Aging, Health and Aggregate Medical Care Spending in France

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Abstract:

Condensed title: Ageing and Health Care Spending in France

Even though institutions rather than ageing influence medical expenditure at the aggregate level, measuring the expected impact of changes in need (age and health status) on expenditure in a given national health care system allows one to assess how institutions allocate resources across ages. I attempt such a decomposition of the variation of medical expenditure between need, socio-economic circumstances and technology in the case of France, using a unique data set at the individual level. I use morbidity as an indicator of health and test for endogeneity of health to expenditure, as well as for temporal stability of the relationship between health and medical care.

Key words: ageing, health care spending, France, health status.
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« Un peuple peut se laisser intoxiquer par l'idée de vieillesse. C'est une suggestion morbide (...) La vieillesse pour un peuple est d'abord un état d'âme (...) c'est-à-dire quelque chose qui reste justiciable de l'esprit et de la volonté »,
Jules Romains, 1939, Cela dépend de nous

Introduction

Since Getzen’s seminal paper (Getzen, 1992) it is well established that, while age is an important predictor of medical expenditure at the individual level, it is a weak or ambiguous factor of medical expenditure at the aggregate (national) level. Institutional arrangements in the health care system (financing, funding and delivering of health care) play a more important role in explaining differences in expenditure and variation of expenditure across time than the proportion of elderly persons in the population. Health need is a key determinant to allocating care among individuals within a system, but has no relationship with
differences between systems; empirically, it would be hopeless to derive any forecast of medical expenditure of an ageing population from the current age-profile of health care expenditure.

However, there exists an intermediate level where health need and age in particular might play a role in influencing medical expenditures at the aggregate level: once institutions determine how a given health status should benefit from what amount and quality of care or be entitled to which access to medical resources, changes in the average health status of the population might partially explain the variation in aggregate health care expenditures across time in one national health care system. Such an intermediate model has been developed by (Cutler and Sheiner, 1998) and recently developed by (Chernichovsky and Markovitz, 2004). The research follows this general frame and aims at explaining ex post facto aggregate expenditure using individual data: at the aggregate level, the variation of national medical expenditure is modeled as depending on the variation in the age composition of the population and the variation in medical cost per age; the latter in turn depends on epidemiology, personal socio-economic circumstances, access to care and medical technology.
This frame allows to measuring the impact of need (age and epidemiology), demand (socio-economic circumstances) and supply (technology and intensity of medical treatments) side effects on aggregate expenditure in the past and to assess how medical expenditure should react to need per se in the future. Such an assessment is needed if one wants to measure the distributional effects of medical expenditure across ages (Chernichovsky and Markowiz, 2004)). Separating the effect of individual age, health need, demand and supply side effects in the explanation of how medical expenditure varies in the aggregate is also a crucial element in policy discussions on health care financing. If age is a predictor per se, and indeed the main predictor of the growth of national medical expenditure, then social health insurance schemes run the risk of being unsustainable and of not addressing properly financing issues. The then French Minister of Health, Jean-François Mattéi, gave the political view in an interview given to the paper Le Monde, May 17, 2003: first, since an under 25 spends €900 per year in health care while an over 75 spends €5 300, “ageing causes a considerable overspending” (the so-called sustainability issue); second, universal coverage of the population through compulsory ear-marked taxes on income is threatened by the
coming demographic changes: when health insurance has been created in 1945, its aim was to cover the costs of illnesses occurring at random. But, according to Mattéi, "ageing is not an accident" therefore its consequences cannot be funded through the extent mechanism. He therefore recommends social assistance or private supplementary insurance to address the ageing issue. The academic view that an ageing population entails a different financing system, namely Medical Savings Accounts, is developed by (Schreyögg, 2004).

The rest of the paper is organized as follows: in a second section, I present the objectives of the paper and its original features. I then describe the data and the estimation strategy (section 3) and detail the results of the estimation of expenditure on age, morbidity and social characteristics at the individual level (section 4). I then use the coefficients estimated in this analysis to run a simulation exercise reconstructing past expenditures in France holding some of the factors constant, which yields estimates of the partial effect of the various factors on spending (section 5). I also use this scenario to discuss tentatively possible future scenarios for the role of need and other factors in explaining the variations in the age-
profile of medical expenditures. A last section discusses these results and emphasizes the importance of changes in treatments of illnesses or health status, therefore indicating a non-negligible role of political and social choices.

1: Objectives and originality

The study aims at decomposing the growth in health care expenditure in France in the 1990s across need, demand side and supply side effects. Its unique features lie in the type of data available, which allows an investigation of the effect of health status among the non decedents, as well as a test of the endogeneity of health status as a factor of medical expenditure. Studying France yields also specific features, due to the intermediate position of the French health care system in many respects.

