Postponement of the Old Age Threshold: When is the Entry into Old Age?

A cross-sectional study over 18 years with the data of the German Ageing Survey from 1996 to 2014.

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Introduction

The increase in life expectancy over the last 160 years in developed countries [Oeppen & Vaupel 2002, p. 1029 - 1031] has resulted in an aging population, combined with a decreasing fertility. Industrialized countries face now the consequences of this ageing process of their populations. More and more people reach the old age. For an industrialized country, such as Germany, its economy must seek to increase the longevity of its population in order to retain their welfare state, for example by raising the retirement age. In this respect, it is important to know how long older people are able to participate in the labor market.

To answer this question, I conduct a cross-sectional analysis with data from the German Ageing Survey (DEAS) in the years 1996 and 2014. With prevalence rates from the Survey population I calculate the temporary unaffected life years in the physical health and social activity aspect for age groups from 65 to 84. The results show that there is a postponement of the old age threshold from 1996 to 2014. Furthermore, further analyses indicate that there is an absolute compression of morbidity of the survey population between the time points. There could be unused resources in the age from 65 until 84, which Germany may focus on to integrate them more efficient in the labor market in order to face the ageing population and its consequences.

Background

A much-noticed topic in the media for several years is the impact of the demographic transition, especially regarding the development of the mortality reduction, which results in a continuous increasing life expectancy. Because different variables influence the mortality and therefore the life expectancy [Barlow 1999, p. 26 f.], there is still a big demand on this research. This is, among others, because of the public interest in this research.

Closely related to the discussion about life expectancy is the question how the additional life years are spent since life expectancy is not a reliable indicator for a healthy population. Furthermore, this measurement makes a country comparison difficult since procedures to measure and calculate it are different in several countries. So the European Commission introduced in 2004 a new indicator, the healthy life years (HLY). These should reveal life quality regarding life expectancy and invest whether the additional years are spent in health or disability resp. disease. [Jagger et al. 2010, p. 2124 ff.]

There are three theories that established in this discussion. The first one is the expansion of morbidity. It says that the gained life years are spent in disease. Recent investigation lead to a further differentiation of this theory. The result is the theory of a relative expansion, which says that the total numbers of healthy years increase but their proportion on the total life span decreases. [Doblhammer & Kytir 2001, p. 385 f.] The counterpart to this theory was developed in the 1980's and is called compression of morbidity. This theory states that the additional life years are spent in health. [Kruse & Wahl 2010, p. 107 f.] Also this theory experienced an addition. The relative compression holds on that while the total disabled years are increasing, the proportion of them on the total life span is decreasing. [Doblhammer & Kytir 2001, p. 385 f.] The last of the three theories, the dynamic equilibrium, says that the proportion of life years spend in disability is constant during the life span.

A decrease in mortality and an improvement of the life expectancy in the last years depends on the reduction of mortality in the older ages. [Meslé et al 2002, p. 169 ff., 186 ff., 191-197, 206 f., 211 - 220, 226 - 234] There was a remarkable mortality decline in the older ages [Christensen et al. 2009, p. 1196-1208], which makes an investigation as from age 65 interesting. Additionally, Jagger et al. stated in 2008 that the life expectancy of the European Union increased but that the healthy life expectancy at age 50 is not even 15 years. This would make a retirement age higher than 65 impossible for an average worker. In Germany the HLY were 13.5 at age 50 at the time of this research. All this makes a research of survey participants as from age 65 desirable.

Also Hoffmann and Nachtmann investigated in such research in 2010. They concluded that the HLY in Germany increased from 1999 to 2005. But according to their research this happened slower than the increase of the life expectancy. As a consequence, there was a proportional rise of life expectancy that was characterized by disability. Therefore, the HLY decreased in relation to the remaining life expectancy. This means a confirmation of a relative expansion of morbidity.

Furthermore, I want to investigate two dimensions of unaffected life years, next to the overall temporary life expectancy. Obviously the physical health aspect of aging is omnipresent but the social activity aspect becomes more and more important as well. Glass et al. pointed already 1999 out that social activites lower the risk of mortality as much as fitness activities do. [Glass 1999, p. 479 – 481] For this reason it is interesting to divide the healthy life years in two dimensions and see if there is a significant difference or not.

