Excess mortality and COVID-19 in Sweden in 2020: A demographic account

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- We examine the demographic impact of Covid-19 in Sweden in 2020

- Careful accounting by age, sex, attribution to Covid-19, region, seasonality

- Broadly more about giving a careful empirical accounting for one country, than pursuing new angles on Covid-19 mortality impact (we have done that in other studies with micro-level data)

- 2 notable differences from most previous research
  - We make cohort mortality forecasts
  - We use forecasted rates for 2020 as a baseline (but in addition use historic averages)

- Origin of the report, was that we were commissioned to examine this by the Swedish Public Health agency (for whom we wrote a Swedish language report).

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In this study, we provide an account of mortality levels in Sweden during 2020, with a focus both on excess mortality and mortality due to COVID-19 deaths. We present various measures of life expectancy of women and men based on age-specific death rates during 2020. Our measures of excess mortality are based on comparisons with benchmarks based on a previous mortality forecast for 2020 by Statistics Sweden and the observed mortality rates during an average of 2017-2019. We present data on regional and seasonal variation in excess mortality as well as estimates of Years of Potential Life lost due to COVID-19. We decompose the excess mortality in 2020 into what can be

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Data

We got a special delivery of data by month and week by Statistics Sweden, and the Swedish Public Health Agency

We only used aggregated data. For 2020, we use 1-year age groups, for regional and seasonal data we use 5-year age groups.

We only account for events, deaths, exposure in 2020

The data are very similar to the official statistics (they are thus not based on the preliminary statistics presented during the year)

We use the Public Health Agency Sminet data for Covid-19 deaths, which are based on matching PIN from positive Covid-19 tests, with all-cause mortality

Some differences with the official cause of death registers, available from National Board of Health and Welfare. Both sources match excess mortality quite well.

Data II

We base our comparisons on excess mortality in 2020 on 2 different baselines

1 - We use a 3-year average, similar to many other studies

2- We unlike most other studies, primarily rely on the pre-Covid-19 population forecast for Sweden in 2020

We think the Swedish mortality forecast is of high quality, it is basically a Lee-Carter model, which use a quite long previous window for calculating trends

A clear advantage of this approach is that it accounts for secular mortality decline over time. It also uses a well established methodology to smoothen trends over time.

A disadvantage is that very recent trends may not be accounted for

Figure A1: Number of deaths in April and December 2020 for men and women in different age groups. Excess mortality compared to 2017–2019, COVID-19 deaths according to the Public Health Agency's SmiNet, and COVID-19 deaths according to the cause-of-death register of the National Board of Health and Welfare

A1a: Women in April
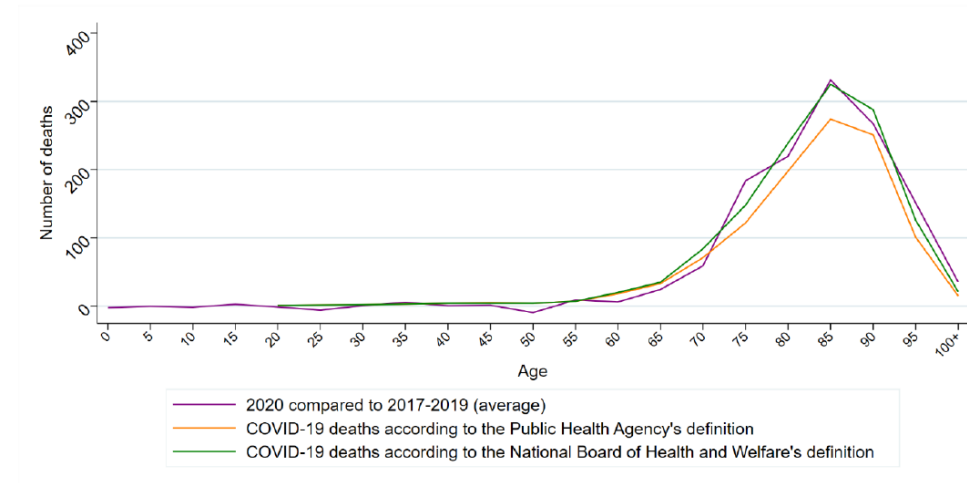
A1b: Men in April
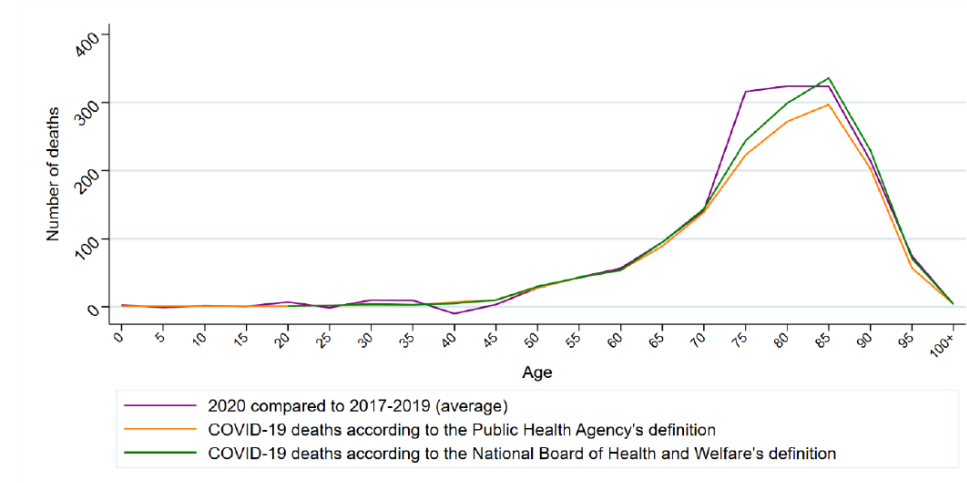
- We have not done any comparison with other countries in this study, as this was not our focus

