

Distr.: General
1 April 2016

English only

Economic Commission for Europe

Conference of European Statisticians

Joint Eurostat/UNECE Work Session on Demographic Projections

Geneva, 18-20 April 2016

Item 5 of the provisional agenda

Assumptions on mortality

Is mortality variation by region of birth an issue for mortality projections? The case of Sweden

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Summary

In the Swedish national population projections fertility, immigration and emigration have been estimated by sex, age and region of birth (based on county of birth) for a number of years. The projected population in the future has also been divided by sex, age and region of birth. Past as well as projected mortality has been analyzed by sex and age only. It has been discussed whether mortality differences by region of birth should also be included in the projections because the proportion of foreign-born people have increased steadily and is projected to become 22 percent in 2060. The foreign-born population of Sweden is of a numerical size that makes it possible to use different mortality assumptions by region of birth. The first issue is to analyze if there are mortality differences by region of birth in Sweden. The next is to evaluate if any differences should be considered for future population projections.

Based on country of birth Statistics Sweden use the following seven regions of birth: Sweden, other Nordic countries, non-Nordic European Union (EU) countries, rest of Europe, non-European countries with high, intermediate and low Human Development Index as defined by United Nations. The Swedish population registry was used to estimate mortality and life expectancy by sex and region of birth for the periods 2000–2004 and 2010–2014.

There are differences in survival by region of birth in Sweden. At age 30, those born in Nordic countries and in European countries outside EU had lower and those born in non-Nordic EU countries and outside Europe had higher life expectancy than the native-born. Differences in life expectancy between various regions of birth were similar in 2000–2004 and 2010–2014. Including assumptions on different mortality for one foreign-born group with higher and one group with lower mortality, should probably lead to small effects regarding projected population size, but somewhat greater in terms of the population distribution by region of birth. Mortality assumptions mainly affects the elderly. The proportion of foreign-born is smaller in older as compared with younger ages. It is therefore questionable if it is any great advantages to differentiate projected mortality by region of birth. More detailed analysis is needed in order to estimate the numerical consequences of introducing this change in the Swedish mortality assumptions.

¹ [Prepared by Örjan Hemström, Demographer].

I. Introduction

1. This paper summarizes an analysis that was made as part of a Demographic report on variation in mortality by various social and demographic groups. An aim of the reports is to develop the population projections that are made annually by statistics Sweden.
2. The mortality component in the Swedish national population projection has been treated differently than fertility, immigration and emigration in terms of the population groups that are included for assumptions. For fertility, immigration and emigration past trends have been analysed by age, sex and seven groups defined by country of birth. Mortality has only been analysed by age and sex although it has been discussed if similar groups also should be used for projecting future mortality.
3. One argument for also dividing mortality by different foreign-born groups in Sweden is the rise of number of foreign-born people in the population. The proportion foreign-born people have increased from 6 to 16 percent between 1970 and 2014, and it is projected to become 22 percent in 2060 (Statistics Sweden, 2015a). The foreign-born population of Sweden is of a numerical size that makes it possible to use different mortality assumptions for native and various foreign-born groups.
4. In the period 1970–2014 1.3 million women and 1.4 million men have settled in Sweden (Statistics Sweden, 2016). Early in the period there were mainly labour migrants but has later changed to a larger proportion of refugees from areas with conflicts, such Iran-Iraq in the end of the 1980's, Yugoslavia in the 1990's, and recently Syria. Family ties have also been a more common reason for migration which has changed composition in terms of countries of origin over the years. In the more recent period migration from other EU countries, in particular after the expansion in 2004 and 2007, has also increased (Statistics Sweden, 2016).
5. During the last four decades emigration has also increased and foreign-born people are more prone to leave the country as compared with the native born population. The increased international mobility over the years also has significant consequences for the population. A hypothetical calculation come to the result that the Swedish population without migration 1970–2014, excluding all events of immigration as well as emigration, would be almost the same as in 1970, about 8 million instead of the actual 9,9 million in 2014 (Statistics Sweden, 2016).
6. The composition of the foreign-born population changes over time, both in terms of the reasons for residence permits and the mix of individual countries. Compared to the native born population, foreign-born groups are younger. These could be important factors that also are related to different survival probabilities for different groups, a central issue of the present paper. Has survival probabilities within various foreign-born groups changed over time compared with the entire population due to changes in the mix of countries within country groups.