Data

For this project, data from the German Aging Survey (DEAS) is used. The DEAS is a nationwide representative cross-sectional and longitudinal survey of the German population aged 40 and older and is funded by the Federal Ministry for Family Affairs, Senior Citizens, Women and Youth. It provides micro data for use both in social and behavioral scientific research and in reporting on social developments. The survey covers a broad spectrum of topics, e.g. employment and retirement, social networks, quality of life, volunteer work. The first wave took place in 1996, further waves followed in intervals of 6 years until 2014. Starting from 2008, the panel survey is conducted every three years with the participants who had entered the DEAS before. The basic survey is still conducted for intervals of 6 years. 2014 the fifth wave took place. For this project, I use the basic surveys from 1996 and 2014. So there is a cross-sectional comparison between these 18 years.

The basic data set 1996 contains 4,838 cases, the one of 2014 6,002 cases. First, all cases under the age of 65 and over the age of 84 years are deleted because I focus on the age group as from 65 years. Since the ages as from 85 years are grouped but I want to use single ages in my analysis, I have to delete cases over the age of 84 years.

Afterwards, I delete missings after the listwise deletion concept. [Diekmann 2011, p. 242 f.] This means that if the missings count 10 or less, they simply can be deleted. If it counts more than 10, I created an own characteristic in the particular variable. There remain 1,666 cases in 1996 and 2,594 cases in 2014 after this process. After the data adjustments, I built four data sets, divided by survey year and gender. Table 1 shows the number of observations in the data sets. I worked with these data sets for the further statistical analysis.

Table 1: Number of observations in data sets, built from data of the German ageing Survey

1996		2014	
Women	Men	Women	Men
825	841	1,150	1,444

For the calculation of the life tables, I used data from the Human Mortality Database (HMD). This data base is a cooperation of the Max Planck Institute for Demographic Research in Rostock with the University of Berkeley to provide detailed data about populations and mortality. At the moment, the data base contains 37 countries. I use mid-year population data as well as the number of deaths from 1996 and 2013 in Germany for this project. Mortality data from 2014 was at the time when the research was conducted not available, which compels to the use of data from 2013 instead of 2014.

This work has to goal to not just investigate the overall temporary life expectancy but also two dimensions of unaffected life years. The first dimension considers the social activity of the survey participant. The goal is to create a dummy variable for this, which expresses with 0 a normal sphere of social activity. A value of 1 indicates a limitation of the social activity. As a base for this dummy variable, an additive index is compounded of different dichotomous variables. To construct the social activity index, I use different variables that contain on the one hand information about activities, which are either not done or done alone (0) or done in company (1). These variables are displayed as number 1 to 7 in table 2. On the other hand, two variables (number 8 and 9) give information if participants get together with a particular group and if there were visits of friends or acquaintances in the last 12 months (0 – no, 1 – yes). So the value 1 expresses a positive aspect of social activity and therefore the participant acquires 1 point for every positive activity in the additive index. So a high value in the additive index indicates a high social activity. An example for this procedure is found in a paper by Huxhold et al. who worked 2013 with data from the DEAS. They used the variables, which are used in this project, to measure social activity. After the index is built, I take a look at the distribution of the index to decide where to set the cutting point for a coding to the dummy variable. The cutting point should be found at the .2 quantile. So basically around 20% of the survey participants should be in one category of the variable to avoid an underrepresentation of the category. The highest possible value of the social activity index is 9, the lowest 0. In the year 1996 23.5% of all participants have either a value of 0 or 1 in the index. That is why the cutting point is set between 1 and 2 as shown in table 2. To maintain the comparability between 1996 and 2014, the cutting point is set at the same position in 2014 like in 1996, even though solely 8.6% of the survey participants have either a value of 0 or 1 in the social activity index.

Table 2: Considered activities to build the social activity index and coding of dummy variable

Social activity variable	Index range	Dummy variable
	0	1 (limitation in social activity)
1. taking a walk	1	
2. doing sports	2	0 (normal sphere of social activity)
3. creative activity	3	
4. visit of a cultural event	4	
5. visit of a sports event	5	
6. play of board games	6	
7. attendance of courses or presentations	7	
8. get together with a particular group	8	
9. visits of friends or acquaintances	9	

The second dimension of unaffected life years considers the physical health. The goal is to create a dummy variable for, which expresses with 0 that there are no limitations due to physical health. A value of 1 indicates that there is a limitation. Unfortunately, there are no questions related to activities of daily living (ADL) in the survey of 1998. Since I want to obtain information about a possible big time distance, I have to find an alternative way. The different dichotomous variables used to build an index for the physical health aspect, which are displayed in table 3, express with a 0 that the survey participant has no disease or if there is a disease, there are no complaints from it. The characteristic 1 though expresses that the disease causes afflictions, no matter if light or severe, or something in between. So the value 1 expresses a negative aspect of physical health and therefore the participant acquires 1 point for every affliction that is caused due to a disease in the additive index. So the higher the index, the worse the physical health. Background for this procedure is that diseases are not necessarily connected to afflictions. The cancer information service of the German cancer research center explains in 2009 that breast cancer in an early stage does not cause restraints or pain. So the life quality would not be affected in a negative way through pain, even though the disease is there. The diseases are chosen because they either cause most of the death cases in Germany [German Statistical Office 2015] or have a huge impact on the morbidity. I hope to solve with this approach the lack of ADL questions, even though this approach is more subjective. After the index is built, I take again a look at the distribution of the index to decide where to set the cutting point for a coding to the dummy variable. The highest possible value of the physical health index is 6, the lowest 0. In the year 1996 29.1% of all participants have a value of 3 to 6 in the index. That is why the cutting point is set between 2 and 3 as shown in table 3. In 2014 16.2% of all survey participants have a value of 3 to 6 in the physical health index.

This is like in 1996 the best possible option and maintains the comparability between 1996 and 2014.

Table 3: Considered activities to build the physical health index and coding of dummy variable

Physical health variable	Index range	Dummy variable
	0	0 (no limitation due to
cardiovascular diseases	1	physical health)
circulatory disorders	2	
joint or bone diseases	3	
respiratory diseases	4	1 (no limitation due to
gastro-intestinal diseases	5	physical health)
cancer	6	

Methods

I obtain the prevalence rates that I need to calculate the unaffected life years from the DEAS data. I use life tables for the calculation of the temporary life expectancy [Arriaga 1984, p. 84 f.] and the unaffected life years, following the Sullivan method [Sullivan 1971, p. 347 – 353]. For this project I use a period life table and therefore, I build a synthetic cohort with the data from the HMD. I use the temporary life expectancy $_ie_x$ after Arriaga because the survey population is summarized as from age 85. This means that there are no reliable data as from these ages for a calculation of healthy life years. Therefore, the old age limit, which is considered by Arriaga to calculate the temporary life expectancy until this limit, can help to exclude negative influences on the calculation through unreliable data. As far as possible, the old age limit should be the oldest age with reliable information, in my case 84. [Arriaga 1984, p. 84 f.]

After the calculation of the temporary life expectancy, I use the prevalence rates to calculate the from physical health problems resp. limitations in social activity unaffected life years. This happens also with the Sullivan method. This method has the aim to create an index based on mortality and morbidity data. Starting point is a life table, complemented with prevalence rates. The Sullivan method increases the expressiveness of the simple life table remarkable, especially regarding health aspects. With this addition to the life table, there is the possibility to not just estimate the life expectancy of groups with different socio demographic characteristics, but also to estimate how this expectancy is divided in healthy and disabled years. [Sullivan 1971, p. 347-353] To obtain coherence, the from physical health problems resp. limitations in social activity unaffected life years are calculated after the Arriaga approach as well within the life table.

I calculate confidence intervals for the results of the unaffected life years. For this, I approximate the standard error of the Sullivan Health Expectancy ignoring the variance of the mortality rates. The first step for this is to calculate the variance of the prevalence rates. This is done through a multiplication of the proportion of the survey population with disability in age x by the proportion without disability. Subsequently, I divide this term by the number of people at age x in the survey. Then I calculate the variance of the health expectancy. Completing, I build the square root of the variance of the health expectancy to calculate the standard error of it. To calculate now the 95% confidence intervals for the disability free life expectancy, I add the product of 1.96 and the standard error to the disability free life expectancy in order to obtain the upper confidence interval. To build the lower confidence interval, I subtract the product from the disability free life expectancy.