  our data match reasonable well with numbers from Short-term Mortality Fluctuations (STMF) data series (Aburto et al 2021)

  our number of deaths are somewhat smaller, for unclear reasons, which seems to account for a small difference in life expectancy estimates (we estimate a decline of e_0 that is around 0.1 smaller, or put differently a 0,1 year higher e_0)

Methods

We decompose age specific contributions to change in life expectancy, taking account also of causes attributable and non-attributable to Covid-19, using an Arriaga decomposition.

We do some standard years of potential life lost calculations

We use Statistics Sweden current population forecast, to estimate effect of actual remaining cohort life expectancy

I.e., we use forecasted cohort life tables, and change the value for 2020 only, while keeping future age-cohort specific forecasted rates constant

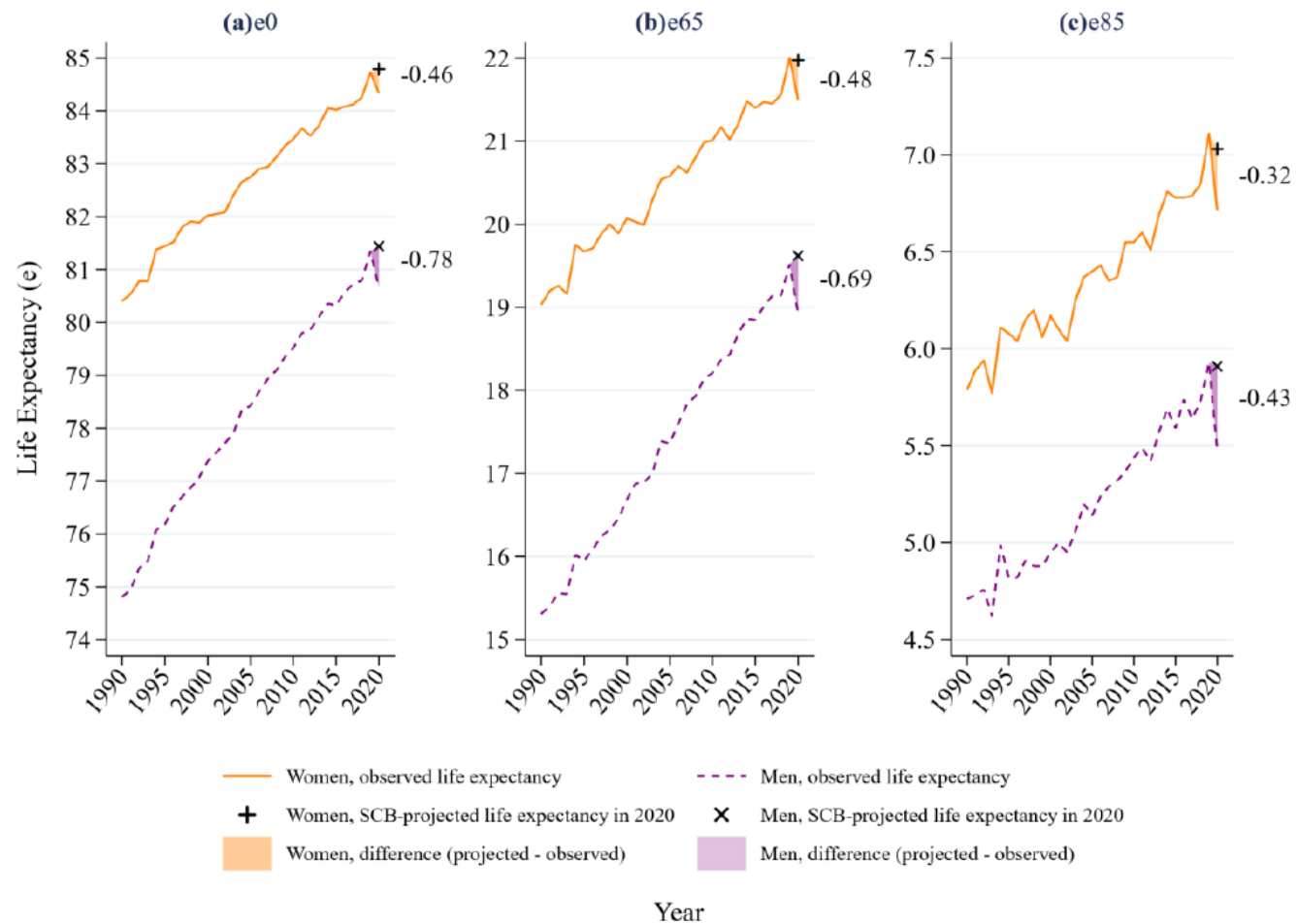Figure 1: Life expectancy at birth, age 65, and age 85 in Sweden, for 1990-2020, and the forecast for 2020

Table 2: Number of deaths in different age groups in Sweden, all-cause mortality and COVID-19 mortality, 2020

Age group	Women			Men		
	Deaths, COVID-19	Deaths, all causes	Deaths from COVID-19 as a % of all deaths	Deaths, COVID-19	Deaths, all causes	Deaths from COVID-19 as a % of all deaths
0-29	8	348	2.3	14	786	1.8
30-34	8	126	6.3	6	241	2.5
35-39	5	157	3.2	6	221	2.7
40-44	9	208	4.3	14	308	4.5
45-49	12	327	3.7	27	497	5.4
50-54	17	541	3.1	61	881	6.9
55-59	35	846	4.1	99	1458	6.8
60-64	53	1340	4.0	134	2170	6.2
65-69	106	2199	4.8	278	3461	8.0
70-74	267	4021	6.6	523	5692	9.2
75-79	482	5723	8.4	782	7699	10.2
80-84	774	7469	10.4	1104	8639	12.8
85-89	1153	9716	11.9	1118	8750	12.8
90-94	1041	9806	10.6	801	6270	12.8
95-99	484	4912	9.9	276	2065	13.4
100+	90	1004	9.0	29	243	11.9
In total	**4544**	**48743**	**9.3**	**5272**	**49381**	**10.7**

Figure 3: Age-specific death rates, in 5-year age groups in 2020 in Sweden, for all-cause and COVID-19 mortality