7. We use here the term region of birth for the classification of groups that have been used in the population projections for Sweden for a number of years. The classification is as follows:
- Sweden
 - Nordic countries outside Sweden
 - Non-Nordic countries in the European Union
 - Other European countries
 - Non-European countries with *high* Human Development Index (HDI)²
 - Non-European countries with *medium* HDI
 - Non-European countries with *low* HDI
8. The division of non-European countries according to their HDI is based on a relative scale. In the original division there is a split between countries with very high and high HDI, but since nearly all countries with a very high HDI is found in European groups in the classification, the two highest levels of HDI is combined (Statistics Sweden, 2015a).
9. The changing size and composition of foreign-born groups in Sweden is an argument for using region of birth for mortality assumptions, in particular if there are differences in mortality and life expectancy between various groups. However, the first question is to analyze if there are mortality differences by region of birth in Sweden. The next is to evaluate if the differences are large enough to be considered for Swedish mortality assumptions in population projections in the future.

II. Data and method

10. The Swedish population registry was used to estimate mortality and life expectancy by sex and region of birth for two periods, 2000–2004 and 2010–2014. The analysis is limited to ages 30 and above. Descriptive data for the periods is given in Table 1. The total number of deaths was 460,000 in the period 2000–2004 and 446,000 in 2010–2014. A total of about 28.5 million person-years were estimated in the earlier period and 30.4 million in the later period.
11. There have been clear changes in the size of different foreign-born groups. The number of people born in Nordic countries – the largest of the foreign-born groups in the early period – decreased between periods for both sexes. All other foreign-born groups increased clearly in size between 2000–2004 and 2010–2014. The greatest increase occurred in the non-European groups. Non-European groups from countries with medium and low HDI more than doubled in population size. Among the countries of birth that has increased the most in size are Iraq and Syria with medium HDI, Afghanistan and Somalia with low HDI. The foreign-born groups are more similar in size the in later as compared with the earlier period.

² Defined by United Nations as an index which combines the income status of the country, the educational level of the population and life expectancy (United Nations, 2013).

Table 1: Number of person-years and deaths by period, sex and region of birth

Region of birth	2000–2004				2010–2014			
	Person-years (1,000's)		Deaths		Person-years (1,000's)		Deaths	
	Women	Men	Women	Men	Women	Men	Women	Men
Sweden	12 631,8	11 995,5	218 255	203 633	12 759,5	12 392,8	206 187	191 411
Nordic countries	732,0	547,8	10 153	9 034	668,4	503,8	12 618	10 469
Non-Nordic EU countries	421,8	380,8	5 109	4 869	550,6	545,0	6 223	5 997
Other European countries	319,2	306,1	2 171	2 442	438,3	411,4	2 931	3 348
Non-European, high HDI	263,6	288,4	1 077	1 213	413,6	426,3	1 516	1 809
Non-European, medium HDI	208,4	205,6	587	763	499,1	432,2	1 151	1 453
Non-European, low HDI	69,6	88,9	149	238	177,7	207,9	328	536
Population	14 646,3	13 813,1	237 501	222 192	15 507,2	14 919,4	230 954	215 023

12. The proportion of deaths is relatively higher in the native-born group as compared with the proportion of person-years. This is because the foreign-born population is younger on average than the native-born. The age distribution of the various groups also has some consequences for estimating life expectancy, which should also be separated by sex. The size of the non-European group with low HDI was very small in the early period, and also the number of deaths is quite small in both periods.
13. Common life table calculation was used, but since the number of people in old age is quite small in foreign-born groups, all groups were estimated with the same mortality risks from age 90 and above. This adjustment might to some extent give some underestimations of differences in life expectancy between groups, but differences in survival between groups in the oldest part of the population tend to be of less significance than differences in younger adult ages.
14. Differences in life expectancy between native-born and some foreign-born groups is analysed in detail by the age contribution to the difference as suggested by Arriaga (1984). It is of special interest to identify whether there is any particular age pattern of mortality differences between native and foreign-born people. Most immigrants arrive when they are in young adult ages, 20–35 years. It has been suggested that they tend to be selected in terms of good health in relation to people in their countries of origin (Trovato, 2003). But what happens when they age in the country? The number of years of residence is an interesting factor when comparing survival between various foreign-born and native-born groups (Bos et al., 2007). One study found that persons that immigrated before the age of 20 had higher mortality from cardiovascular diseases than those that immigrated at higher ages (Colón-López, et al., 2009). This would perhaps indicate that there could be an acculturation effect that makes migrants more similar to the host population the younger they are when they age in the country.