To evaluate if there was a movement from 1996 to 2014 regarding morbidity, I calculate health ratios. These are necessary to evaluate if there is an expansion or a compression of morbidity. In the first case, life expectancy increases but the health ratio (ratio of healthy years to the life expectancy) decreases. This matches an absolute expansion of morbidity. Is the health ratio increasing while the life expectancy and the healthy life years are increasing as well, there is an absolute compression of morbidity. However, if the life expectancy and the healthy life years are increasing but the health ratio is decreasing, it is called relative expansion of morbidity. The relative compression of morbidity is observed when the life expectancy and the health ratio are increasing but nevertheless the healthy life years are decreasing.

Conclusive, I calculate the differences in the temporary life expectancy as well as in the from physical health problems resp. limitations in social activity unaffected life years between 1996 and 2014 with a standardization. This should show the effect of the modification of the prevalence rates.

Results

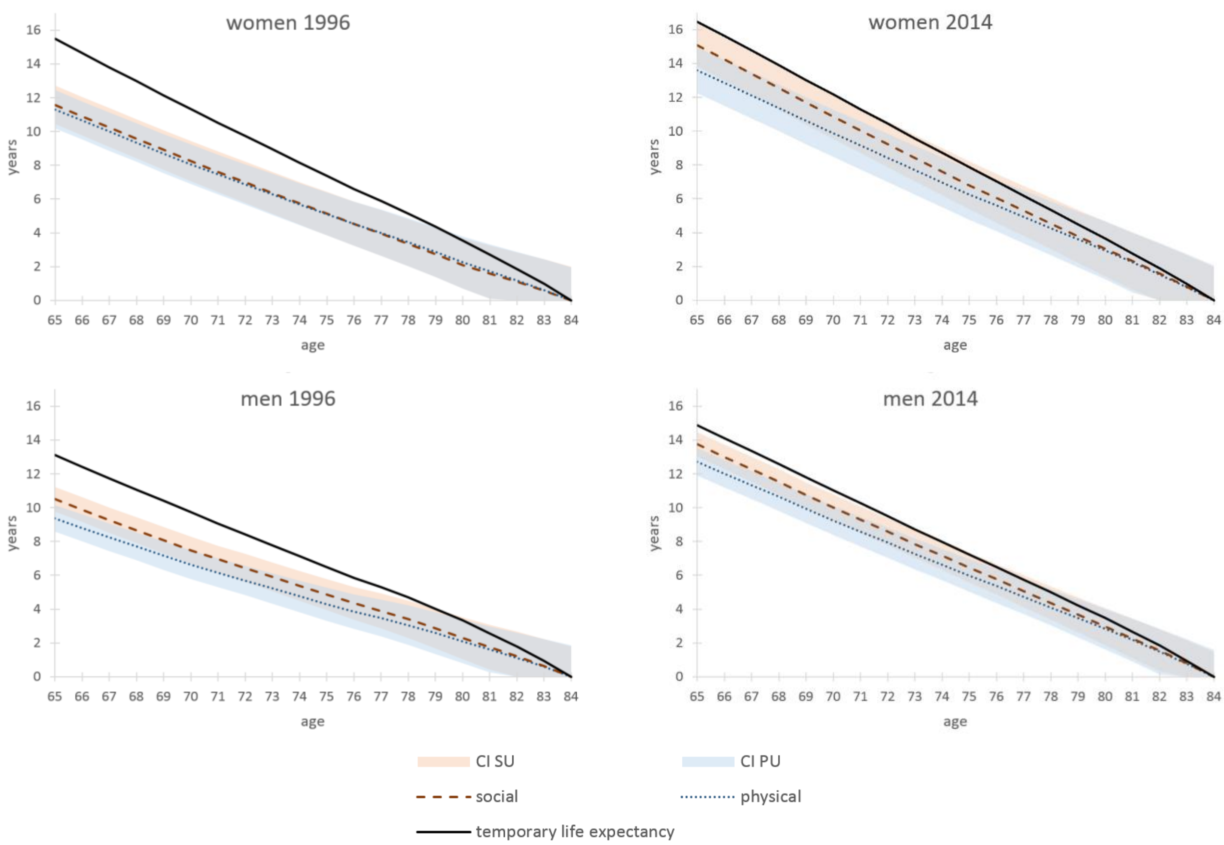
The prevalence rates are obtained by age groups (65 - 69, 70 - 74, 75 - 79, 80 - 84) and are shown in table 4. They are not constructed for single ages because the differences between single ages are small, which makes age groups sufficient enough.