Figure 4: Relative difference in observed mortality 2020 compared with the 2020 forecast, and the average of 2017–2019, for different age groups of women and men in Sweden
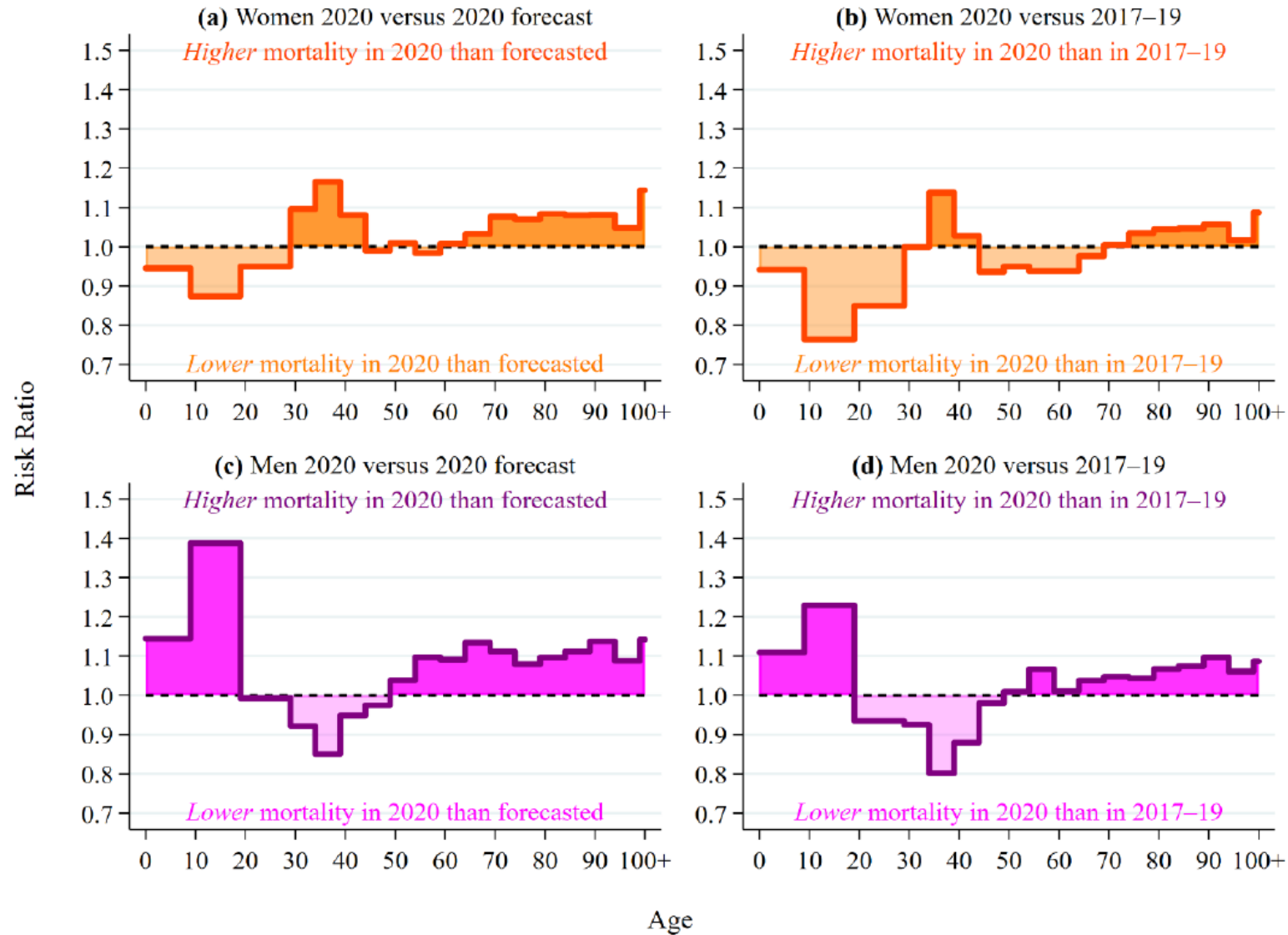
Figure 5: Death rates by month during 2020, by age