Unique features of the data set:

Disentangling the effects of need, demand and supply in medical expenditure is data demanding since it requires an accurate knowledge of expenditures as well as a reliable indicator of health status and socio-economic characteristics on a sample representative of the overall
(national) population and big enough to estimate the complex (two step) models of health care expenditures. A first possible type of data is comprised of a payer’s claims data; these data usually contains accurate (albeit incomplete if some services are not covered) health care expenditure at the individual level, but are poorly informed on health status and socio-economic circumstances; they represent the covered rather than the national population. A first study (Zweifel, Fender and Meier 1999, from now on ZFM) used such data to show that the time remaining till death explains the whole variation in health care expenditure at the individual level – hence, there was no need for richer data describing health status or socio-economic characteristics (rather, the specific health status of being in the last N years of life was enough to summarize individual’s health). This paper has prompted many methodological disputes; first, the risk of collinearity stemming from the use of an inverse Mills ratio in the second step of the analysis (the estimation of expenditure, conditional to any use) was emphasized (Dow and Norton, 2002); second, the issue of endogeneity of time to death to expenditure, which might jeopardize the estimated effect of both age and time to death on expenditure, was raised (Salas and Raftery, 2001); third,
since ZFM conducted their estimation on a restricted sample of decedents, the possibility to generalize the result that, controlling for proximity to death, medical expenditure was invariant at the individual level; last ZFM results can be biased by a possible clustering effect and (Seshamani and Gray, 2004) show that panel data estimation differ from cross-section, in fact yielding an even stronger effect of proximity to death on expenditure. In a rejoinder, (Zweifel, Felder and Werblow, 2004) address these three first critics, providing tests rejecting the risk of endogeneity of time to death to expenditure (using an instrumental variable technique), rejecting the colinearity issue linked to the use of a Heckit model but agreeing with the feasibility of using a pure two step model, and, most importantly, admitting that introducing non decedents (those who are going to survive more than 42 quarters) in the analysis, they find that age is again a factor of expenditure (rather, that controlling for time to death doesn’t wipe age out completely). There is still scope for analyzing the link between age, epidemiology, socio-economic circumstances and technology on a population of non decedents, therefore requiring rich data on health and expenditure at the individual level. To my knowledge, such data are scarcely used in analyses of
medical expenditure: (Meerding et al., 1998) used the richest available data, based on the Dutch population to assess the financial burden of diseases at various ages; (Cutler and Sheiner, 1998) on Medicare data, show that disability is the main predictor of health care expenditure in the U.S.; (Hoover et al., 2002), using the Medicare Current Beneficiaries Survey for 1992-96 investigate the financial costs of different services (inpatient hospital care, long term care facilities) at different ages. Lastly, (Chernikovsky and Markowitz, 2004) use a dummy of the extent of any chronic disease as an indicator of health status in a multivariate analysis of health care expenditure, showing a strong positive effect of morbidity on the use of primary care services.

In this analysis, I use a unique data set, merging claims data on a random sample of 10,000 individuals from the main sickness fund in France with a household survey collecting information on health (disability, morbidity and self-assessed health) and socio-economic characteristics. The data set is called “Appariement EPAS-ESPS”, where appariement stands for merging in French, EPAS stands for Echantillon Permanent d’Assurés Sociaux (On-Going Sample of Insured Individuals), and ESPS stands for Enquête Santé Protection Sociale (Survey on Health and Social
Protection). The data set is detailed in the following section.

I exploit the richness of the data on health status to test the endogeneity of various indicators of health status to medical expenditure, using a standard instrumental variable technique. Such a test is needed as one is to use the coefficient(s) linking health to expenditure at the individual level to assess the effect of health need on the variation of aggregate health care expenditure: if health status is endogenous to expenditure, coefficients will likely underestimate the true effect of health need on expenditure.

I also exploit the fact that this data set is available at several points in time to assess the temporal stability of the estimated relationships between expenditure on one hand and need and demand side effects on the other hand; as shown in (Cutler and Meara, 2001), this could provide a first step at estimating the effect of changes in supply or medical technology, an analysis expanded further on in complementary papers (Dormont and Huber, 2005, Dormont, Grignon and Huber, forthcoming).

*Gain in studying the French case:*
The literature linking aggregate expenditure and individual determinants relies on two opposite case studies, the U.S., representing the market system, and the Israeli, representing a system of public allocation based on capitation. France lies somewhere in the middle, with universal coverage, co-payments and a private market for health care and health insurance (see endnote ii, or (Le Pen and Rodwin, 2004), for a short presentation of the French health care system, or (Sandier, Paris, and Polton, 2004), for a detailed one).