III. Results

15. In the entire Swedish population, life expectancy at age 30 was very close to that of the native-born majority in the period 2000–2004, 52.8 years for women and 48.7 years for men. Between the two five-year periods life expectancy had increased with 1.4 years for women and with 2 years for men to 54.2 and 50.7 years respectively.
16. There is a clear variation in life expectancy between various regions of birth. The variation was greater among men as compared with women, and greater in the earlier as compared with the later period. In both sexes and both periods the group born in Nordic countries had the lowest and those born in non-European countries with high HDI had the highest life expectancy. The difference between those groups was 3.7 years for women and 4.9 years for men in the period 2000–2004 and 3.1 years for women and 4.3 years for men in the period 2010–2014.
17. Life expectancy increased in all groups between 2000–2004 and 2010–2014. The increase was greatest among men born in non-European countries with low HDI, 2.9 years, and smallest among women born in non-European countries with high HDI, 0.7 years.

Table2: Life expectancy at age 30 by sex, period and region of birth and change between periods

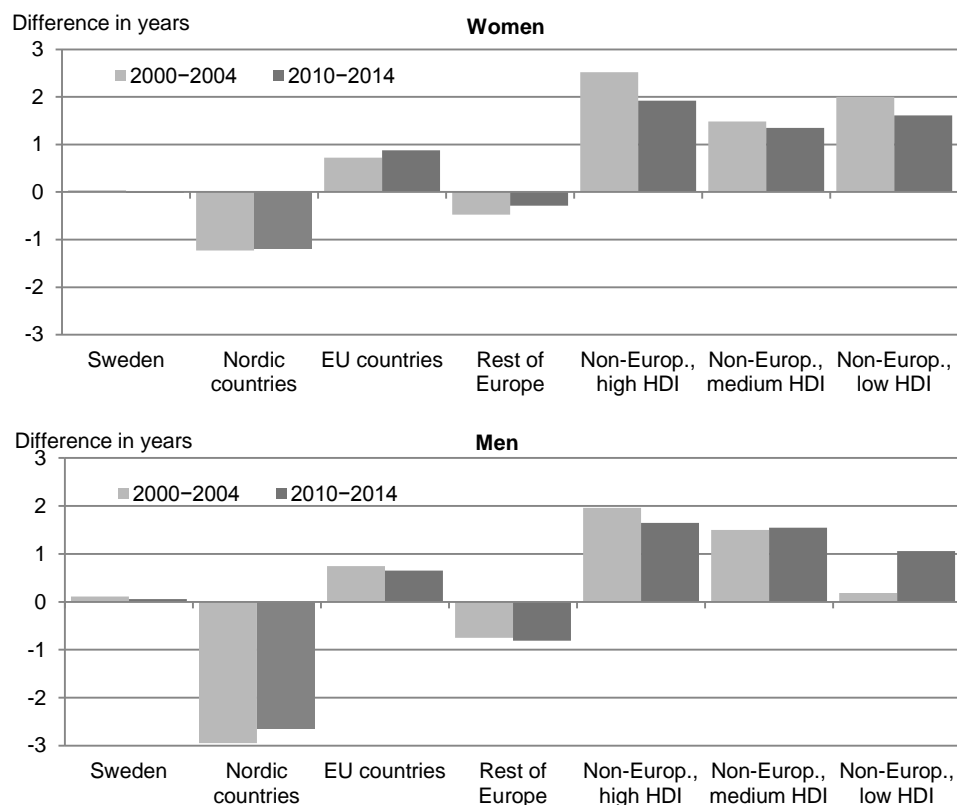
Region of birth	Women			Men		
	2000–2004	2010–2014	Change	2000–2004	2010–2014	Change
Sweden	52.9	54.2	1.3	48.8	50.8	2.0
Nordic except Sweden	51.6	53.0	1.4	45.8	48.1	2.3
EU except Nordic	53.6	55.1	1.5	49.5	51.4	1.9
Rest of Europe	52.4	53.9	1.5	47.9	49.9	2.0
Non-European, high HDI	55.4	56.1	0.7	50.7	52.4	1.7
Non-European, med. HDI	54.3	55.5	1.2	50.2	52.3	2.1
Non-European, low HDI	54.8	55.8	1.0	48.9	51.8	2.9
Total	52.8	54.2	1.4	48.7	50.7	2.0

HDI = Human Development Index.