group in Sweden, for the average of 2017-2019 and observed in 2020: all-cause and COVID-19 deaths
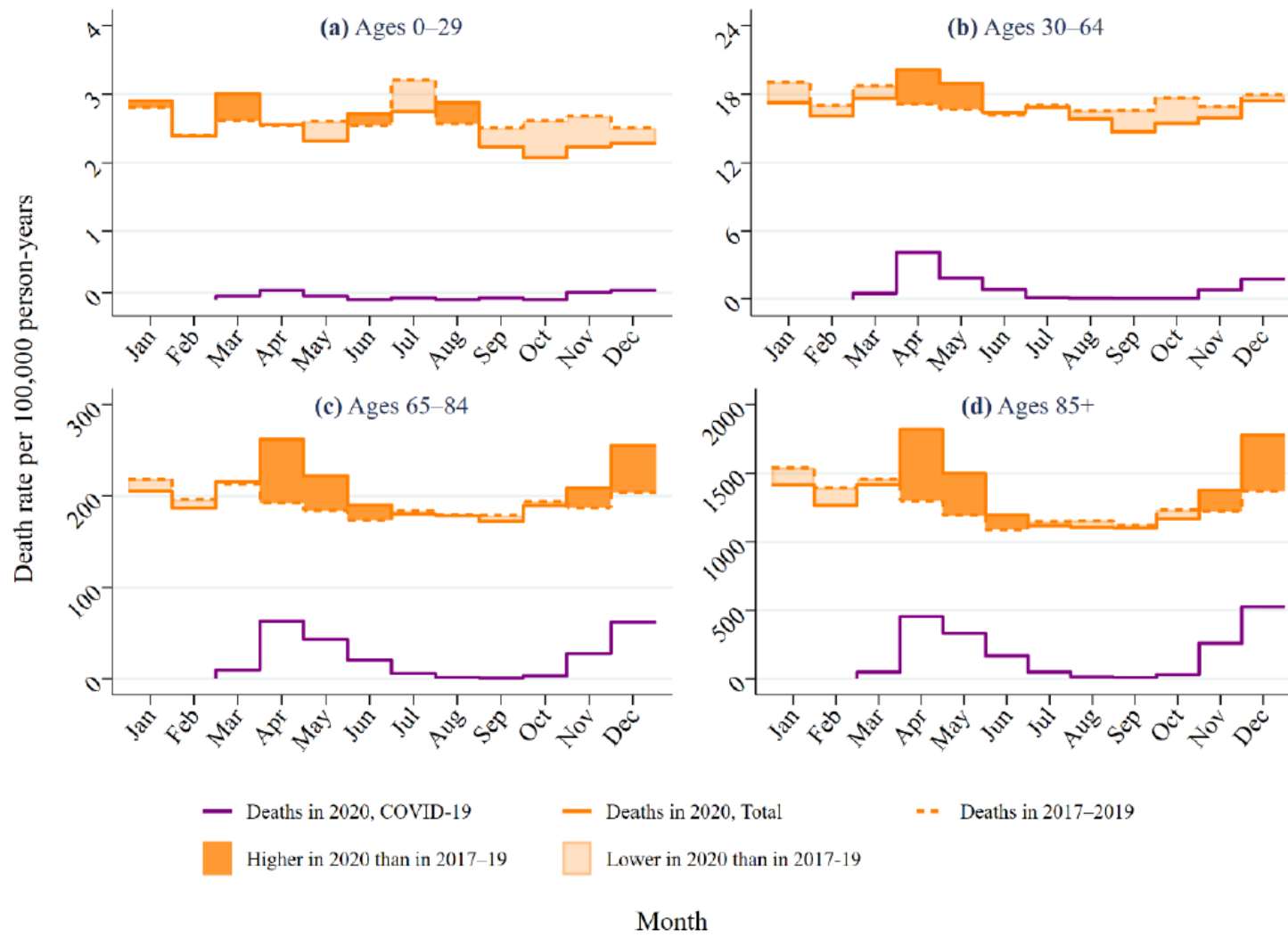
Figure 6c: Map on regional change in Life expectancy (e_0) at birth in different regions of Sweden for 2017–2019 and 2020