Ageing is also somewhat specific in the French case. The proportion of people age 65 and older within the population will grow, from 16% in 2000 to 21% in 2020 and 28% in 2040 (Brutel, 2001). According to (Dang et al., 2001), France lies in the intermediate range of forecasted dependency ratio (the ratio of the number of 65 and over, out the number of 20-64, multiplied by 100), ranking 5th out of 10 countries in both 2035 and 2050: neither a country where each individual of working age (20 to 64 years of age) would have to support more than 0.6 individual aged 65 and over in 2035 (in the absence of any change in immigration), as are the cases of south European countries nor a country where each individual aged 65 and over will find more than
2.22 individuals of active age to support her in 2050, as are the cases of the Netherlands, the United Kingdom and the U.S.

Table 1 about here

Were dependency ratios constant among countries, the variation in relative health care cost of an elderly (65 and over) compared with a young (0-64) is another reason why specific country examination of the impact of ageing on health care expenditure would still be of interest: Reinhardt shows that this ratio varies from 5.0 in Japan to 2.8 in Germany, France being near the low-end of the distribution with a ratio of 3.0 (Reinhardt, 2000). Canada, Australia and the U.S.A all are above 4.0 (Reinhardt, 2000).

Last, while the age structure is complicated in many countries by immigration, France can be considered a “pure” demographic case of ageing, since immigration is very low and has been so for many years in France. Therefore, ageing in France will be mostly a transitory phenomenon, due to the baby-boom cohort, accompanied by two smaller permanent phenomena of increased longevity and declining fertility (see appendix below).
Besides these factual elements, the specific history of ageing in French ideology and academic research justifies a close examination of the evidence in France: being the first of all European countries to experience a dramatic decline of its fertility in the 19th century, France developed a collective fear of demographic fall. According to Le Bras, the ageing of the population was theorized as the main driver of the fall of France during the inter-wars period (François Boverat wrote in 1926 that ageing was a factor and a symptom of a society running to its end), and Alfred Sauvy write in 1979 a book titled *La France ridée* (the wrinkled France), paralleling France with the late Roman Empire (Le Bras, 1999). A consequence is that ageing is not seen in France as a mere transitory phenomenon due to baby boomers getting old, but rather as a catastrophic never-ending process.

**3 Data and method**

I use data from an ongoing survey of reimbursement claims from the three major sickness funds, representing 90% of the French population (civil servants are excluded from this data file). Claims are not the whole health care
expenditure: some nursing homes are paid according to the number of beds (lump-sum payments), outpatient services delivered through hospitals, and lump-sum payments to home care services are not paid on an individual basis, therefore are absent from the data file. I work on expenditure on ambulatory visits, prescription drugs (OTC accounts for a very small proportion of drugs expenditure in France), hospital stays, and paramedical services (physiotherapists, nurses, etc.), which may be called “acute health care expenditure”, long-term care expenditure linked to dependence of rehabilitation being put aside. The lack of knowledge on long term care facilities is certainly the main drawback of the analysis, since (Hoover et al., 2002) have shown the growing importance of long term care in the age profile of medical expenditure. Moreover, since I am interested in public spending only, I made the assumption that the average cost sharing will remain constant.

Eventually, the data cover approximately 90% of the scope of total health care expenditure, and I worked on the public reimbursement share, namely 65% of this total health care expenditure. EPAS is a simple random survey of the overall population, total spending from EPAS underestimates the aggregate value by 15%, due to the extent of non-
individual data in the aggregate (long term care facilities) and the underestimate in hospital stays referred to in endnote (iii).

These claims data are enriched with information from a general population survey, bringing information on health status, supplementary coverage, education and income.

The resulting file is composed of 3,911 individuals in 1997 (3,265 in 1992), for whom I know both socio-demographic characteristics, health status and health care expenditure for the year 1997 or 1992 (I know the amount claimed for health care utilized during the year 1997 or 1992). I used such files for the years 1992 and 1997, and I calculated one age profile for each year. In 1992, data on wage earners (80% of the total French population) only were available therefore any comparison between the two files is based on this sub-population.

I detail the sample for 1997, drawing upon (Aligon et al., 2001).

The household survey suffers from a non-response bias: EPAS is comprised of 9,046 enrollees (some of whom having dependents who share their registration number with the sickness fund); out of these 9,046, 5,579 actually “exist”
(they have a mail address that can be accessed); the remaining 3,467 exist only in the administrative files of the sickness funds (some are registered with two sickness funds or with two local branches of the same fund because they have moved in the meantime; since EPAS sample is drawn based on date of birth, such enrollees are drawn twice or more). Of the 5,579 mail addresses, 70% or 3,905 households agree to answer ESPS, yielding 5,811 individuals for whom claims and survey information are known (11,425 individuals live in the 3,905 households, but only 5,811 are enrollees or dependents of enrollees drawn in EPAS). A rate of 30% non-response is common in non-compulsory household surveys. As usual also, these non-respondents are likely to be young (25-34 years old) or old (65 and over) and less educated. Since total expenditure is known for all individuals in EPAS, it is also possible to show that, among those with a positive expenditure (individuals with zero expenditure can be actual non-users or multiple-enrollees), individuals with the highest expenditure are less likely to answer the survey. Overall, the merged file underestimates expenditure (when compared with EPAS) by approximately 20%; it also appears that underestimation is more severe among the old than among the young, hence the age-profiles are certainly flatter than the true ones.
Out of these 5,811 individuals, 782 were excluded because they were dependent-enrollees at the time their household was drawn in EPAS, but enrollees in their own name at the time of the ESPS, hence their record for total expenditure in EPAS is not a yearly record but a partial record. Since it would have been too complicated to calculate the date at which they switched status, they were excluded from the analyses.