18. In relation to life expectancy in the Swedish population it was higher in the groups born in EU countries, except Nordic countries, and all three groups born in non-European countries, see Figure 1. Life expectancy was lower compared with the population in groups born in Nordic countries, such as Finland, and the rest of Europe, i.e. former Yugoslavia and Bosnia-Herzegovina. The pattern of differences seems to be stable over time. There were only marginal changes between 2000–2004 and 2010–2014 in terms of differences between groups and the rank order of the groups by the level of life expectancy. The lowest life expectancy in the group born in Nordic countries was more pronounced among men than among women. Compared to the level in the population it was 3 years lower among men but

just over 1 year lower among women. Men born in non-European countries with low HDI had a life expectancy close to the population in 2000–2004, but in 2010–2014 it was 1 year higher than in the male population.

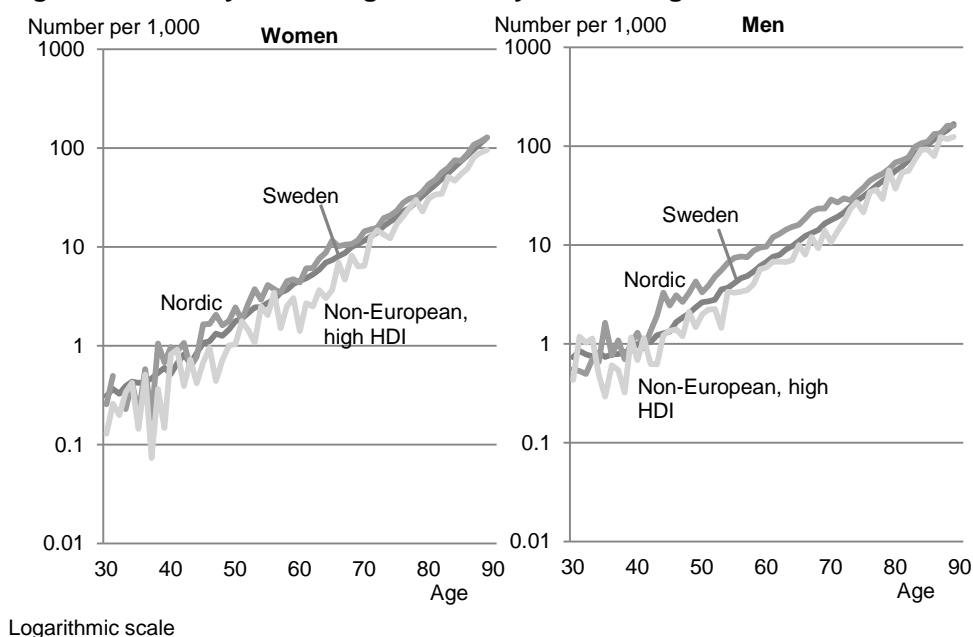
Figure 1: Difference in life expectancy at age 30 for different regions of birth compared with the Swedish population 2000–2004 and 2010–2014



19. Death risks by age are displayed for three of the seven groups in Figure 2, Sweden, Nordic countries and non-European countries with high HDI. These three regions represent the groups with average, lowest and highest survival respectively. Women and men in the group born in Nordic countries had the highest mortality in nearly all ages 30–89 in 2010–2014 and those born in non-European countries with high HDI had the lowest mortality in most ages. The majority group of native-born people had a level of mortality at an intermediate level between the two foreign-born groups with highest and lowest mortality. This indicates that survival differences between groups are relatively similar for various ages.

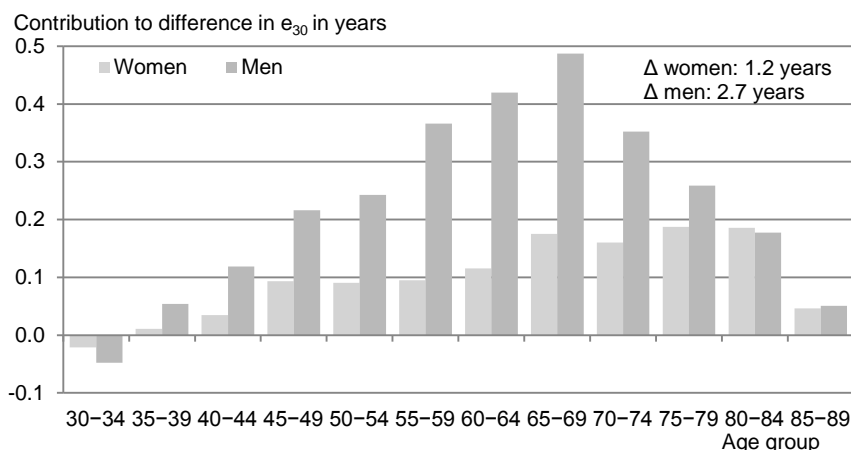
20. Women born in non-European countries with high HDI had low mortality compared with native-born women particularly in ages 60–70. Among men the group born in Nordic countries had clearly higher mortality than the native-born in a widespread age span, 40–70.