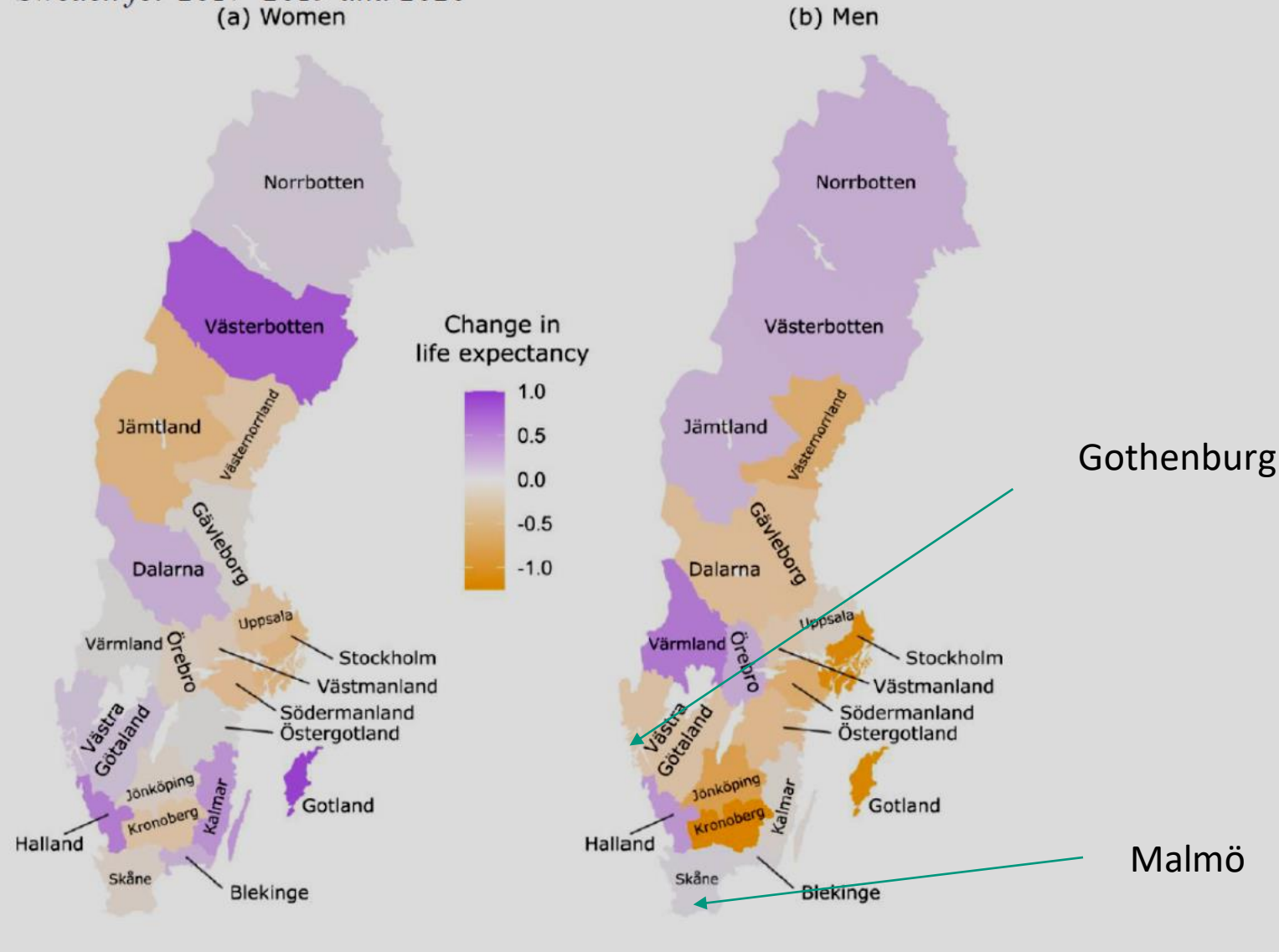
Figure 7: Decomposition of difference in life expectancy in Sweden in 2020 compared to the forecast for 2020 (in years), with positive and negative contributions from mortality changes in different age groups. Decomposition