Last, health status is not known with acceptable quality in 1,168 individuals (23%), who were subsequently excluded from the multivariate analysis (they are kept in the figure comparing the age profiles in 1992 and 1997)\textsuperscript{iv}. These individuals with poor quality health questionnaires are more often high spenders. Excluding them from the estimation is likely to underestimate the coefficient of morbidity on spending, and excluding them from the simulation is likely to underestimate the impact of the coefficient on aggregate spending. Among those with good quality health questionnaires, 9.3% reported no illness, 27% reported 2 or 3 illnesses, 18.5% 3 or 4, 14.7% between 5 and 7 and 7.5% 8 or more.

All these exclusions left 3,911 individuals in the analyses.
I analyzed the log of individual health care expenditure through a four-step model (Duan et al., 1983). A first pass simply models expenditure on age and squared age in order to provide a profile of expenditure according to age group that can be compared across time.

I use the calculated mean per age group derived from the model instead of the empirical average instead of the empirical average values for two main reasons: first, yearly health care expenditure (mostly hospital expenditures) show a non standard distribution, both highly skewed and exhibiting zero consumption; therefore, empirical averages by age are spurious. Second, the model provides easy-to-use coefficients that can then be entered into the simulation exercises (Section 5).

I then enter various measures of health status and a dummy variable for supplementary coverage, household’s income and the individual’s level of education as supplementary explanatory variables in the complete model.

Health status is measured by morbidity. I chose morbidity because it is a priori less subject to reverse causality with health care spending: the purpose being of estimating the causal impact of individual health on spending rather than mere correlation between the two phenomena, a measure
of health status that is amenable to the volume of medical care (such as functional impairment) would likely yield spurious estimates.

I rely upon a model of health and health care where chronic illnesses are determined by individual characteristics and behaviors (smoking, diet, and exercise) but not affected by medical care. In this model, medical care helps individuals suffering from a chronic illness to survive longer and with fewer disabilities, but cannot remove the illness. If such a model holds, morbidity is less likely to be endogenous to expenditure than disability as an indicator of health status.

To test this assumption, I ran a standard Hausman endogeneity tests on the health status indicators: a first equation uses Body Mass Index, smoking and education as instruments of morbidity and I compared the coefficients in the expenditure equation when the instruments are used instead of the observed variable. I ran a Sargan test on the instruments to assess their quality (correlation with the instrumented variable, but not with the dependent variable).

Morbidity was also preferred to self-rated health (excellent-good-fair-poor) because the latter seems even more difficult to forecast than the former.
More details are to be found in (Grignon, 2002), in French, and available upon request in English.

The Profile of spending per age group should be distorted in the future

The common wisdom of assessing the effect of need on total expenditure assumes the profile of spending per age to remain constant and derives need from changes in the age structure of the population. Such a scenario, however, is built on an assumption: the stability of the profile of health care spending per age group in the years to come. Now this hypothesis seems to have been false in the past. In fact, when we look at repeated observations (ones obtained according to an identical methodology, so that the comparison makes sense) we notice that the profile of spending per age group is distorted over time.

Thus, using the data from a German insurance fund between 1979 and 1996, Florian Buchner (Buchner, 2001), shows for example that this profile had a tendency to “dig itself into a hole” (the elder seniors consuming more and more
compared to the younger seniors) between 1979 and 1990, in order to remain sensibly constant from this date until 1996.

Likewise with French data, reproducing the calculation of the profile per age group performed for 1997 on the data from the same source, but for 1992, we observe a distortion of the profile, here again by means of a slight hollowing, (see Figure 1).

Figure 1 about here

If we want to estimate the impact of ageing on the total expenditure of medical care, we cannot be satisfied with a profile of spending per age group that is stable over time. We have to explain this profile, know what constitutes it, what is hiding behind the connection empirically noted between age and spending. The first possible explanatory factor is evidently health status: if we consume more as we get older, it is notably because age is accompanied by a deterioration of health status.

It would be suitable then at least, to provide a reasonable estimate, to separate, in the profile per age group, what
belongs to age itself, and what is linked to health status. The estimate would consist of adding a "pure" age group effect (controlling for the effect of health status), to the spending per age linked to health status per age group; for this last step, we must anticipate the link between age and health status.

