Health Economics,* 10 (7), 669–671.

Seshamani, M. and A. Gray (2004a), "Ageing and Health Care Expenditure: The Red Herring Argument Revisited", *Health Economics* 13 (4), 303–14.

Seshamani, M. and A. Gray (2004b), "A Longitudinal Study of the Effects of Age and Time to Death on Hospital Costs", *Journal of Health Economics* 23 (2), 217–35.

Shang, B. and D. Goldman (2007), "Does Age or Life Expectancy Better Predict Health Care Expenditures?" *Health Economics* 17 (4), 487–501.

Spillman, B. C. and J. Lubitz (2000), "The Effect of Longevity on Spending for Acute and Long-term Care", *New England Journal of Medicine* 342 (19), 1409–15.

Stearns, S. C. and E. C. Norton (2004), "Time to Include Time to Death? The Future of Health Care Expenditure Predictions", *Health Economics* 13 (4), 315–27.

Steinmann, L., H. Telser and P. Zweifel (2007), "Aging and Future Health Care Expenditure: A Consistent Approach", *Forum for Health Economics & Policy* 10 (2), 1–30.

Werblow, A., S. Felder and P. Zweifel (2007), "Population Ageing and Health Care Expenditure: A School of „Red Herrings"?", *Health Economics* 16 (10), 1109–26.

Zweifel P., S. Felder and M. Meier (1999), "Ageing of Population and Health Care Expenditure: A Red Herring?", *Health Economics* 8 (6), 485–96.

Zweifel, P., S. Felder and A. Werblow (2004), "Population Ageing and Health Care Expenditure: New Evidence on the "Red Herrings"", *The Geneva Papers on Risk and Insurance* 29 (4), 652–66.

Zweifel, P., L. Steinmann and P. Eugster (2005), "The Sisyphus Syndrome in Health Revisited", *International Journal of Health Care Economics and Financing* 5 (2), 127–45.