of all-cause mortality in panel a and c, and decomposition by type of mortality in panel b and d.
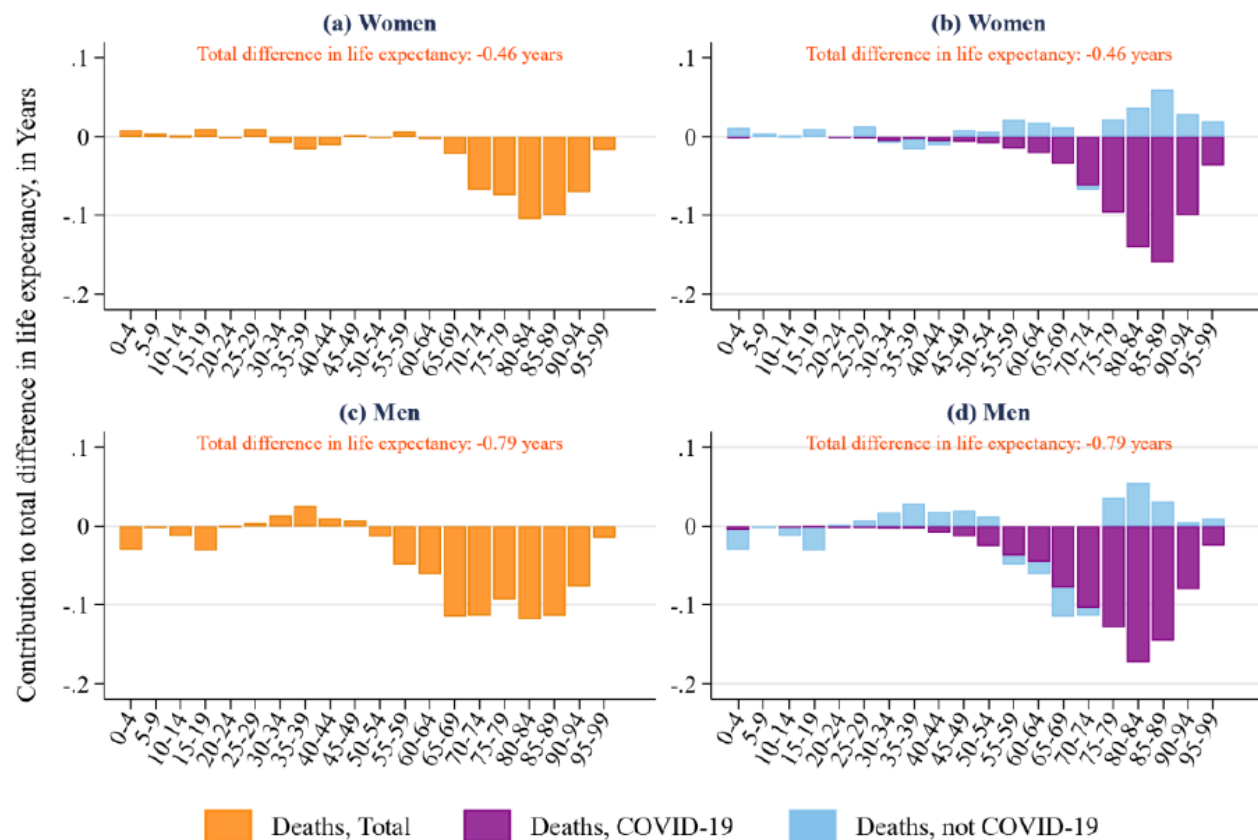
Figure 8: Years of potential life lost (YPLL) attributed to deaths from COVID-19 in 2020, for women and men in Sweden by one-year age groups