4 Results: Estimated Relationships between Age, Health Status, Complementary Coverage and Health Care Spending

This analysis was performed based on the data from the "appariement EPAS-ESPS", modeling annual spending as a function of health status, age, household income, whether or not the individual is covered by complementary insurance, and finally his or her level of education. Indeed, the income level, the complementary coverage and education can influence the level of medical consumption and to vary with age. Therefore they can contribute to the explanation of the profile of spending per age group. For this reason, I have added these factors into the preferred model just as I did for health status. Health status is measured through self-reported morbidity: the individual answers questions on whether he/she suffers from specific illnesses (suggested by the interviewer). I
utilized the mere number of reported illnesses as well as dummies for the extent of heart disease and diabetes as the health status variables (according to (Meerding et al., 1998), these two diagnostics represent 20% of health care expenditures in the Netherlands among the 65-84 years old, and still 11% among the 85 and over – according to these authors the costliest diagnostic is dementia, but individuals suffering from it are usually excluded from households surveys). Of the three variables used, and on the four equations (four step model), only one (out of twelve) failed the Hausman test (I could not reject the null hypothesis that morbidity was endogeneous).

This model confirms the massive effect of morbidity on the link observed between age and spending: for a 65 year-old man, the first sickness adds € 360 per year to spending all else being equal, the second year € 620 and the fourth € 1,830.

The other explanatory factor is supplementary coverage, which positively influences the consumption of care. Because people age 80 and older are less likely to have complementary coverage then people 40-79 years of age (in 1997, 22% of the 80+ were non-covered versus 12% among the
40-79 years old, (Dumesnil et al., 1999)), the effect of coverage on spending has a tendency to make the age group profile less convex beyond 30 years of age; this phenomenon could also take into account the steepening of the profile per age group between 1992 and 1997, since the possession of complementary coverage by older people is approaching that of the younger people (in 1992, the rates of the non-covered were respectively 29% for the 80+ group and 12% for the 40-79 years-old, (Bocognano et al., 1993)). On the other hand, the level of education and income level have little influence on the level of spending once the other factors are controlled.

Last, we observe a residual effect of age on health care spending, weak and negative, holding health status and complementary coverage constant. According to the model, one more year would mean, at 70 years-old and all else being equal, an average reduction in expenditure of less than € 10.

Several explanations can be given for this negative residual effect of age:

- a rationing effect by the health care system, which affects mostly the elderly (Brun et al., 2001),
- A voluntary renunciation of care by the elderly who consider that the health investment is no longer worth it (Grossman, 1972),
- A cohort effect, the eldest also come from a different time, when universal coverage did not exist and the health care system was not a given like it is now (Mizrahi and Mizrahi, 1997),
- A “surviving effect”: since the data exclude institutionalized individuals, it is not unreasonable to think that only the healthier ones (therefore the low expenditure individuals) remain in the data set at very old age.

This negative age effect should be taken cautiously however, since it comes partially from the functional form (age and squared age) I imposed to the data: an alternative model with a series of age dummies didn’t show such a clear negative age effect. In any case, we can retain the idea that the age effect on a given health status is weak.

5. Using the estimated relationships to simulate the respective impact of need and other factors on health care expenditure: a recollection of the past
In order to roughly assess the demographic, health status, cost, demand-side and technology components of public health care spending growth, I simulate expenditure per capita in 1997 and 2000, starting from the actual figure for 1992. A first simulation assesses the demographic component by estimating a mechanical scenario (use of the age profile of 1992 and changes in the numbers of individuals per age between 1992 and 1997 or 2000). Then I add a cost effect by inflating spending per capita by the price index of total medical consumption (consommation médicale totale, base 1995). I therefore ignore any possible difference of price inflation of medical products according to age, even if it is documented in the US case (Berndt et al., 1997). Last, I use the coefficients estimated in the four-part model of expenditure on age, squared age, supplementary coverage dummy and health status to assess the impact of changes in the proportion of individuals covered (at each age) and in the health status per age. The residual (what is left unexplained by this preferred model in the actual increase in health care spending in France between 1992 and 1997 or 2000) stems from a compound of supply-side drivers (namely, technological progress) and demand-side drivers (what is referred in France as the generation effect).
This simulation confirms the low impact of the demographic component in the past decade in France (though higher than in Australia, Canada or the USA, (Reinhardt, 2003)): the increase due to the pure demographic change (or ageing) lies between 3.63 out of 15.67, or 23% of the total increase from 1992 to 1997, and 5.98 out of 30.51, or 20% of the total increase from 1992 to 2000\textsuperscript{vi}. As already mentioned (see endnote i) the same holds for the years 2000–2020.

