Projecting health-care expenditure for Switzerland: further evidence against the 'red-herring' hypothesis

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by

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SUMMARY

This paper contributes to the debate about the impact of population ageing on health care expenditure. Some health economists claim that the commonly presumed impact of population ageing is a "red herring". Based on empirical studies these authors conclude that proximity to death and not age per se matters. In projecting health care expenditure for Switzerland the present study provides evidence that proximity to death is of marginal importance. These projections suggest that population ageing is still the most important age-related cost-driver. Moreover, morbidity outweighs mortality as a factor of health-care expenditure. But most vital are non-demographic drivers such as medical progress. Thus, from the point of view of cost-benefit analysis one should even ignore costs of dying when projecting health care expenditure. Moreover, regressions might overestimate proximity to death due to systematic biases. Finally, ever-increasing health-care expenditure can be slowed down by appropriate policy measures.

JEL codes: H51, I19, J11

Key words: health-care expenditure, population ageing, public health-care budget, proximity to death, morbidity.

INTRODUCTION

Ever-increasing health-care expenditure in developed countries and future demographic burdens would appear to affect public finances severely. In particular, the ageing of the baby-boom generation will not only affect public finances via increasing pension payments but also through rising health-care expenditure. Against this backdrop there is an on-going debate among health-care economists on the relevance of population ageing as a driver of health-care expenditure (e.g. Reinhardt, 2003; Zweifel et al., 2004). Zweifel et a.l (1999) provide empirical evidence that the commonly held view that population ageing affects health-care costs noticeably is a red herring. According to Zweifel et al. (1999) the estimated demographic effects of previous studies are biased upwards because these studies did not control for a person's remaining time to death. Zweifel et al. (1999) argue the latter should be considered because if a person is approaching death medical treatment and, therefore, costs will alter substantially. Thus, time remaining until death seems to affect health-care expenditure more significantly than ageing per se (e.g. Stearns and Norton, 2004; Gray, 2005). Nonetheless, several authors have cast doubt on the robustness of the findings of Zweifel et al. (1999) (e.g. Salas and Raftery, 2001). Though Zweifel et al. (2004) confirm their results by using a refined econometric method, and Werblow et al. (2007) even claim the existence of a school of "red herrings", the matter has not been settled so far. Only recently Westerhout (2006) has argued that the "red-herring" hypothesis grossly overestimates the impact of time-to-death and that population ageing is still a relevant factor driving health-care expenditure. Recent projections of health-care expenditure such as those of Oliveira Martins et al. (2006) for OECD countries and Breyer and Felder (2006) for Germany seem to confirm the view held by Westerhout (2006). However, both studies suffer from the shortcoming that health-care expenditure profiles by age and gender have not been available for some OECD countries and for Germany. The present study aims at contributing to this debate by reporting the results of the projections for the Swiss case. This study draws upon original data for the Swiss case which should, compared to previous studies, improve the quality of the forecasts. The projections of health-care expenditure for Switzerland show that the time remaining to death does not play a crucial role in driving health-care expenditure. Rather than mortality, morbidity seems to be more important as a driver of health-care expenditure.

Furthermore, it is the first time that a comprehensive study on the effects of an ageing society on health-care expenditure including government expenditure has been carried out for the Swiss case. Other projections of Swiss health-care expenditure either focus on a certain branch of health care, such as long-term care (Weaver et al., 2008), or on overall health-care expenditure (Vuilleumier et al., 2007). In addition, the projections undertaken by Vuilleumier et al. (2007) and Weaver et al. (2008) fail to take the full effect of population ageing into account as their scenarios range only from 2004 and 2005 respectively to 2030, opposed to a period from 2004 to 2050 in the present analysis. For example, according to the baseline population scenario of the Federal Statistical Office of Switzerland (FSO) (2006) more than half of the increase in the ratio of the population over 80 years old to the Swiss population from 2004 to 2050 is seen after 2030. Also, the old-age dependency ratio, i.e. the ratio between the population over 64 years old and the working force, is expected to rise continually after 2030 and will diminish only at the end of the 2050s. Thus, for assessing the impact of population ageing on health-care expenditure it is sensible to prolong the projection period beyond 2030.

We proceed by introducing the main hypotheses of the literature concerning the drivers of health-care expenditure. In section 3 the data and projection methods used are described. Section 4 presents the results of the different scenarios and section 5 concludes.

DRIVERS OF HEALTH-CARE EXPENDITURE

In this section an overview is provided of the main cost drivers relevant to projecting health care expenditure that are identified by the relevant literature (Hsiao and Heller, 2007; Oliveira Martins et al., 2006; Westerhout, 2006). Cost drivers of health care can crudely be divided into age-related and non-demographic drivers. First of all, age-related cost drivers are presented.

Age-related cost drivers

Due to the ageing of society the old-age dependency ratio will rise steadily. Therefore, if population ageing was crucial fiscal burdens of the working population would inevitably rise. Per capita health-care expenditures increase more or less with age (see figure 1a and 1b below). This implies that older people have a higher demand for health care than younger people. Therefore, part of the health-care literature assumes that the ageing of the population will severely affect health-care expenditure because the "expensive" older age groups will gain weight (see e.g. Westerhout, 2006, 5). According to the medium baseline population scenario of the Federal Statistical Office (FSO) the old-age dependency ratio will more than double from 23% in 2004 to 47% in 2050 in Switzerland (FSO, 2006). In contrast, between 1960 and 2000 old-age dependency ratios across OECD countries have risen only by 6.5 percentage points (Oliveira Martins et al., 2006).