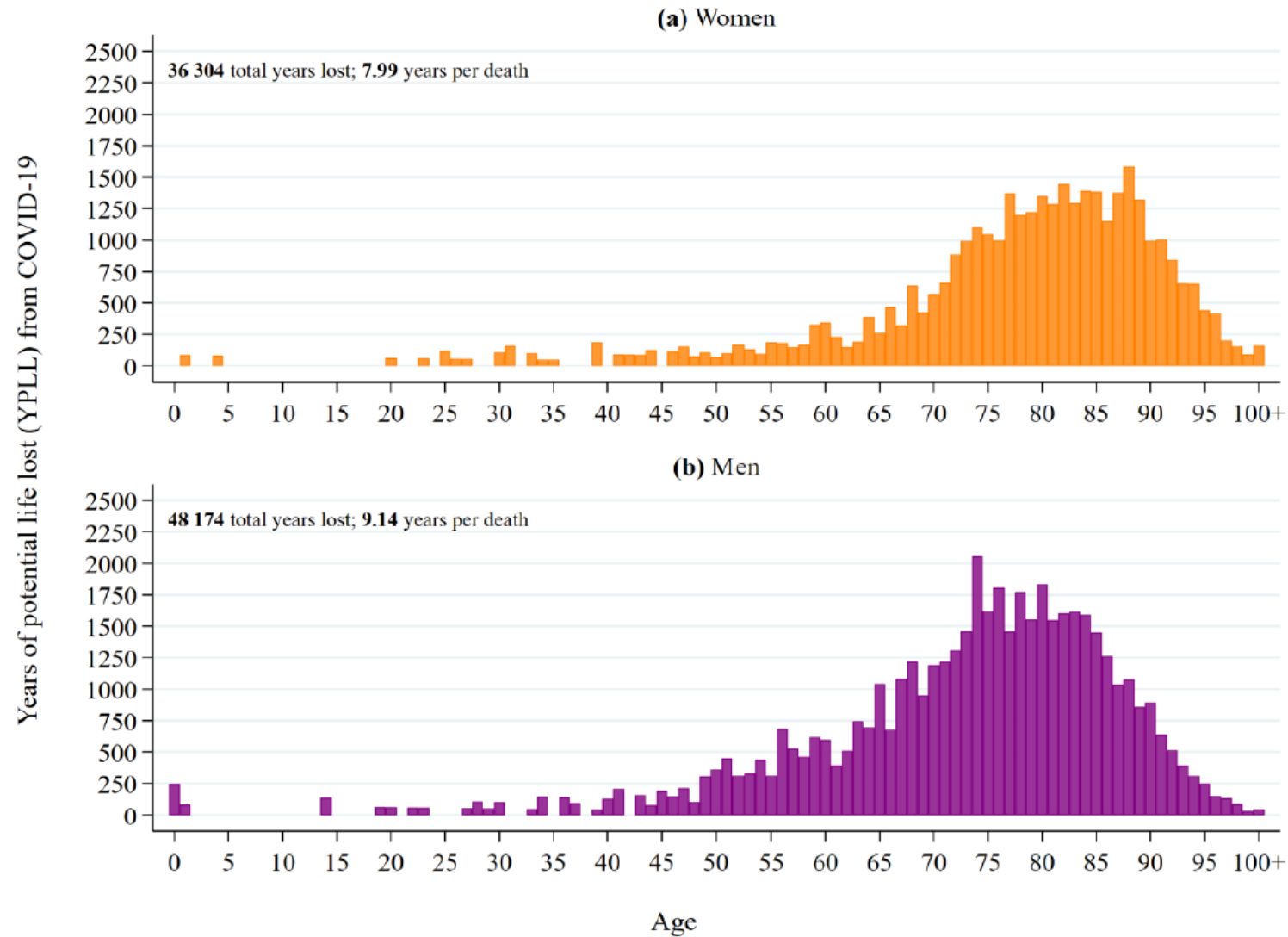
Table 3: Change in remaining life expectancy due to mortality changes at different ages during 2020, based on cohort life tables. Difference between the impact of observed and forecasted mortality for 2020