Table 4: Prevalence rates of the German survey population (DEAS) aged 65 to 84 for 1996 and 2014, separated by gender and health condition

Age groups	1996				2014			
	Women		Men		Women		Men	
	Physical health	Social activity	Physical health	Social activity	Physical health	Social activity	Physical health	Social activity
65 – 69	.224	.208	.228	.143	.143	.025	.110	.036
70 – 74	.267	.226	.296	.207	.163	.067	.149	.074
75 – 79	.268	.239	.323	.217	.214	.115	.164	.084
80 – 84	.367	.410	.370	.315	.191	.167	.186	.149

The prevalence rates are decreasing from 1996 to 2014, independent of gender, dimension of health status and age group. With these rates I calculate the temporary life expectancy (TLE) and the from physical health unaffected life years (PU) as well as the from social activity unaffected life years (SU), including the confidence intervals (CI). An overview of the results can be seen in the graph overview 1 below.

Graph overview 1: temporary life expectancy and unaffected life years in different heath conditions of the German survey population (DEAS) in 1996 and 2014, separated by gender



The results show an overall increase of absolute temporary life expectancy as well as in the unaffected life years in the different health conditions from 1996 to 2014. This is observed independent of the gender. In 1996 as well as in 2014 the women have an overall higher temporary life expectancy than the men. Furthermore, the women have more from physical health unaffected life years than the men, in all ages. From age 65 to 77 the women have more from social activity unaffected life years than the men but as from age 78 this changes and the men have the advantage. These trends do not change in 2014, except for the switching point regarding the advantage in the from social activity unaffected life years. This point is postponed in 2014 and now at age 83. The results seem to show nevertheless a balance between the genders. The differences, especially in the higher ages, are minimal.

The confidence intervals are overlapping throughout the analysis, independent of health dimension, gender or age. So there is no significant difference between the two measurements of unaffected life years. This shows that a differentiation between life years that are either unaffected by physical health or social activity is not necessary.

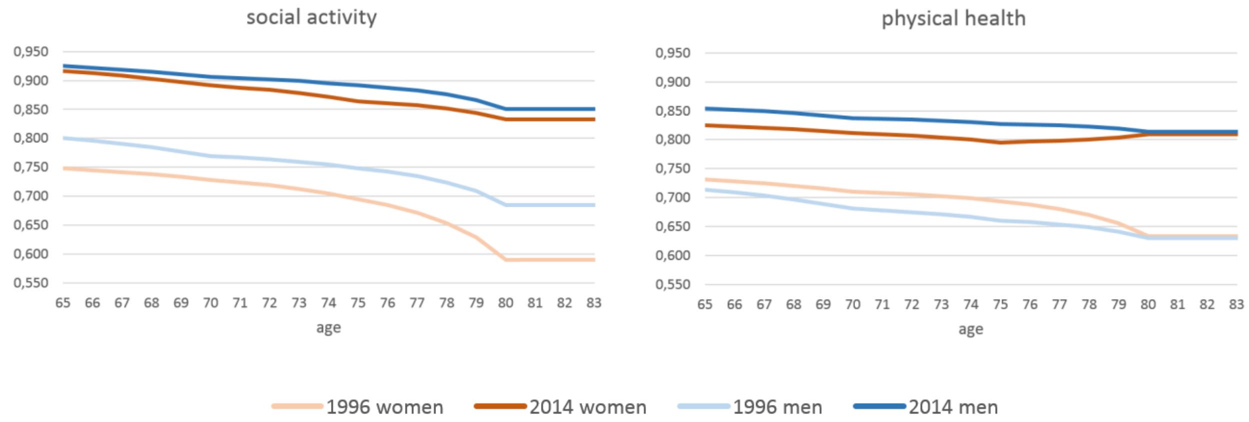
The old age threshold is defined in 1996 at age 75. This is due to Neugarten's separation from young-old and old-old. [Neugarten 1974, p. 190 f.] After this, the young-old people are aged 55 to 75. People who are 75 years and older are considered old-old. In this work, the criteria for the old-old of Neugarten fit the perception of old age. Neugarten describes how stereotypes about old age are primarily based on the old-old, such as sick or isolated. These criteria meet the definition of old age in this work. So taking a look at the remaining unaffected life years in the year 1996, gives the indicator for the old age threshold in 2014. So a comparison between those time points is possible and therefore an evaluation if there was a shift of the threshold or not. To give a clearer output, the threshold age is displayed in table 5 with decimal place. For this, a linear aging process is assumed. For the overall female threshold age there is a postponement from 1996 to 2014 of 0.6 years, so around 7.2 months, from age 75 to 75.6. For the from physical health unaffected life years there is even a postponement of 1.8 years, so 21.6 months. In the from social activity unaffected life years the old age threshold shifted from age 75.0 to 77.3, basically 2.3 years or 27.6 months. For men there is the same trend. The overall male threshold age is raised of 1 year. The from physical health unaffected life years threshold age shifted for 2.7 years, 32.4 months. And the from social activity unaffected life years threshold is postponed from age 75.0 to 77.2, so 26.4 months. So there is a postponement of the old age threshold overall and in both health dimensions, independent of the gender.

Table 5: Old age thresholds in 1996 and 2014, separated by gender and dimensions of disability

physical		social		overall		physical		social		overall	
1996	2014	1996	2014	1996	2014	1996	2014	1996	2014	1996	2014
75.0	76.8	75.0	77.3	75.0	75.6	75.0	77.7	75.0	77.2	75.0	76.0

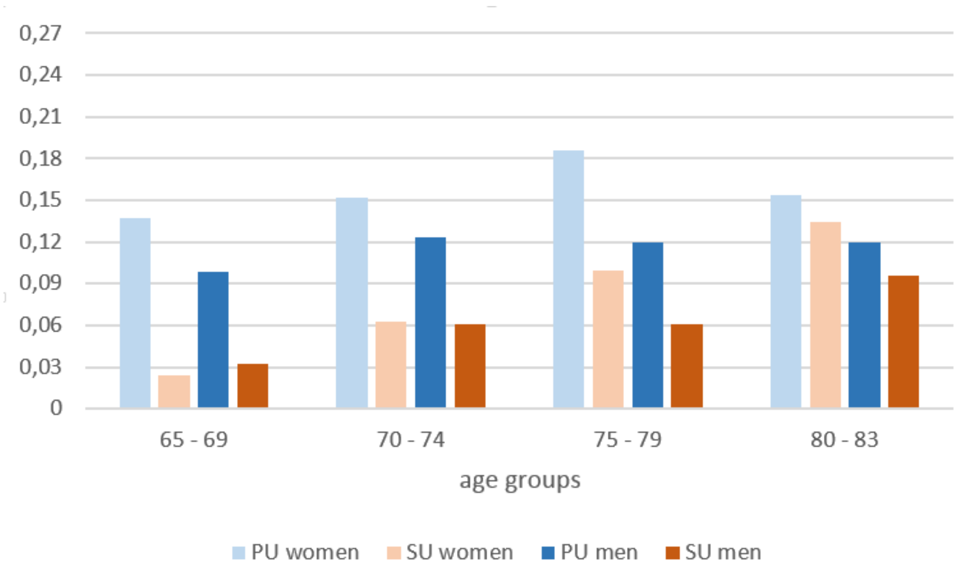
Noticing that therefore the temporary life expectancy increased, as well as the healthy life years, the health ratios in graph overview 2 show an increase in all ages and dimensions, independent of the gender. The gender gap that is dominant in 1996 in the social activity aspect, seems to disappear in 2014. The advantage of the women in 1996 regarding the physical health dimension, disappeared until 2014. Men have now the advantage throughout in all ages, even though this advantage becomes smaller until age 80. From this age on, there is a balance between men and women, even though men still exceed the women slightly.

Graph overview 2: Health ratios in different health conditions in 1996 and 2014



After considering these results, the standardization also shows this trend. In graph 3 are the results from the calculation, shown in age groups. There is an overall positive outcome in all age groups and dimensions, independent of the gender. Nevertheless, there are differences to recognize when taking a closer look. Women of the survey population gained the most improvement for from physically health unaffected life years in the age group 75 to 79. Men though have the biggest gain one age group earlier, at age group 70 to 74. For the social active unaffected life years, women as well as men experience the biggest improvement in the age group 80 to 83. The standardization shows that men exceed women in the improvement of the social aspect in the first age group until they approach a balance in the next age group. In the third age group though, women exceed men regarding this improvement. The improvement in the physical aspect are bigger for the women but in the age group 80 to 83, the improvement decreases while the men continue closing the gap over the ages through a stabile improvement. They do not reach a common balance with the women though. The improvements that the standardization shows are smaller than the calculation of the temporary life years after Arriaga suggests. Nevertheless, the improvement is clearly there, with the same trend.

Graph 3: Change of the life expectancy in different dimensions from 1996 to 2014, calculated with the standardization



Discussion

The results show that the temporary life expectancy as well as the temporary health life expectancy in both dimensions increased from 1996 to 2014. The survey population became older but also healthier and socially more active in older ages. The health ratios increased as well. These indicators lead to the assumption that there was an absolute compression of morbidity in the survey population of Germany from 1996 to 2014, independent of the gender. This conclusion is valid for the view on disabilities like it is done in this project.

The old age thresholds show a remarkable shift to later years. So a postponement is significantly there. The improvement in the healthy life expectancy increased faster than in the general temporary life expectancy which is a remarkable development for the German survey population.

The confidence intervals show that it is not important to differentiate the temporary healthy life expectancy in separate dimensions for a disability of the physical health or social activity. The standardization confirms the results of the previous calculations. A further step could be to calculate a life expectancy after Pollard because each age step could play a different role in the postponement. This gives space for future research since it would be interesting to find out in which way the different age groups contributed to the postponement.

The empirical analysis shows that the survey population 2014 in the ages 65 to 84 is more socially and physically unaffected than 18 years before. It is interesting to know why this could be. One explanation could be the increasing networking of the social media leads to less socially disabled elderly in the year 2014. Using computers seems to be more normal in 2014 than 1996 since they are easier available, as well as the internet. [Jones & Fox 2009, p. 1-4] A networking between each other can happen despite long distances or physical obstacles, e.g. via e-mail. Furthermore, the sprouting awareness that the older age groups are growing, can lead to a broader social supply in the environment of the elderly. There are plenty of groups where people of different or the same socio demographic groups can come together and join a hobby. [Sum et al. 2009, p. 191 f.] Also this can result in an increased social temporary life expectancy in the older ages. [Bargh & McKenna 2003, p. 584]

The improvement in the physical dimension is harder to explain. Despite the lack of remarkable medical revolutions, the increase of disability free years cannot be denied. A possible explanation could be that the medicine procedures improved, despite the lack of big breakthroughs in medicine. Procedures gain routine and experience improvements throughout. The same is valid for medications. There are more and more investigations to fight cardiovascular diseases and cancer so that they can be fought more efficient. Additionally, the preventive checkup could have a higher significance in 2014 than 1996, so that diseases are diagnosed in an earlier status. Therefore, the treatment could be more efficient and they could even be cured.

Beyond, a social improvement can correlate with a physical one. Rollators make a better mobility possible despite diseases and related afflictions. As a result, social supplies can be used, independent of external help. A new independence could be the result, as well as a new awareness of age.

Another possibility could be that problems in the research design cause these results. This can happen on different levels. One option can be that the assumptions of the model are not optimal. The lack of ADL questions and therefore the missing of the opportunity to build the physical dependent variable out of this, can influence the results for sure. Judgments of the existence of afflictions by the survey population and using these variables to define physical disability is ambitious. But since I try to find a way to do such an analysis without ADL questions, it may be a good alternative, even though there has to be awareness that this approach is really subjective. On the other hand, working with self-rated health conditions always includes this risk but may be the only possibility when there are no more objective measurements. Nevertheless, the DEAS offers an amazing data source which should be worked with. Not all data sources, especially when they include older years, include ADL questions. But excluding them from research may prevent interesting findings.

Noteworthy is also the selection effect of the survey population. Mainly healthy people in older ages take part in the survey since their physical and mental disabled counterparts could not be able to do so. As a consequence, there is a biased sample that is not representative for the basic population. This can lead to false interpretation when there is no awareness for this effect. But this argument is valid for all surveys and a sacrifice of the work with surveys is not reasonable, especially in the field of aging and demography.