Health status (rather the number of chronic illnesses as declared in the general population survey matched with the claims data) drives spending downward, and explains minus 2% of the total health care spending between 1992 and 2000 (minus 10% between 1992 and 1997). How will “need” (so defined as morbidity) evolve in the coming years depends on the forecasted relationship between age and health. Three opposed concepts confront each other (Sermet, 1998): the first, pessimistic, claims that the prolongation of life expectancy is only due to an improvement of survival techniques at a given health status, but not to an improvement of the health status itself. According to this
concept, all the working years are accompanied by a weakening of health and medical activity enables people who would have died a few years earlier to survive. For this hypothesis, superior longevity would bring with it a decrease in quality of life, but also an increase in average spending per person more rapid than estimated in the recollection of the past.

The second, optimistic hypothesis claims that the prolongation of life expectancy has to do with ameliorating the health status: at each age, people would be in better health, because their life conditions are better, and this improvement in health would explain the most part of the increase in survival rate at each age. In this hypothesis, superior longevity would be accompanied by an improvement in quality of life, but also by an increase in spending per person slower than that of the simulation.

Finally, the third distinguishes morbidity (which would increase with longer life spans) from incapacity (which would decrease along with to the prolongation of life): in this scenario, superior longevity will be more or less costly according to the respective importance of morbidity and of incapacity as factors of health care spending.
The variation over time of the link between disability and age has been studied extensively and the common wisdom is now that, for a given age, we observe a lower level of disability (Manton and Gu, 2001), even though observations in some countries at some periods in time seem to run contrary to it (Jacobzone, Cambois and Robine, 2000).

The variation over time of the link between morbidity and age has been less studied in general, even though information exists in the French case.

In France, a regular statement of objective health status (upon medical exam) of the population does not exist. The principle resources are thus declarative and the comparison of declarations at two different dates reflects changes in the diffusion of information or mentalities as much as real differences (Sermet, 2001). Based on this fragile data, it seems that invalidity and vital risk (prognostic of survival) have gotten better for a given age between 1980 and 1990 (Robine, Mormiche, Sermet, 1998), a tendency that would last into 1990-95 (Sermet, 1998), or 1988-98 according to a regional cohort study (Pérès and Barberet-Gateau, 2001).
As for morbidity, Jean-Marie Robine, Emmanuelle Cambois and Isabelle Romieu (Robine, Cambois, Romieu, 1998) find that throughout the 1980’s, life expectancy without any potentially disabling illness would remain stable, which signifies that the prolongation of life would translate to an equivalent prolongation of life with at least one illness. However, this binary definition of the morbid state (whether the individual suffers or not from at least one disabling illness) does not permit us to induce much about medical spending, it being rather sensitive to combinations of illnesses.

To provide new insight on this issue in the case of France, I compared morbidity in the ESPS studies from 1988 and 1998. From this comparison, it would seem as though we are witnessing a global stability, an improvement for certain illnesses and certain age groups, of health status at a given age. We would therefore tend to lean toward an optimistic approach, but these first results are still fragile: we must again recall that it is a question of declarative data and not of medical examinations.

Returning to the recollection of the past, I go from need to more economic factors of medical expenditure: Cost
inflation explains another 40% of the increase leaving 43% for technology and demand-side effects.

Among these demand-side effects are those of supplementary coverage. The past tendency has been for a closing of the gap between the percent of elderly and others who have it, and we can thus reasonably deduce from this that the negative impact of the absence of coverage by the elderly should disappear; however, if the obligatory regime should pull out of reimbursement, and leave a growing share to the complementary regimes, thus making the cost of coverage more expensive, it is possible that the gap in coverage between those 80 years-old and over and the others would widen again.

6 Discussion: Evolutions in the Relationships between Health Care Spending and Health status and Complementary Coverage

I have established a method, and certain indications of results, for a reasonable estimate of the impact of ageing on health care spending. However, this reasonable estimate depends on an underlying assumption on the stability of the
link between health status, possession of complementary coverage... and medical care spending.

However, as in the case of the age profile, empirical findings are rather unfavorable to this stability assumption: by re-running the model (run in 1997) on the data from 1992, I find that the residual impact of age is different (the difference, being tested by a simple Chow statistic, is highly significant) in 1997; even more surprising, it is more negative in 1997 than in 1992, even though the cohort-effect explanation assumed a leveling off\textsuperscript{vii}.

Likewise we observe that the impact of health status (measured by morbidity) on spending is different, and higher, in 1997 from what it was in 1992. In other words, to care for the same morbid state does not entail the same costs over the years. This result, if confirmed by future analyses, suggests that the modifications of treatment modes, linked to medical technical progress or to the evolution of the demand from patients and their family, also play a role in the increase of health care spending. This point is investigated further and more systematically, using an Oaxaca-type decomposition of the change over time.
of the age profile of health care expenditure (Dormont and Huber, 2005, Dormont, Grignon and Huber, forthcoming). For the little that technical progress concerns illnesses coming about with age, or that it be judged less acceptable that a person lose his autonomy because he or she is ageing, the modification of ways to assume medical responsibility for illnesses could dig into the profile of spending per age group. The stake of ageing would not be so much the increase of the proportion of seniors in the population but rather the decisions made with regards to resources destined to the care of the aged and of the younger population, or to medical care in general compared to other health spending. More than demographic projections, we then need scenarios of possible choices, an explanation of their consequences, and a guide to those choices that seems the most fitting to our preferences and our constraints.