Sex	Remaining life expectancy / Number of people in life	Turned 55 years old in 2020	Turned 65 years old in 2020	Turned 75 years old in 2020	Turned 85 years old in 2020	Turned 95 years old in 2020
Women	Remaining life expectancy (years) with forecasted death rates	33.58	23.66	14.72	7.46	3.21
	Remaining life expectancy (years) with deaths observed	33.58	23.65	14.70	7.42	3.15
Men	Remaining life expectancy (years) with forecasted death rates	31.38	21.55	12.91	6.28	2.71
	Remaining life expectancy (years) with deaths observed	31.37	21.53	12.88	6.20	2.64
		Age 55	Age 65	Age 75	Age 85	Age 95
Women	Population, end of 2019	68 104	54 350	54 018	16 221	1 956
Men	Population, end of 2019	69 700	53 745	51 059	23 265	5 361

Summary

- 2020 had clear excess mortality, and excess mortality overall overlaps well with observed Covid-19 mortality
  - Deaths by causes attributable to Covid-19 were lower than previous years and the 2020 forecast

- Mortality much higher than in the other Nordic countries, but intermediate relative other EU and OECD countries

- Mortality conditions in 2020 similar to those for 2017 for men, and 2018 for women

- Total number of deaths similar across sex, but age profile (and impact on e0 differs)

- When calculated as reduction in expected cohort life expectancy, results are rather modest (less than one month in worst affected groups)
  - Look forward to more of these calculations in other contexts

Some notes

- Age patterns largely comparable to other countries, for example the US and many Central-Eastern European countries had higher share of relatively younger deaths

- In particular women who died in Covid-19 were relatively old in Sweden

- Improved hospital care may have decreased the share of deaths in younger age groups towards the end of 2020

- Deaths by region match regionally observed cases quite well.
  - No straightforward story about density, though a concentric spread from Stockholm is clear
  (some evidence of a more equal impact in 2021)

- Look forward to more attempts to calculate cohort life expectancy in other settings

Thank you for your time

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