The results of this work and their interpretations could be an important element while facing the implications of the aging population in Germany. Jagger et al. argued in 2008 that an increase of the retirement age in the European Union should be reconsidered, because of the lack of remaining healthy life years at age 50 to fulfil the working role until age 65. This may have changed after using more recent data. This does not mean that an increasing retirement age in Germany can or should stop the costs of the aging population. There has to be rather a governmental and company rethinking. Like this work shows, elderly could have indeed the physical and social potential to be effectively integrated in the employment market. Using this possible insight, there can be found possibilities to ease the skilled worker shortage with already available workers. In the future, it could be central that companies use this potential, supported by the government since this could be a win-win situation for everybody. The companies could have a pool of skilled workers that can and want to be efficiently included. The employees could benefit from the feeling of being needed, especially in older ages regarding a positive social effect, as well as a financial one. And the government could experience a relief of the social security systems. To use those synergies could be a goal for the future.

References

Arriaga, Eduardo E. (1984): Measuring and Explaining the Change in Life Expectancies. In: Demography, Vol 21(1). Page 84 f..

Bargh, John A. / McKenna, Katelyn Y.A. (2004): The Internet and Social Life. In: Annual Review of Psychology Vol. 55, Page 584.

Barlow, Robin (1999): Determinants of national life expectancy. In: Canadian journal of development studies 20 (1). Abingdon: Taylor & Francis. Page 926 f..

Cancer Information Service of the German Cancer Research Center (2009): https://www.krebsinformationsdienst.de/tumorarten/brustkrebs/symptome.php [28.06.2016 14:07]

Christensen, Kaare / Doblhammer, Gabriele / Rau, Roland / Vaupel, James W. (2009): Ageing populations: the challenges ahead. In: The Lancet 374 (9696). Amsterdam: Elsevier. Page 1196-1208.

Diekmann, Andreas (2011): Empirische Sozialforschung. Grundlagen. Methoden. Anwendungen. 5. Auflage, Hamburg: Rowohlt Taschenbuch Verlag. Page 242 f..

Doblhammer, Gabriele / Kytir, Josef (2001): Compression or expansion of morbidity? Trends in healthy-life expectancy in the elderly Austrian population between 1978 and 1998. In: Social Science and Medicine 52. Amsterdam: Elsevier. Page 385 f..

Federal Statistical Office (2015): https://www.destatis.de/DE/ZahlenFakten/GesellschaftStaat/Gesundheit/Todesursachen/Todesursachen.html [30.06.2016 17:43]

Glass, Thomas A. / Mendes de Leon, Carlos / A Marottoli, Richard / Berkman, Lisa F. (1999): Population based study of social and productive activities as predictors of survival among elderly Americans. In: British Medical Journal, Vol. 319. Page 479 – 481.

Huxhold, Oliver / Fiori, Katherine L. / Windsor, Tim D. (2013): The dynamic interplay of social network characteristics, subjective well-being, and health: The costs and benefits of socio-emotional selectivity. In: Psychology and Aging 28(1). Page 3 - 16.

Jagger, Carol / Gillies, Clare / Moscone, Francesco / Cambois, Emmanuelle / Van Oyen, Her-man / Nusselder, Wilma / Robine, Jean-Marie (2008): Inequalities in healthy life years in the 25 countries of the European Union in 2005: a cross-national meta-regression analysis. Lancet, Vol. 372. Page 2124 ff..

Jones, Sydney / Fox, Susannah (2009): Generations Online in 2009. Pew Research Center. Page 1 - 4.

Kruse, Andreas / Wahl, Hans-Werner (2010): Zukunft Altern. Individuelle und gesellschaftliche Weichenstellungen. Wiesbaden: Springer Spektrum. Page 107 f..

Meslé, France / Valkonen, Tapani / Vallin, Jacques (2002): Trends in mortality and differential mortality. In: Population studies 36. Straßburg: Council of Europe Publishing. Page 169 ff., 186 ff., 191-197, 206 f., 211.

Neugarten, Bernice L. (1974): Age Groups in American Society and the Rise of the Young-Old. In: The Annals of the American Academy of Political and Social Science, Vol. 415, No. 1. Page 190 f..

Oeppen, Jim / Vaupel, James (2002): Broken Limits to Life Expectancy. In: Science, Vol. 296, No. 5570. Page 1029 –1031 - 220, 226 - 234.

Sullivan, Daniel F. (1971): A single index of mortality and morbidity. In: HSMHA Health Reports Vol. 86. Page 347-353.

Sum, Shima (2009): Participation of older adults in cyberspace: How Australian older adults use the internet. In: Australasian Journal on Ageing Vol. 28 No. 4. Page 191 f..