Figure 2: Mortality risks in ages 30–89 by sex and region of birth 2010–2014



21. Various age groups contributions to the difference in life expectancy at age 30 were calculated for the difference between native-born and born in Nordic countries as well as between native-born and born in non-European countries with high HDI. This was done for the period 2010–2014.
22. The difference in life expectancy between native-born and born in Nordic countries in the period 2010–2014 was 1.2 years among women and 2.7 years among men. It was a positive contribution from nearly all age group as can be seen in Figure 3. The group born in Nordic countries had lower survival than native-born in all age groups except 30–34 years. Among men, the age specific contribution increased gradually with increasing age and reached the highest value, almost half a year, in the age group 65–69. In older age groups the age specific contributions gradually diminished. The smaller difference among women compared with men is seen in most age groups in Figure 3.

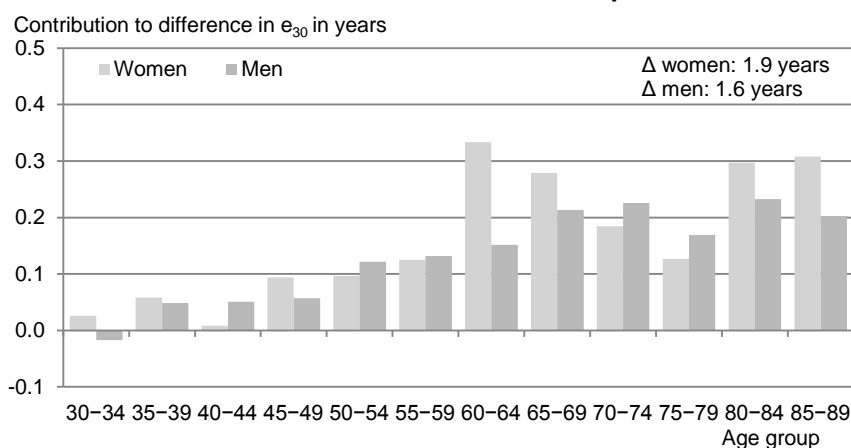
Figure 3: Contribution from various age groups to the difference in life expectancy at age 30 between native-born and those born in Nordic countries 2010–2014



Δ = Total difference in life expectancy between native-born and those born in Nordic countries.

23. Life expectancy at age 30 was 1.9 years higher (women) and 1.6 years higher (men) in those born in non-European countries with high HDI as compared with native-born. Among women, the native-born group had poorer survival than the group born in non-European countries with high HDI in all five year age groups, see Figure 4. In men this was observed for all ages except 30–34. There was a sharp rise in the age-specific contribution among women between the age groups 55–59 and 60–64. A similar sharp rise in the contribution with age was not observed in men. Among men there was rather a gradual increase in the age-specific contribution with increasing age up to the age group 70–74.

Figure 4: Contribution from various age groups to the difference in life expectancy at age 30 between native-born and those born in non-European countries with high HDI 2010–2014



Δ = Total difference in life expectancy between native-born and those born in non-European countries with high HDI.

IV. Discussion

24. There were clear differences in survival between various groups defined by country of birth in Sweden. Differences in life expectancy by region of birth were found to be roughly of a similar size as the difference in life expectancy between women and men. It was surprising that the size of the group differences was somewhat smaller in 2010–2014 as compared with 2000–2004. In the last decade the size and composition of a number of foreign-born groups has changed. But this has not greatly affected the rank order of groups or the distance in life expectancy for these groups compared with the Swedish population. This could be taken as an indication that there are stable and robust processes leading to some foreign-born groups having higher and others lower life expectancy than the native-born in Sweden. A similar finding, that is a higher mortality in some migrant groups and lower mortality in other groups, has also been reported from the Netherlands (Bos et al., 2007).
25. Life expectancy at age 30 was very similar for native-born as compared with the level for the population in both periods. Groups with higher life expectancy than native-born, those born outside Europe and in EU-countries, have increased in population size between 2000–2004 and 2010–2014, from 7 to 11 percent (ages 30 and above). The size of the groups with lower life expectancy than the native-born, those born in Nordic countries and the rest of Europe, was about the same in 2010–2014 as compared with 2000–2004.
26. There are a number of factors contributing to survival differences by country of birth. In a previous report, high survival in foreign-born groups was analyzed and discussed in particular in terms of over coverage in the population register (Statistics Sweden, 2004). The number of people registered as resident in Sweden that has emigrated without reporting this is greater from certain countries of birth than from others. This contributes to biased low mortality in certain groups. A recent analysis found that the population size is overestimated in particular in groups that were found with higher survival in the present paper, in particular groups born in non-European countries (Statistics Sweden, 2015b). Part of the observed survival advantage in those groups is due to an underestimated mortality. Attempts have been made to only include resident foreign-born people in the mortality analyses, by using certain income criteria (Weitft et al., 1999). But even after such adjustments a number of groups still were found with lower mortality compared with the native-born majority.
27. There are also other factors known to contribute to high survival in foreign-born groups. Migrants, international as well as national, tend to be healthier on average than non-migrants. It has also been suggested that international migrants tend to migrate when they are in their healthiest and most productive ages, 20–30 years, and sick people normally do not move (Trovato, 2003). A number of lifestyle factors, such as low alcohol consumption and

healthy diet, possibly also contribute to low mortality in a number of foreign-born groups (Abraído-Lanza et al., 1999).

28. Part of the survival advantage in a number of foreign-born groups is surely an effect of underestimated mortality, but in terms of computing population projections and mortality assumptions this is not so relevant. The population projection uses the number of persons that is registered as resident in Sweden in the jump-of year (Statistics Sweden, 2015a). Therefore it could be seen as relevant also to model mortality trends for groups having a partly biased mortality level.
29. In the period 2010–2014 just over one-tenth of the registered Swedish population were born in countries with lower mortality than the population. They were from non-European countries and from non-Nordic EU countries. A smaller population proportion with elevated mortality was born in Nordic countries and in European countries outside EU. If mortality assumptions should be different for foreign-born groups, the relatively stable differences during the last 15 years suggest that three main groups are included in the computation:
 - native-born
 - foreign-born with low mortality from non-Nordic EU countries and all non-European countries
 - foreign-born with high mortality from Nordic countries and the rest of Europe
30. There are a number of additional issues to discuss and evaluate. The number of foreign-born people is relatively small in ages where most people tend to pass away. In the entire population, mortality trends have been irregular below age 50 since the end of the 1990's. A similar rough assumption on future mortality was made for women and men combined in younger ages (Statistics Sweden, 2015a). Mortality trends for foreign-born groups in younger ages are even more uncertain. Figure 2 shows the irregular age pattern of mortality for two foreign-born groups when using a five-year period. Because survival in the population is still very close to the survival of the native-born majority, an additional assumption of different mortality levels in two foreign-born groups will have small effects of the projected total population number. It will have somewhat larger effects in terms of the population distribution of various foreign-born groups. For both issues, mortality assumptions mainly affect the projected population at advanced ages. In these ages the proportion foreign-born is smaller than in younger ages. The number of foreign-born people in higher ages will increase in the future, and it will be increasingly more relevant to use different mortality assumptions for foreign-born groups.
31. The group of older people born in Finland mainly consists of people with lower education who were labour migrants when they entered Sweden in young adulthood (Statistics Sweden, 2016). This could be one explanation to their high mortality compared with native-born. It is possible that the composition of foreign-born groups will change in the future, for

instance in relation to educational level. Mortality differences between foreign-born groups can also change. If different mortality assumptions for foreign-born are added in population projections, it is necessary to monitor and evaluate how various groups could be classified in relation to past and future mortality.

V. Conclusion

32. Life expectancy at age 30 was very similar for native-born as compared with the level for the population. Groups with higher life expectancy than native-born, those born outside Europe and in EU-countries, have increased in population size, from 7 to 11 percent in ages 30 and above. Including assumptions on different mortality for two main foreign-born groups should probably lead to small effects regarding projected population size, but somewhat greater as regards the distribution of the population by region of birth. Assumptions on mortality have consequences mainly in elderly age groups where the proportion of foreign-born is smaller than in younger ages. It is therefore questionable if it is any great advantages to differentiate projected mortality by region of birth. More detailed analysis is needed in order to estimate the numerical consequences of introducing this change in the Swedish mortality assumptions. It will also be increasingly more relevant to add different mortality assumptions for foreign-born groups when the number of foreign-born people of old age increase in the future.

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