The impact of these different choices is apparent in the evolution of the progress of life expectancy during the last century (Cutler, 2000): whereas, between 1900 and 1940, the increase in life expectancy at birth represented 15 times the increases realized after age 65; between 1960 and 1990, the relationship is only 2. Society allocated
medical resources to illnesses acquired during youth and saved young peoples’ lives much more massively 60 years ago than today, and we can therefore suppose that the link between health status and medical spending was very different at this time period than what it is now. Nothing leads us to believe that such an evolution will not occur in the next 60 years: the profile of spending per age group may then steepen a little more, but, more than an effect of ageing or mere need of the population on spending, we should talk about an effect of decisions to distribute resources differently across ages.
Appendix:

Predictions on ageing of the French population take into account three different phenomena.

- First, there is a transitory phenomenon that is the consequence of the baby-boom of 1946-73\textsuperscript{viii}. While individuals in the age group 65-90 in 2000 were born in 1910-1935, a period with approximately 14 million births, the same age group in 2030 will be composed of people born between 1950 and 1975, years which yielded 21 million births.

- A second long-term (and certainly more permanent than transitory) phenomenon is the increase in life expectancy at 65 years of age. Between 1950 and 1990 the probability of living to 85 conditional on reaching the age of 60 more than doubled in France (Dinh, 1995) and we can anticipate that the years to come will follow this trend: In 2040, life expectancy at 60 years-old will be 25 years, versus 20 at the same age in 2000 ([10])\textsuperscript{ix};

- A third phenomenon, which is more difficult to foresee, is linked to the decrease in the size of the population under 20 years-old by fewer births: Brutel predicts a
reduction of descendants (2.1 children per woman today to 1.8 for the generation of women born in 1985) leading to 13 million 20 year-olds in 2050, versus 15 million in 2000 (Brutel, 2001).

Among these three causes, the transitory effect due to the baby-boom is by far the most important: a scenario that assumes a high mortality rate and a high fertility rate (which therefore only reflects the transitory effect) will cause the 65+ population to represent 25.6% of the population; this is about 80% of the total expected increase. The longevity effect (difference between the central scenario and the high mortality scenario) only explains 7% of the increase of the proportion of senior citizens, the fertility effect expected (difference between the central scenario and the high fertility scenario) therefore only explaining the remaining 13%. In 2060, when the cohort born between 1970 and 1995 is between 65 and 90 years old, there will be a net slowing of the weight of seniors on the population. At that point, we can thus count on a stabilization of this weight at around 30%.
It is now well established that age per se (the change in age structure of the population with a constant age profile of health care expenditure) will not provoke any sustainability crisis in the next 50 years. In a recent paper, Uwe Reinhardt gathers evidence showing that sustainability crisis is nothing more than a myth (keeping the age profile of health care expenditure constant) in at least three countries, namely the USA, Australia and Canada (Reinhardt, 2003), see also (Evans et al., 2001), (Richardson and Robertson, 1999), (Rochon, 2002) for Quebec and (Grignon, 2002) for France.

The French health insurance system is basically a single payer system (coverage is universal, compulsory and uniform across the whole population). However, this single payer doesn’t cover all necessary services and shares costs with patients: the compulsory health insurance, funded through contribution proportional to income, covers approximately 75% of total expenditure, leaving out-of-pocket payments for drugs (co-payments), visits (co-payments and balance-billing), dental prosthesis and eye-wear glasses. These out-of-pocket can be covered through so-called supplementary insurance, covering approximately 12% of total health care expenditure. They raise flat rate contributions, usually not risk rated, except for a difference between retirees and individuals of working age: Employers may and do subsidize these supplementary insurance contributions, but retired people have to buy supplementary on the individual insurance market.

Information on hospital stays is not complete, since hospitals have no incentive in transmitting data on it. Every expenditure on hospital has to be inflated by a 1/0.85 coefficient to correct this bias.

The alternative would have been to use the variable on the number of illnesses as a categorical variable, with a specific category “no health questionnaire available”. I opted for a numerical variable for morbidity status for simplicity sake in the simulation.

I am indebted to Jerry Hurley for this remark on the consequences of the functional form.