Some authors conclude from empirical estimations that health-care expenditure is driven more, or even solely, by the proximity to death of an individual, that is by changing mortality, than by age per se - the "red-herring" hypothesis (Zweifel et al. 1999; Zweifel et al., 2004; Gray, 2005; Werblow et al., 2007). Health-care expenditures incurring at the end of life are dubbed costs of dying or death-related costs. The "red-herring" hypothesis implies that older people do not consume more health care because they are old but because they are close to death. If so then increasing life expectancies would mean that in some age cohorts the mortality rates will decline. This would result in a drop in health-care expenditure for those age cohorts for which the mortality rates will decline. As a result, the impact of population ageing would be mitigated (see Westerhout, 2006, 9). Moreover, the morbidity rate that is a measure of the health status of the population is also assumed to be correlated with increasing life expectancies (see EC, 2006, 109).

How morbidity will evolve alongside higher life-expectancies is a controversial issue among health experts (see EC, 2006, 109-110). Some authors argue that older people become more vulnerable to chronic diseases. Thus, people would spend gained life-time in ill-health. Others argue that the health status of most of the people remains modestly stable until the final phase in which severe disability emerges. Then, overall, people could spend additional life time in good health. Additionally, one should note that morbidity and mortality, which are interrelated concepts, need only be disentangled if life expectancy changes over the projection period as is assumed in the underlying population scenario for Switzerland (FSO, 2006).[1] Otherwise neither mortality nor morbidity would affect the development of health-care expenditure.

Non-demographic cost drivers

Apart from age-related cost drivers, non-demographic cost drivers play a vital role in determining health-care expenditure. Since World War II the development of health-care expenditure has outperformed GDP growth in OECD countries. Some health-care economists hold the view that this development is due to the fact that health care is a superior good (e.g. Hall and Jones, 2005). However, this view has been challenged

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Whereas the mortality rate corresponds to the proportion of a given population dying in a given time period, the morbidity rate is defined as the proportion of a given population suffering from a disease or disability in a given time period. Both concepts are interconnected in the sense that some diseases can cause death.

because income and expenditure for health care are only indirectly related through insurance premiums (e.g. Getzen, 2000). This can bring about moral-hazard problems (see Hsiao and Heller, 2007, 17). Due to ex-post moral hazard, patients may be inclined to overuse health-care services. Moreover, due to asymmetric information between the physician and the patient physicians can induce demand and set prices (see Hsiao and Heller, 2007, 19).

Medical progress is viewed as one of the main supply-side drivers (see e.g. EC, 2006, 111). In contrast to other branches, technological progress in health care consists mainly in product innovations, which often lead to higher quality but also to more treatments and higher prices (see Hsiao and Heller, 2007, 13). Here, another information problem comes into play because it is often not clear whether quality gains can justify the amount of the price increases. Lobby groups can take advantage of this information problem. Thus, public authorities facing the pressure of lobby groups may admit new medical products too generously. This point is particularly valid for mandatory health insurances such as in Switzerland. In doubt about the effectiveness of new medical products, policy-makers in affluent societies may be induced to cover superfluous medical products in mandatory health insurance (see Hsiao and Heller, 2007, 15). This can be due to strong lobby groups in health care and possibly ill-informed voters. For example it is well-known that some pharmaceutical companies spend more on marketing than on research and development.

Moreover, some authors argue that labour saving progress is virtually impossible in the health-care sector (Baumol, 1993; Hartwig, 2007). As a result, to recruit enough health-care workers, wage increases must exceed labour-productivity growth in health care. This leads to rising relative prices in health care, which is called Baumol-effect or

Baumol's cost disease. Recently, a consensus among health economists in international organisations such as the OECD and the EC seems to be emerging that the Baumol-effect is crucial in long-term care but not in health care (EC 2006; Oliveira Martins et al., 2006).

Hsiao and Heller (2007, 19) who have reviewed the literature on health-care expenditure reach the conclusion that, overall, the supply side is the more important driver in advanced economies. But one should bear in mind that it is notoriously difficult to disentangle supply-side and demand-side factors in empirical studies (see Oliveira Martins et al., 2006, 74). This is mainly due to the fact that there is a lack of appropriate indicators for medical progress. This problem becomes apparent when examining the findings of empirical studies. For example, two recent empirical studies that have tried to address the problem outlined above by choosing various proxies for medical progress come to rather different conclusions. Whereas the Productivity Commission of Australia (2005, T1.17) shows that health care is a superior good for the Australian case, Dreger and Reimers (2005, 16) conclude that health care is a normal good using data for 21 OECD countries including Australia.

METHOD AND DATA

The adopted approach and underlying assumptions

In order to project public expenditures on health care we use a two-stage approach. At the first stage total health-care expenditure is forecasted. According to current standards the projections for health-care expenditures are decomposed into expenditure for long-term care (LTC) (i.e. services provided by nursing homes and homes for the elderly) and health-care expenditure (HC) (i.e. services provided by general practitioners and medical specialists in hospitals) (Oliveira Martins et al., 2006).[2] In line with common practice we have projected LTC only for people over 64 years old. Based on the projections for total health-care expenditure, general government spending on health care in Switzerland, i.e. all Swiss government levels and social insurances, is projected at the second stage. Health insurance is mandatory for Swiss residents. In contrast to most European countries the services are provided by private insurers. Consequently, the mandatory health insurance system is not part of general government.[3] However, costs of the mandatory health scheme feed into the public budget through means-tested premium subsidies for eligible low-income households. These subsidies are jointly funded by the Federal government and the Cantons. Apart from these premium subsidies, which amounted to about 14% of public health-care expenditure in 2004, outlays on hospitals stood at almost 70%, on long-term care at 10% and on other expenditures such as on administration and prevention at 6% of the public health-care budget in 2004 (see Appendix). Thus, subsidies for hospitals constitute the lion's share of public health-care expenditure in Switzerland.

The projections of health-care expenditures are provided in per capita and in GDP terms. These measures are chosen to indicate how the absolute and relative burden of HC and LTC expenditure would evolve for an average income earner in Switzerland.

From now on we use the term "total heath care expenditure" if we refer to health care expenditure that includes expenditure of long-term care.

[3] Insurers fix premium levels competitively but are compelled to accept all individuals irrespectively of their health status. Insurance premiums are lump-sum and fully paid by private households. In addition, co-insurance applies to the mandatory health insurance.

The time period for the projections has been given by the data availability. As a result, we have projected total health-care expenditure from 2004, the base year, to 2050.

In our projections the status quo of the current policy framework is assumed. Thus, no policy change is taken into account. Apart from the population scenario of the FSO (2006), long-run macroeconomic forecasts of GDP and wages are needed as further exogenous variables to project health-care expenditures. Real GDP is projected by multiplying the growth rate of real wages by the work force forecasts of the population scenario of the FSO (2006). We assume that growth of real wages is neutral to the functional distribution of capital and labour so that real wage growth corresponds to labour productivity growth of the economy. Moreover, we assume productivity growth (ω) to be equal to 1%, which roughly corresponds to the average productivity growth of the last thirteen years in Switzerland (1.2% from 1992 to 2005). As a result, per capita growth of Swiss real GDP would be on average 0.9% from 2004 to 2050.

Projecting HC and LTC expenditures

To project the impact of population ageing per capita, health-care expenditures are decomposed by age groups, gender and services, i.e. long-term care and health care. The decomposition of health-care expenditures results in four different expenditure profiles. These profiles encompass the per capita expenditure of men and women by age group for health care and long-term care (see figure 1a and 1b).

***Insert Figure 1a and 1b about here**

The expenditure profiles of the base year 2004 stem from the National Health Accounts of Switzerland provided by the Federal Statistical Office (FSO).[4] Per capita

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The FSO provides data for age cohorts of five years. But yearly data are necessary to take the impact of morbidity change into account. Thus, data of the National Health Accounts are interpolated to obtain expenditures are multiplied by the age cohorts of the medium demographic scenario of the FSO (see Table 1; FSO, 2006, 30-39).

Insert Table 1 about here

This is a fairly standard method of estimating the extent to which population ageing affects health-care expenditure (see e.g. Westerhout, 2006, 6). This procedure implies that the expenditure profile does not change over time. This method has been criticised for omitting relevant factors that can modify the expenditure profiles such as time to death, changes in the morbidity of the population or social trends, e.g. declining informal care to older generations due to a changing societal role of women (see Westerhout, 2006, 8). To respond to this criticism, at least partly, scenarios are constructed that include the proximity to death and morbidity as factors of HC expenditure, and LTC in the case of morbidity.

To take account of morbidity changes the method used by the Oliveira Martins et al. (2006) and the EC (2006) is applied. According to this method expenditure profiles of the base year are shifted to the right. The extent of this shift depends on the average increases of life expectancies of different age groups over the projected time period and the assumption on what proportion of the gained life-time is spent in good health. This means for example, that in 2050 expenditure for a 65 year old man runs at the same level as in 2004 for a 62 year old man. Since the way increasing life expectancies

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yearly data, which are shown in figures 1 and 2. Furthermore, we assume for HC that the change in morbidity is negligible in younger age groups so that the interpolation starts with expenditures for the population over 40 years old. This may lead to a slight underestimation of the morbidity impact. In addition, HC expenditures for people under 41 years old shown in figures 1 and 2 correspond to the average of age cohorts of five years. Only the medium age of these age cohorts is given on the abscissas.

translate into morbidity is an unsettled issue, as a compromise, we shift per capita expenditure by half of the average increase of life expectancies in a baseline scenario for HC and LTC and a death-related-cost scenario for HC (see Table 1). This means that the Swiss population will spend half of their gained life-time in good health. To take into account the uncertainties surrounding the assumptions on morbidity we have also carried out two further scenarios, a pure-ageing and a healthy-ageing scenario (see Table 2). In the healthy-ageing scenario we assume that the additional life-time can be fully spent in good health, whereas in the pure-ageing scenario the Swiss population spend all additional life-time in bad health.

Insert Table 2 about here

For non-demographic factors it is sensible to make different assumptions for LTC and HC. In line with other projections of LTC we assume that technological progress is not relevant in LTC but that the Baumol-effect comes fully into effect (see Oliveira Martins et al., 2006, 20-21; EC, 2006, 135). In contrast, also as in the projections mentioned above, no Baumol-effect is presupposed in HC. Since it is notoriously difficult to disentangle demand-driven and supply-driven factors in empirical studies we assume that except for the Baumol-effect all remaining non-demographic impacts can be captured by the impact of GDP on HC, both measured in per capita terms. In particular, it would appear that the estimated impact of GDP on health-care expenditure is biased upward in empirical studies because medical progress cannot be properly taken into account (see Oliveira Martins et al., 2006, 74). Based on a recent estimation of the Oliveira Martins et al. (2006, Table A4) for 30 OECD countries a one percent increase of GDP has caused on average a 1.1 percent rise in health-care expenditure for the time period from 1970 to 2002 if population ageing is accounted for. For Switzerland it is difficult to generate reliable estimations because the time span since the introduction of the mandatory health insurance in 1996 has been comparatively short. Therefore, we assume for our projections that a one percent increase in per capita GDP causes a 1.1 percent rise of per capita health-care expenditure.

The chosen projection method can be summarised as follows:

$$\frac{E(t,j)}{pop(t,j)} = \underbrace{\left(\frac{12-\lambda}{12} * \frac{E(0,j-\tau)}{pop(0,j-\tau)} + \frac{\lambda}{12} * \frac{E(0,j-\tau-1)}{pop(0,j-\tau-1)} \right)}_{\text{morbidity}} * \underbrace{(1+\omega*(1-\beta))^{t}}_{\text{Baumol}} * \underbrace{\prod_{i=1}^{t}(1+\eta*y(i))}_{\text{demand\& supply}} \qquad (1)$$

with:

0:= base year and t= 1,...,45; E(t, j):= expenditure on HC and LTC respectively of age cohort j in year t at prices of the base year; pop(t, j):= population of age cohort j in year t; $\lambda(t,j)$:= sub-annual morbidity parameter of age cohort j in year t, $\lambda(t,j)\in\{1,\ldots,12\}$; $\tau(t,j)$:= annual morbidity parameter of age cohort j in year t, $\tau(t,j)\in N$; y(i):= per capita growth rate of real GDP in year i. η:= "income elasticity", η = 1.1 for HC and η = 0 for LTC; ω:= productivity growth rate of the economy; β:= Baumol parameter, $0\le\beta\le1$, β=0: Baumol effect fully comes into effect, β=0 for LTC and β=1 for HC.

As is shown in equation (1) both per-capita HC and LTC expenditure (E/pop) are affected by changes in the morbidity of the population. The morbidity parameters of equation (1), λ and τ, may need further explanation. Suppose that the life expectancy of 50 year old men will have increased by 3 years and 4 months from 2004 to 2040. Based on the morbidity assumption in the baseline scenario, 50 year old men will have the same health status as men who are 1 year and 8 months younger, i.e. who are 48 years and 4 months old, in 2004. Therefore, the annual morbidity parameter corresponds to $\tau(35, 50)$ =1 with t = 35, i.e. 2040, and age cohort j = 50. Since the sub-annual gain of healthy life corresponds to 8 months, the per capita expenditure, which is only available on a yearly basis, of male age cohorts 48 and 49 in 2004 is weighted by 4/12 and 8/12 respectively. Correspondingly, the sub-annual morbidity parameter is λ(35, 50)=8 with t=35, i.e. 2040, and age cohort j=50.

To obtain HC and LTC expenditures, first, per capita expenditures on HC and LTC by age cohort j are projected by taking into account morbidity and non-demographic cost drivers (see equation (1)).

$$E(t) = \sum_{j} \frac{E(t, j)}{pop(t, j)} * pop(t, j) \qquad (2)$$

Then, the per capita expenditures are multiplied by the population of each age cohort j in order to calculate the sum of HC and LTC expenditures (see equation (2)). In the case of the death-related costs scenario, per capita HC expenditures are further decomposed by survivors and non-survivors as is shown in the subsequent section.

Decomposition of HC expenditures in the death-related costs scenario

As already pointed out some authors argue that health-care expenditure is much less , or even not at all, influenced by ageing than by the proximity to death in the last years of life. Since the expenditure profiles become steeper with age per se the "red-herring" hypothesis can be a strong counter-argument against the population-ageing hypothesis (see Westerhout, 2006, 8). Thus, if one does not take into account the time remaining to death this may grossly overstate the population-ageing effect. To evaluate the impact of the proximity to death the present study makes projections including a differentiation between expenditure for survivors and the deceased. In our analysis survivors are defined as those people who survive a given year t, e.g. 2020, whereas the deceased and non-survivors respectively refer to people who die in a given year t. Through comparison with the sometimes called naive, i.e. not death-related-cost corrected, projections the effect of the proximity to death can be evaluated. The projections of LTC expenditure are not corrected by death-related costs because LTC differs substantially from HC (e.g. Oliveira Martins et al., 2006). While LTC provides a wide range of care services for the elderly to make a current fragile condition more bearable HC includes medical services aiming at improving the health condition of an individual. Moreover, most individuals become frail in the last (about two) years of their life. Consequently, it does not seem to be sensible to discern between survivors and the deceased for LTC. This is even supposed by Werblow et al. (2007) who claim the existence of a school of "red herrings".

Though FSO does not publish data on HC expenditures for survivors and the deceased, data has been available from a Swiss health insurance company that comprises almost 1 million insurants, roughly one seventh of the Swiss population (see Appendix). This sample is made up of at about 981000 survivors and 8300 deceased people. The decomposition of the sample is extremely close to the Swiss population. For the base year the share of both female and male survivors amounts to 99% in both populations and the proportion of females is 53% in the Swiss health insurance company compared to 51% in the Swiss population. Therefore, it seems to be appropriate to base the decomposition of HC expenditures provided by the FSO into expenditures for survivors and non-survivors on the sample of the health insurance company.

The per-inhabitant HC expenditures on survivors (E^{S}/pop) and non-survivors (E^{N}/pop) respectively in the base year 0 are obtained by multiplying the per-insurant HC expenditures for survivors ($E^{S,SF}/E^{SF}$) and non-survivors respectively ($E^{N,SF}/E^{SF}$) provided by the Swiss health insurance company with the per-capita HC expenditure provided by the FSO (E/pop). Thus, the base year's per-capita HC expenditure of age cohort j can be expressed as follows:

$$\frac{E(0,j)}{pop(0,j)} = \frac{E^{S,SF}(0,j)}{E^{SF}(0,j)} * \frac{E(0,j)}{pop(0,j)} + \frac{E^{N,SF}(0,j)}{E^{SF}(0,j)} * \frac{E(0,j)}{pop(0,j)} = \underbrace{\frac{E^{S}(0,j)}{pop(0,j)} + \frac{E^{N}(0,j)}{pop(0,j)}}_{=\varepsilon(0,j)} \tag{3}$$

To show under which conditions changing mortality rates affect per-inhabitant HC expenditures if the latter is decomposed by survivors and deceased, i.e. equal to ε, we convert the right-hand side of equation (3) (ε) to:

$$\begin{aligned} \varepsilon(t,j) &= \left(1-\sigma(t,j)\right) * \frac{E^{S}(0,j)}{S(0,j)} + \sigma(t,j) * \frac{E^{N}(0,j)}{N(0,j)} \qquad \text{with}: \sigma(t,j) = \frac{N(t,j)}{pop(t,j)} \\ &= \frac{E^{S}(0,j)}{S(0,j)} + \sigma(t,j) * \left(\frac{E^{N}(0,j)}{N(0,j)} - \frac{E^{S}(0,j)}{S(0,j)} \right) \end{aligned} \tag{4}$$

For an arbitrary chosen year t of the projection period the per-inhabitant HC expenditures (ε) of age cohort j can be expressed as the sum of the per-survivor HC expenditures on survivors (E^S/S) and the product of the mortality rate (σ), i.e. the probability of dying, multiplied by the difference between per-non-survivor HC expenditures on non-survivors (E^N/N) and per-survivor HC expenditures on survivors (E^S/S) (see equation (4)).[5]

$$\Delta\varepsilon(t,j) = \Delta\sigma(t,j)\left(\frac{E^{N}(0,j)}{N(0,j)} - \frac{E^{S}(0,j)}{S(0,j)} \right) \begin{matrix} > \\ = \\ < \end{matrix} 0 \qquad \text{with}: \Delta.(t,j) = .(t,j) - .(0,j) \tag{5}$$

Under this assumption per-capita HC expenditures (ε) of age cohort j deviates from the base year 0 in year t only if the mortality rate (σ) of age cohort j changes over time and per-non-survivor HC expenditures on non-survivors does not equal per-survivor HC expenditures on survivors (see equation (5)). Under these two conditions the naive

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The term (1-σ(t,j)) in equation (4) represents the probability of age cohort j to survive year t.

projections on HC expenditures of age cohort j would be biased upwards or downwards. However, the naive projection of overall per-capita HC expenditure is only upward biased, and downward biased respectively, at time t if the negative sum of the differences of ε across all age cohorts j is ceteris paribus lower, and higher respectively, at time t than in the base year (see equation (6)).

$$\sum_j \left(\frac{E(0,j)}{pop(0,j)} - \varepsilon(t,j) \right) \overset{>}{\underset{<}{=}} 0 \quad \text{iff} \quad \sum_j \Delta\varepsilon(t,j) \overset{<}{\underset{>}{=}} 0 \tag{6}$$

As has been mentioned previously the proponents of the "red-herring" hypothesis would predict an upward bias if the costs of dying are neglected for the projections of HC expenditure. However, this prediction can not be confirmed a priori as will be shown in the following. According to the population scenario by the FSO (2006) the probability of dying declines across all age cohorts from 2004 to 2050, i.e. life expectancy is extended, so that the first prerequisite for a bias of naive projection is fulfilled (see equation (5) and Table 1). Thus, under the medium demographic scenario by the FSO (2006) $\Delta\sigma$ enters equation (5) as a negative term. To examine the second condition of equation (5) one has to turn to the expenditure profiles of the base year 2004, which are displayed in figures 2a and 2b. The dark solid lines represent the expenditure profile for non-survivors ($E^N(0,j)/N(0,j)$) and the grey solid lines depict the expenditure profile for survivors ($E^S(0,j)/S(0,j)$) for men and women. [6]

Insert Figure 2a and 2b about here

Since the expenditure profile for non-survivors is substantially different from that of survivors, the second condition for a possible bias of a naive projection of HC

Since the ratio of death-related expenditures for the population under 21 years old to total HC expenditures of that population is extremely low, roughly 0.3%, this age group is neglected.

expenditure is met (see equation (5)). The costs of dying fall below survivor costs at the age of about 90. Furthermore, the inverse U-shaped relationship between per capita expenditures on non-survivors and age corresponds to economic theory, which predicts that the willingness to pay for survival reaches its maximum at medium ages (see figures 2a and 2b).

Given the fact that $\Delta\sigma$ is negative in equation (5), the naive projections of per-capita HC expenditures should overestimate HC expenditures for age cohorts up to age 90 if the costs of dying are neglected. The intuition is that falling mortality rates diminish the weight of the higher costs of dying. At the same time falling mortality rates imply higher survival rates that put more weight on the lower costs of surviving up to the age of 90 (see figures 2a and 2b). This is consistent with the prediction of the "red-herring" hypothesis. The higher the increase in longevity ($-\Delta\sigma$) over the projection period, the stronger is the mitigating impact of the proximity to death on HC expenditure (see Stearns and Norton, 2004, 316). However, beyond the age of 90 it is just the other way around so that according to equations (5) and (6) a downward bias of the naive projections of per-capita HC expenditure would result. Consequently, as changes in mortality cause two opposing effects one can already infer that the mitigating impact of the proximity to death on increasing HC expenditure is limited. As a result, an increasing life expectancy does not necessarily boost the impact of the proximity to death on HC expenditure as is assumed by the proponents of the "red-herring" hypothesis (e.g. Stearns and Norton, 2004, 316). This is all the more true, as the expected decline of mortality rates increases exponentially with age in the demographic scenario of the FSO (2006). At the same time, the difference between per-capita HC expenditure on survivors and non-survivors narrows in older age groups compared to younger age groups. Consequently, in every age cohort j the value of one of the two factors shown in the right-hand side of equation (5) is quite small, which weakens the overall time-to-death impact on HC expenditure. From this one can infer that the proponents of the red-herring hypothesis seem to overrate the impact of an increasing longevity on the decomposition of HC expenditures into survivors and non-survivors, which is further confirmed in the succeeding section.

EVIDENCE AGAINST THE "RED-HERRING" HYPOTHESIS

In Table 3 solely the impact of population ageing, mortality and morbidity on HC expenditure in real per capita terms is shown.[7] Though real per-capita health-care expenditures would be boosted by about one third by 2050, ageing does not appear to be the main driver as one can see by comparing the results reported in tables 3 and 4.

Insert Table 3 about here

In particular, costs of dying do not cause a major downward shift in HC expenditure. In the death-related-cost scenario HC expenditure would only rise by about three percent less than in the baseline scenario, which does not include costs of dying (see Table 3). In contrast, the assumption on morbidity has a more pronounced effect on growth. If one presupposes that contrary to the baseline scenario an additional half of the gained life expectancies is spent in good health, the healthy-ageing scenario, the HC expenditure rise is slowed down by approximately twenty percent whereas in the opposite case, the pure-ageing scenario, the upward trend in HC expenditure is reinforced to roughly the same extent (see Table 3). These findings suggest strongly that the "red-herring" hypothesis by Zweifel et al. (1999) grossly overstates the effect of

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For a more detailed account of projections of Swiss health-care expenditure see Colombier and Weber (2008).

proximity to death in the case of Switzerland. Furthermore, these results seem to be robust because the impacts of morbidity and mortality remain fairly stable over time (see Table 3).

Insert Table 4 about here

Taking account of non-demographic drivers such as medical progress corroborates the above findings. The findings in Table 4 show that non-demographic drivers would have a significant bearing on HC expenditure. While about half of the increase in HC expenditure is due to non-demographic factors, only around one third of the increase can be attributed to age-related drivers in our projections. The residual is due to interactions between these drivers. A further look at Table 4 reveals that the impact of the costs of dying slows down the increase in HC expenditure by 2050 only negligibly by 1%. If people spent an additional half of their gained life expectancy in good or bad health this would change HC expenditure by about 6%. Though due to including non-demographic drivers the impact of morbidity is less intensive, it still makes up 15% of the total age-related effect. Nonetheless, conflicting with the "red-herring" hypothesis, 84% of the age-related effects is due to population ageing per se. Moreover, the impact of age-related drivers will start to weaken from 2040 onwards (see tables 3 and 4).

Insert Table 5 about here

In accordance with the above findings, neither total health care expenditure nor public health care spending is greatly affected by costs of dying (see Table 5). Due to a different expenditure composition the increase in public spending would virtually not be affected by taking the proximity to death into account. Moreover, future LTC spending will be more severely affected by age-related drivers than HC expenditure. About fifty percent of the projected increase in LTC is due to age-related drivers under the baseline scenario. This causes a more pronounced effect of morbidity on total health-care expenditures than on health-care expenditures excluding long-term care. Thus, the pure-ageing scenario would bring about an additional boost in total health-care expenditure of about 1.1 percentage points of GDP, whereas in the healthy-ageing scenario the increase in total health-care expenditure would slow down. The corresponding change in public spending would be 0.5 percentage points of GDP. Furthermore, total health-care expenditure would go up by 4.6 percentage points of GDP in the baseline scenario. Public expenditure would rise by about 2.3 percentage points of GDP. Consequently, the mandatory health insurance scheme in Switzerland will face a more pronounced increase in fiscal burden than public finances will.

The results of this study are broadly in line with other recent projections of health-care expenditures. The projected increase in public health-care expenditure of 2.3% of GDP from 2004 to 2050 under the baseline scenario is in accordance with the forecast in a comparable scenario by Oliveira Martins et al. (2006) for Switzerland. Our results are also consistent with the expected average increase of those European Union (EU) member countries that formed the EU by 2004, the EU15, under the reference scenario of the EC (2006). According to the baseline scenario of Weaver et al. (2008, 66) LTC expenditure of Switzerland would increase by 1.2% of GDP from 2005 to 2030, which is 0.5% of GDP more than the corresponding scenario of the present analysis. This is due to the fact that Weaver et al. (2008, 56) assume a substantially higher productivity growth of yearly 1.6%, which is 0.6 percentage points above the productivity growth assumed in our projections. The projection of total Swiss health care expenditure from 2004 to 2030 by Vuilleumier et al. (2007, 38-40) exceeds our forecast by around 2% of GDP. This is because Vuilleumier et al. (2007) extrapolate the impact of non-demographic cost drivers so that the dynamics of health care expenditure is decoupled from probably decelerating economic growth.

CONCLUSION

What the projections for the Swiss case suggest is that mortality plays only a minor role for the development of HC expenditure. Conflicting with the "red-herring" hypothesis declining mortality rates, i.e. an increasing life expectancy can even turn into a driving force if HC expenditures on non-survivors are lower than outlays on survivors in old-age groups. Morbidity seems to be more important but still population ageing remains the most influential age-related driver. In addition, the impact of population ageing may be underestimated because the resulting increase in demand may well put wages of health care workers and prices in health care under pressure. This pressure would even be intensified if the expected shrinking of the workforce fosters productivity growth (see Westerhout, 2006, 13).

Overall, the findings of the present study corroborate the results of recent studies such as Oliveira Martins et al. (2006) and Breyer and Felder (2006) who also ascertain only a small impact of proximity to death on health-care expenditures. As already pointed out by Breyer and Felder (2006) the significant relevance of non-demographic drivers even diminishes the role of time to death as a possible factor of health-care expenditure. In view of these findings it would appear that the "red-herring" hypothesis, put forward by some authors such as Werblow et al. (2007), should not be overrated. Therefore, from the point of view of a cost-benefit analysis, in the case of projections of health-care expenditure, one should ignore the proximity to death as a separate factor of health-care expenditure. Given other uncertainties of projecting health-care expenditure such as the impact of morbidity or of medical progress and labour market effects of population ageing a possible overestimation by a naive approach is of minor importance.

Furthermore, the "red-herring" hypothesis is based on econometric regressions which might overrate the impact of the proximity to death because of the following two biases. First, econometric studies suffer from the fact that population ageing has not been so pronounced in the past as it is expected to be in the future due to the retirement of the baby-boom generation (the past bias) (see e.g. Westerhout, 2006, 12). Therefore, econometric estimations should be judged against differing demographic developments in the past and in the future. Second, econometric estimations might suffer from an "expectation bias". Estimates concerning the costs incurring at the end of life are based on ex post data. However, logically, the deceased should only be treated differently than survivors if physicians expect them to die (the expectation bias). For example, if people fall seriously ill physicians are probably only capable of assessing whether a person will die or not from a quite late stage of the illness on. Thus, rather than using the number of deceased as a proxy for estimating the cost effect of the proximity to death it would appear to be more appropriate to use the number of those people who are considered as terminally ill by physicians.

Finally, the findings of this study suggest that although population ageing is significant much can be done by policy-makers to dampen ever-increasing health-care expenditures in Switzerland. For example, a more restrictive admission of new medical products for the mandatory health insurance, disease prevention to tackle morbidity and an anticipatory planning of worker capacities, in particular in LTC, can be appropriate measures to manage health-care expenditure properly.

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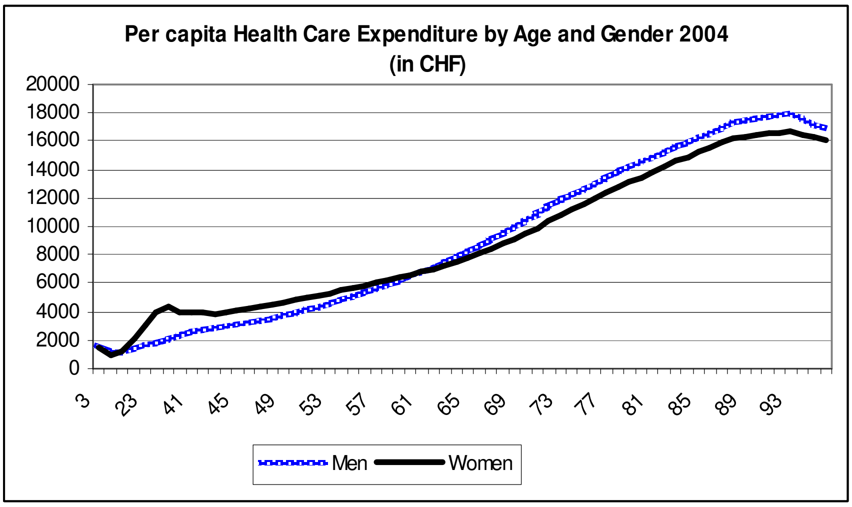
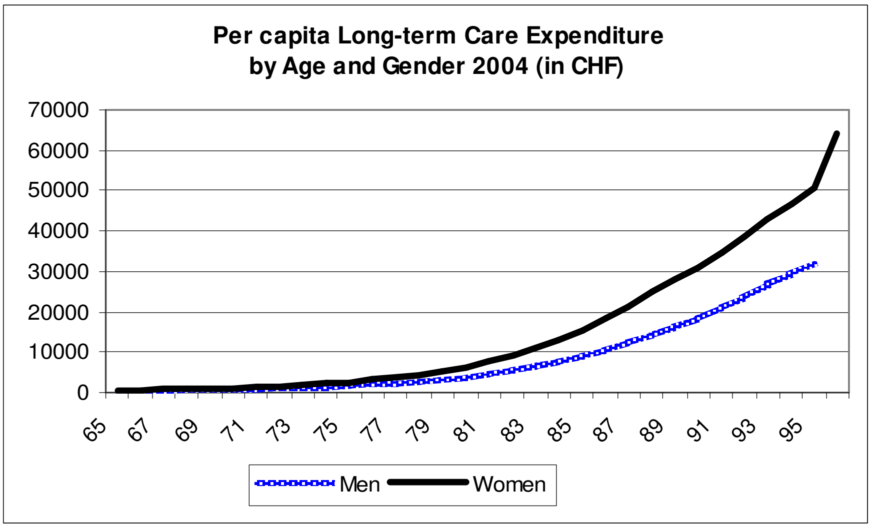
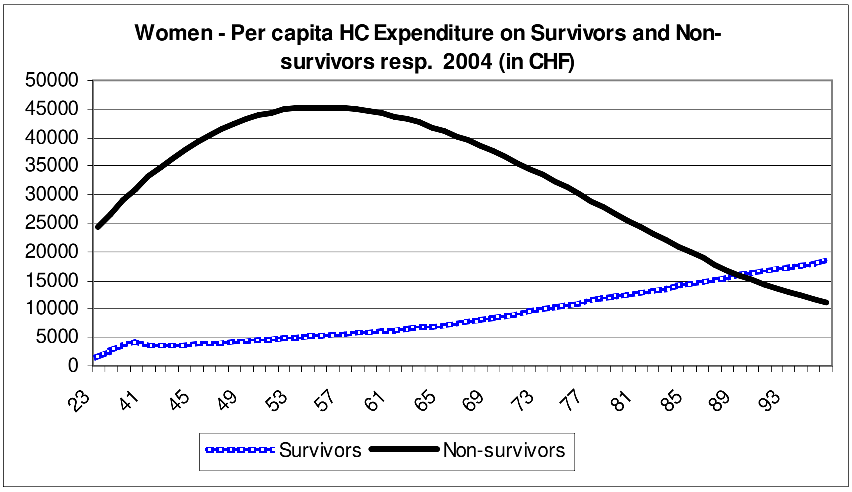
APPENDIX: DATA SOURCES

Public healthcare expenditure is taken from Swiss Public Finance Statistics 2004 published by the Federal Finance Administration in 2006. The residual healthcare data stem from the National Health Accounts of Switzerland 2004 published by the Federal Statistical Office (FSO) in 2006. Data on health care expenditure for survivors and deceased is obtained from a database of the Swiss health-care insurance company "CSS". Population data are collected from the Swiss Population Statistics 2004 published by the FSO in 2006. The population scenario applied to this present study is the medium baseline scenario "A-00-2005" constructed by the FSO (2006). The projections of health-care expenditure are part of the 2009 -2011 medium-term financial plan of the Swiss Federation published in 2008.


Per capita Health Care Expenditure by Age and Gender 2004
(in CHF)
20000
18000
16000
14000
12000
10000
8000
6000
4000
2000
0
3
23
41
45
49
53
57
61
65
69
73
77
81
85
89
93
Men
Women


Per capita Long-term Care Expenditure
by Age and Gender 2004 (in CHF)
70000
60000
50000
40000
30000
20000
10000
0
65
67
69
71
73
75
77
79
81
83
85
87
89
91
93
95
Men
Women


Women - Per capita HC Expenditure on Survivors and Non-survivors resp. 2004 (in CHF)
50000
45000
40000
35000
30000
25000
20000
15000
10000
5000
0
23
41
45
49
53
57
61
65
69
73
77
81
85
89
93
Survivors
Non-survivors

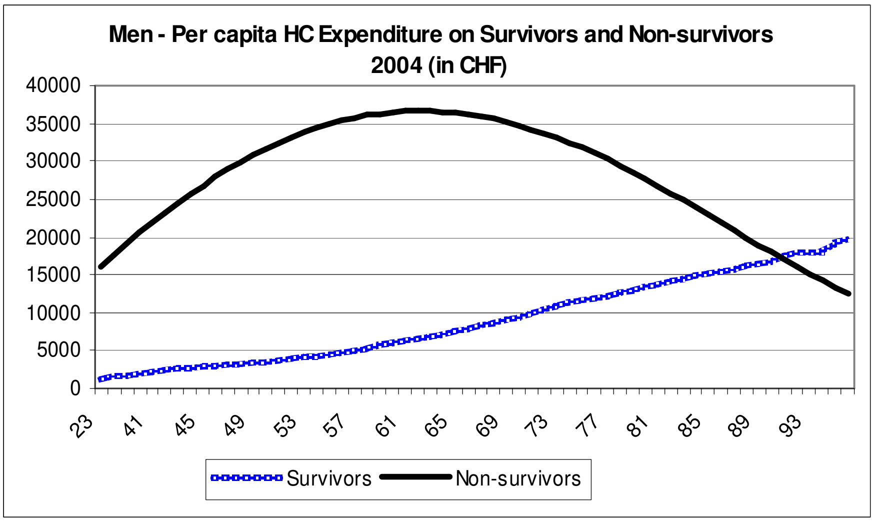

Men - Per capita HC Expenditure on Survivors and Non-survivors 2004 (in CHF)
40000
35000
30000
25000
20000
15000
10000
5000
0
23
41
45
49
53
57
61
65
69
73
77
81
85
89
93
Survivors
Non-survivors

Table 1: Key assumptions of the medium baseline demographic scenario

	Miscellaneous	Gender	2005	2050
Fertility rate	1.4			
Annual net immigration	15 000			
Life expectancy at birth (in years)		women	83.6	89.5
		men	78.5	85.0
Life expectancy at age 65 (in years)		women	21.5	25.5
		men	18.0	22.5
Mortality rate (average of age groups)		women	3.0	2.0
		men	4.1	2.4

Source: Federal Statistical Office (2006).

Table 2: Scenarios for HC and LTC

Service provided	Scenario	Morbidity (Δ good health/ Δ life expectancy)	Income elasticity (η)	Baumol - effect	Survivors and non-survivors
HC	Baseline	0.5	1.1	no (β=1)	no
HC	Death-related Costs	0.5	1.1	no (β=1)	yes
HC	Pure Ageing	0.0	1.1	no (β=1)	no
HC	Healthy Ageing	1.0	1.1	no (β=1)	no
LTC	Baseline	0.5	0.0	yes (β=0)	no
LTC	Pure Ageing	0.0	0.0	yes (β=0)	no
LTC	Healthy Ageing	1.0	0.0	yes (β=0)	no

Note: Δ:= difference.

Table 3: Impact of age-related factors on per-capita HC expenditure

Scenario	2004 - 2050		2004 - 2040		2004 - 2030		2004 - 2020	
	2004=100	Deviation from baseline (as %)	2004=100 per capita	Deviation from baseline (as %)	2004=100	Deviation from baseline (as %)	2004=100	Deviation from baseline (as %)
Baseline	130	-	128	-	122	-	114	-
Death-related Costs	129	-3	127	-4	121	-4	113	-4
Pure Ageing	136	+21	133	+18	126	+19	116	+17
Healthy Ageing	124	-19	122	-19	118	-18	112	-17

Table 4: Impact of all factors on per-capita HC expenditure

Scenario	2004 - 2050		2004 - 2040		2004 - 2030		2004 - 2020	
	2004=100	Deviation from baseline percent	2004=100	Deviation from baseline percent	2004=100	Deviation from baseline percent	2004=100	Deviation from baseline percent
Baseline	195	-	173	-	152	-	135	-
Death-related Costs	193	-1	172	-2	151	-2	134	-2
Pure Ageing	205	+7	180	+7	157	+8	137	+7
Healthy Ageing	185	-6	166	-7	147	-8	132	-7

Table 5: Health care and public health care expenditure as percent of GDP

Expenditure	Base year 2004	Baseline	Death-related Costs**	Pure Ageing	Healthy Ageing
Total	10.6*	+4.6	+4.5	+5.7	+3.6
HC	9.1	+2.3	+2.2	+2.8	+1.8
LTC	1.5	+2.3	(+2.3)	+2.9	+1.8
Public	4.9	+2.3	+2.3	+2.8	+1.8
HC	4.4	+1.5	+1.5	+1.8	+1.2
LTC	0.5	+0.8	(+0.8)	+1.0	+0.6

*This figure is different from the official figure of the FSO because long-term care for people under 64 years is not taken into account.

** Due to the reasons outlined in section 3 costs of dying are not taken into consideration for LTC. Thus, for LTC the baseline scenario is chosen as counterpart of the death-related-costs scenario of HC.