Remember that I work here only on what I called “acute care” expenditure, meaning after excluding long term care facilities. We also know that the data set under represents the decedents (those who die within a year from the survey), even those living at home and receiving acute
medical care. Therefore our results refer mostly to non decedents. Adding decedents would both steepen further the age profile and lower total expenditure. The application of mortality rates used for the main projection of the Insee (Brutel, 2001) to the pyramids of future ages shows that the proportion of people in their last year of life will continually decrease in France between 2000 and 2020 or 2040. If this last year of life costs 5 times more than any other (an average of what has been found in various countries and confirmed in the case of France by (Hauet, 2000)) a simple simulation of the decrease of this total number of people near death shows that the prolongation of life will permit to “save” .25 points of the national wealth over 20 years, under the assumption that over-spending in the last year of life stays constant in the future.

(Mizrahi, An. and Ar. Mizrahi, 1997) found rather that the residual effect of age at a given health status had a tendency to abate, which seemed to confirm to them the generation effect. The difference between their results and ours is likely attributed to the fact that they only controlled the age effect by health status, while I add other factors in our model, notably possession of complementary coverage.

For the demographers, the baby-boom is measured in fertility, beginning in 1941 and ending in 1964; what interests us here is the total number of birth cohorts, and the fluxes over 800,000 per year are observed between 1946 and 1973.

Dinh proposes a prolongation of the tendency to decrease for the preceding decades, but this would be confirmed by a method founded on the prediction of the effects of reduction of the causes of mortality, called Period and Cohort Components of Mortality, (Hobcraft and Gilks, 1984).

This scenario was constructed by the author, based on projections by (Brutel 2001), by joining the high-fertility scenario for those under 65 and the high mortality for those 65 and over.

To be exact, I have to mention that I only measure here the impact of longevity growth with respect to a pessimistic hypothesis and not with respect to the absolute stability of the mortality, which would be even more pessimistic. I therefore under-estimated the impact of longevity.
References


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Hauet, Eric, 2000, Mortalité et fins de vie, unpublished manuscript, Fédération Nationale de la Mutualité Française


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Exhibits:

Table 1: dependency ratios in various OECD countries, 2000, 2035 and 2050

<table>
<thead>
<tr>
<th>Country</th>
<th>DR in 2000</th>
<th>DR in 2035</th>
<th>DR in 2050</th>
</tr>
</thead>
<tbody>
<tr>
<td>Italy</td>
<td>28.8</td>
<td>56.8</td>
<td>66.8</td>
</tr>
<tr>
<td>Spain</td>
<td>27.1</td>
<td>48.2</td>
<td>65.7</td>
</tr>
<tr>
<td>Japan</td>
<td>27.7</td>
<td>53.9</td>
<td>64.6</td>
</tr>
<tr>
<td>Germany</td>
<td>26.6</td>
<td>54.1</td>
<td>53.2</td>
</tr>
<tr>
<td>France</td>
<td>27.2</td>
<td>47.5</td>
<td>50.8</td>
</tr>
<tr>
<td>United Kingdom</td>
<td>26.6</td>
<td>44.6</td>
<td>45.3</td>
</tr>
<tr>
<td>The Netherlands</td>
<td>21.9</td>
<td>46.0</td>
<td>44.9</td>
</tr>
<tr>
<td>Australia</td>
<td>20.4</td>
<td>41.1</td>
<td>47.0</td>
</tr>
<tr>
<td>Canada</td>
<td>20.4</td>
<td>42.2</td>
<td>45.9</td>
</tr>
<tr>
<td>USA</td>
<td>21.7</td>
<td>38.2</td>
<td>37.9</td>
</tr>
</tbody>
</table>

From Dang, Antolin and Oxley (2001), countries ranked according to decreasing level of DR in 2050
table 2: simulations of the impact of various components of health care spending

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
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<tbody>
<tr>
<td>Actual figures (O)*</td>
<td>+15.37%</td>
<td>+30.51%</td>
</tr>
<tr>
<td>Demography (S1)</td>
<td>+3.63%</td>
<td>+5.98%</td>
</tr>
<tr>
<td>Demography plus cost inflation * (S2)</td>
<td>+12.68%</td>
<td>+18.06%</td>
</tr>
<tr>
<td>Demography, cost inflation, plus health ** and supplementary coverage *** (S3)</td>
<td>+11.32%</td>
<td>+17.45%</td>
</tr>
<tr>
<td>Residual (O – S3) [technology and generation effects]</td>
<td>+4.05%</td>
<td>+13.07%</td>
</tr>
<tr>
<td>Residual out of actual evolution</td>
<td>30%</td>
<td>43%</td>
</tr>
</tbody>
</table>

*: from EcoSanté software ®, data for France

**: from SPS survey, years 1992, 1997, 2000. Since in 1992 health status is the mere number of chronic illnesses per individual, I use this same variable to characterize health status per age group in 1997 and 2000


Figures used (and the easy arithmetic encapsulated in Excell cells) are available upon request.
Figure 1: