Cohort trends in working life expectancies in the U.S.
A register-based study using Social Security Administration data

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Abstract

Objectives: Little is known about the length of working life, despite being a key indicator for policy makers. In this paper, we study how the length of working life has developed in the US from a cohort perspective.

Methods: We use a large longitudinal sample of U.S. social security register data, covering close to 1.7 million individuals of the cohorts born from 1920 to 1965. For all cohorts, we study the employment trajectory and working life expectancy by gender and nativity (native-born/foreign-born). For cohorts for which employment trajectories are only incompletely observed we borrow information from older cohorts to predict their working life expectancy.

Results: The length of working life has been increasing for native-born males and females, and younger cohorts worked longer than older cohorts. But working life expectancy might peak and stall soon. For the foreign-born the gap to the native-born has increased over time, although they might be able to catch up in coming years.

Discussion: Our findings show that studying employment from a cohort perspective reveals crucial information about working life. The future development of the length of working life should be a major concern for policy makers.

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1 Introduction

Increasing the length of working life is a major policy goal in many countries, aiming to counteract shrinking and aging of the workforce. In the US, Social Security retirement age has been increased from age 65 to age 66 for individuals born in 1943-1954, and it will increase further for cohorts born in 1955 and after (Behagel and Blau, 2012). How the length of working life has developed in general and at older ages in particular is not known, though. Specific transitions during working life have been studied extensively, like the transition from retirement to work. In contrast, the accumulated time spent in work at older ages has received less attention, despite its importance for policy makers (Dudel and Myrskylä, 2017).

The duration of working life can be studied from a cohort perspective or from a period perspective, similar to life expectancy (Leinonen et al., 2018). In the cohort perspective, the average length of the working trajectories of individuals born during a given time frame is considered; e.g., the duration of working life of individuals born in 1940. In the period perspective, the conditions of a single year (or a few years) are assumed to prevail during the lifetime of a synthetic cohort, resulting in artificial working trajectories. While the period perspective is a useful summary measure for the conditions of a single year, it does not translate to the experience of any real cohort (Loichinger and Weber, 2016).

For the U.S., studies using the cohort perspective have been rare. The exceptions are studies conducted by Hayward and Grady (1990) and Hayward et al. (1996), using data from the National Longitudinal Survey of Older Men (NLS). They covered males aged 45 and older from the cohorts 1907-1921 and covering the years 1966 to 1983. Since then, working at older age has changed considerably (Henkens et al., 2018). How the length of working life has developed for more recent cohorts is not known, though. Moreover, no results are available for females and for the foreign-born population, who experience working trajectories different from native-born males (e.g., Calvo et al., 2018; Engelman et al., 2017).

In this paper, we use longitudinal U.S. administrative data, the Continuous Working History Sample (CWHS), to study the length of working life at the population level from a cohort perspective. The CWHS is a 1% sample of Social Security Numbers and the associated earnings trajectories. Using information on close to 1.7 million individuals, we assess employment trajectories of the cohorts born from 1920 to 1965, presenting results by gender and nativity, that is, for native-born as well as foreign-born individuals. The earliest data we use is from 1970, while the latest is from 2015. We focus on two main measures to study working trajectories: cohort profiles of the average number of person-years spent in employment by age for the age range from 50 to 74; and cohort working life expectancy (WLE), defined as the expected total lifetime spent in employment over the same age range.

2 Background

2.1 Working at older ages in the U.S.

After World War II labor force participation of older individuals can be characterized with two phases. First, labor force participation rates at older ages decreased for males, and were flat for females. Second, from the 1990s on, participation rates increased for both older males and older females (Gendell, 2008). According to the Bureau of Labor Statistics (2017a), in 2016 46.2% of males aged 55 and older were part of the labor force, compared to 38.3% twenty years earlier in 1996. For females aged 55 and older, these numbers are 34.7% (2016) and 23.9% (1996), respectively.

Several explanations have been put forward to explain the increase of the labor force participation of older individuals. Among these explanations are changing norms and preferences among cohorts (Fernández, 2013; Schirle, 2008); better health and longer lives as well as higher educational attainment (Pleau and Shaumann, 2012); and social policy reforms. These reforms include major 1983 legislation increasing the full retirement age to 66 and 67; increasing benefit reductions for early retirement; and removal of the retirement earnings test for ages 70 and 71, followed by a complete removal of the earnings test beyond retirement age in 2000 (Gendell, 2008). Moreover, benefits for delaying claiming benefits beyond full retirement age have been introduced. Nevertheless, social security reforms and changes in composition only explain a moderate part of changes in participation rates at older ages (Banerjee and Blau, 2016).

Moving from labor force participation to employment and unemployment, economic conditions might also play a major role in shaping the working trajectories of the elderly (Dudel and Myrskylä, 2017). While there have been several recessions starting from the 1980s, their effects on the labor market and the elderly were mostly moderate or short-lived (Cahill et al., 2015). In contrast, the 2007-2009 recession might have been more severe, though. Farber (2011) found that unemployment of the elderly sharply increased, and Coile and Levine (2011) reported that during this recession unemployed workers had a higher probability of retiring than employed workers. Men seem to have been more affected than women (Engemann and Wall, 2009). Whether the recession has a significant impact on the duration of working life of the affected cohorts is unclear.

Working after reaching the full retirement age has become more common in recent years (Pleau and Shaumann, 2012), although more so for men than for women (Pleau, 2010). This has to be seen in context of the consistent finding that in the U.S. transitions from work to retirement are often not one-time, permanent transitions, but more complex sequences, including part-time work and bridge jobs (Calvo et al., 2018; Cahill et al., 2015), as well as returns to the labor market after retiring (Hayward et al., 1994). Retirement patterns differ by gender, ethnicity, education, and other variables, with white educated males most closely following the conventional pattern from full-time work to retirement (Calvo et al., 2018; Flippen and Tienda, 2000).

An increasing share of the elderly population is foreign-born, and the proportion of immigrants in the workforce aged 55+ is rising. In 2017 this proportion was 15% according to the Bureau of Labor Statistics (2017b). Older foreign-born males have working trajectories different from native-born males (Borjas, 2011); first, the employment rates of native-born males tend to decline more sharply with age; and second, there is a cross-over age, before which native-born have a higher likelihood of being in employment, and after which foreign-born tend to work more often. This pattern is due to eligibility restrictions to Social Security benefits for immigrants (Borjas, 2011); and might be amplified by lower incomes of immigrants making retirement difficult (O'Neil and Tienda, 2015), as well as better health of immigrants (Engelman et al., 2017).

2.2 Working life expectancy

The length of working life has received considerable less attention in the literature than general and age-specific trends in labor force participation and employment. The small literature on the duration of working life studies uses working life expectancy (WLE) as a main measure (Loichinger and Weber, 2016; Hoem, 1977). In this paper, WLE is defined as the average lifetime spent in employment. It is usually considered to be a better measure of the length of working life than, e.g., the age at retirement (Hytti and Nio, 2004). Because WLE captures complex trajectories and the whole of working life in a way that is easy to understand, it is a useful summary indicator of working trajectories. When compared across socio-economic groups, WLE can also be used to shed light on labor market inequalities, as it shows how (dis)advantage in the labor market accumulates (Hayward and Lichter, 1998).

WLE has mostly been studied from the period perspective, that is, using artificial cohorts. For the U.S., a recent study found that given the conditions of the period from 2008 to 2011, men aged 50 could expect 13 years of employment, and women 11 years (Dudel and Myrskylä, 2017). That men have a higher WLE than women is a finding consistent across studies (Dudel and Myrskylä, 2017; Skoog and Ciecka, 2010; Warner et al., 2010; Millimet et al., 2003). Moreover, the literature shows that WLE differs considerably by ethnicity, and is higher among the higher educated than the lower educated. Period WLE in the U.S. dropped considerably during the financial crisis 2008 and the following years (Dudel and Myrskylä, 2017).

Papers studying WLE from the cohort perspective are rare. The data demands are considerably higher for cohort studies than for period studies, as observing the working trajectories of a single cohort requires data covering many years. Moreover, for many cohorts, working life is still ongoing and WLE is incomplete. The few papers studying cohort WLE include Leinonen et al. (2018) studying Finland, Denton et al. (2010) using Canadian data, and Liefbroer and Henkens (1999) for the Netherlands. Leinonen et al. (2018) and Denton et al. (2010) also compared results from the period perspective to cohort results, finding that the results of both perspectives differ. Moreover, it is unclear whether and, if so, to what extent the inequalities in WLE found using the period perspective are similar to those found using the cohort perspective.

The only studies for the U.S. using a cohort perspective were conducted by Hayward and Grady (1990) and Hayward et al. (1996), using data from the National Longitudinal Survey of Older Men (NLS). Hayward and Grady (1990) studied men of the cohorts 1911 to 1921 and found that WLE at age 55 was around 8.7 years. Hayward et al. (1996) reported, among other things, the partial WLE from age 55 to 75; for white men this amounted to 8.0 years, while for black men it was 6.1 years; parts of this difference in WLE estimates between whites and blacks can be explained by differences in health and mortality.

In light of the findings on labor market trends and WLE, we can expect that the length of working life increased for more recent cohorts, in particular for females. This implies that the gap in cohort WLE between males and females should have narrowed. Moreover, recent reforms and the 2007/2008 recession can be expected to have left a clear footprint on cohort WLE, which in case of the recession means a dent in the increasing trend of cohort WLE. Increases in WLE can be expected to be at least partly due to increasing employment at older age. Predictions for the foreign-born are more difficult, but given the differences to native-born in the age pattern of employment, a larger part of their WLE should come from older ages, at least for males.

3 Data and methods

3.1 Study population and measurement

Our longitudinal data comes from the Continuous Working History Sample (CWHS). The level of observation are Social Security numbers (SSNs), for which earnings trajectories as well as receipt of old-age pension and disability pension are recorded, and death. The data is a 1% sample of all SSNs. It covers the years 1970 to 2015, and the cohorts from 1920 to 1965. The data includes SSNs from all U.S. states as well as individuals from Puerto Rico and other US territories. For each SSN, we have information on the gender of the SSN's holder, their birth year, and whether they were born in the U.S. (native-born) or not (foreign-born). We calculate the age as year of observation minus birth cohort. This means that the age variable is defined as age reached during a year.

Throughout, we will assume that each SSN relates to a distinct individual. This likely is true for most SSNs, but not all, as in rare instances one individual has several SSNs. For some of the individuals with several numbers the CWHS includes an indicator pointing to this issue. As in most cases most of the earnings of an individual will be associated with only one of the SSNs, leaving the other ones mostly without earnings, we dropped known multiple SSNs which show no or only little earnings. As the Social Security Administration only issues multiple SSNs in very specific circumstances, the number of cases affected by this is small, though; e.g., for the 1940 cohort less than 0.5% of the sample, leaving results virtually unchanged.

Employment is captured through annual earnings. We define an individual as employed for a given year if their earnings are above the threshold for a "quarter of coverage" for that year. A "quarter of coverage" (QC) is used to determine whether an individual is insured under the Social Security program. The threshold required to earn one QC has changed over time. Before 1978, for instance, a wage of 50 dollars or more for one quarter of the year gave one QC. From 1978 on, the reporting of earnings changed and QCs are awarded based on annual earnings. In 1978, 250 dollars earned one QC, and in 2015 it was $1,220$ dollars. Alternative thresholds are discussed in the supplementary materials.

Before 1978, somewhat different rules applied for the self-employed than for the dependent employed: for the self-employed, there was an annual threshold of 400 dollars, in contrast to the quarterly threshold for the dependent employed. From 1978 on, the same rules as for dependent employment applied for earning of QCs. In our analysis, for consistency we used the QC rules, and thus different rules for self-employed and dependent earnings before 1978. Alternative analyses are presented in the supplementary materials. They also include adjustments for the (rather minor) changes in earnings coverage of the CWHS. They give very similar results to the ones presented here.

3.2 Statistical methods

For each cohort, we calculate the average number of person years spent in employment by age. The person years spent in employment are calculated assuming that individuals with earnings above the threshold of one QC spent one full year in employment. Individuals who had earnings above the threshold, but also either received retirement benefits or disability benefits or died during that year are assumed to have spent a half year in employment. All other individuals count as having zero years in employment. Given the total number of person years spent in employment age, the average number was calculated by dividing with cohort size at age 50.

Working life expectancy (WLE) at age 50 is calculated as the sum of person years spent in employment over the age range from 50 to 74, divided by the cohort size at age 50. We choose an upper limit of 74, close to the limit used by Hayward et al. (1996), as to be able to calculate cohort WLE as for many cohorts as possible. Results will be rather close to actual cohort WLE, because employment over age 74 is extremely small, and contributes only little to overall WLE. More formal descriptions of the calculations are given in the supplementary materials.

To complete WLE for cohorts for which the last observed age is below 74, we borrow information from older cohorts, similar to Leinonen et al. (2018). Specifically, if for one cohort the time spent in employment in age x is not observed, we take this information from the youngest cohort for which it is available. For instance, for the cohort born in 1942 the last age we observe is 73 years (in 2015), meaning that employment is not observed for age 74. This is taken from the cohort 1941, for which it is available from the year 2015. Cohort WLE forecast by this method shows how the length of working life would develop if the conditions of the last period observed (2015) stayed constant.

Working trajectories and WLE are adjusted with respect to inflated cohort size due to unobserved outmigration. Outmigration is not captured in the data. The same is likely true for deaths happening abroad, especially for the foreign-born population. For instance, if an individual migrates to the U.S., works there for a certain period of time, and then returns to their home country, it is not recorded that the individual left the U.S. and also likely not when they died. Instead, the SSA record just shows years without contributions and without receiving benefits, potentially up to high ages.

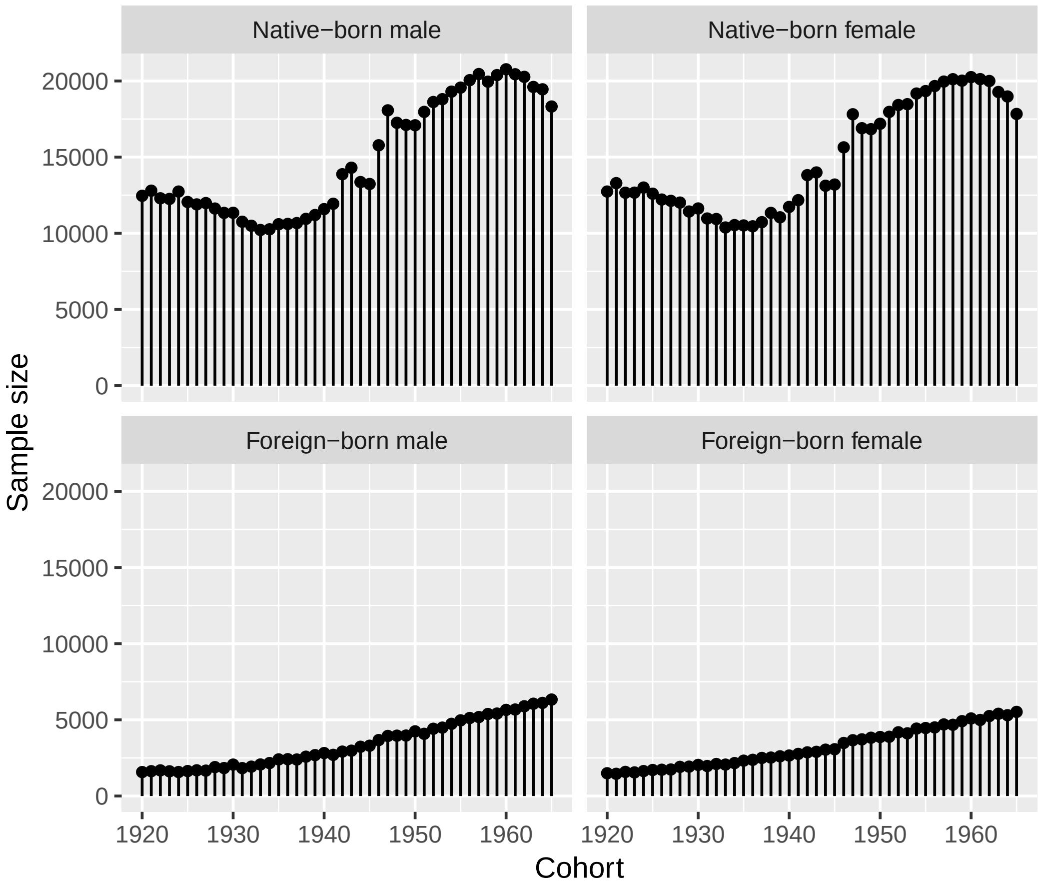

Figure 1: Sample size by cohort, gender, and nativity (native/foreign). Source: CWHS; own calculations.

To deal with this challenge, we exploit that it leads to "immortal" individuals in the data, who seemingly do not die. These can be detected by comparing the CWHS data with life table data from the Human Mortality Database (2018). This comparison shows that there are indeed too many surviving individuals, which we remove from the sample. For details, see the supplementary materials.

4 Results

4.1 Sample size

In Figure 1 the sample size for all birth cohorts by gender and place of birth is shown. In total our analysis covers $1,675,011$ individuals: $686,212$ native-born males and $685,409$ native born females; and $156,652$ foreign-born males and $146,738$ foreign-born females. Overall, 18% of our sample are foreign-born. Sample size varies by cohort. For instance, for native-born men the smallest sample is for the 1933 cohort and includes 10, 253 individuals, and the largest is for the cohort born in 1960 with a sample of 20, 783 persons. Sample size is smaller for foreign-born individuals, with the smallest sample being for foreign-born females of the cohort 1920, amounting to 1, 459 individuals. Sample size increases by cohort, and for latter foreign-born cohorts sample size reaches more than 5, 000 individuals.

4.2 Working trajectories by cohort and age

Figures 2 and 3 present results by cohort and age. Specifically, Figure 2 shows employment trajectories by gender and nativity (native/foreign), using the average person-years spent in employment for each age. Each line represents one of the cohorts from 1920 to 1965. Older cohorts are shown in blue (1920-1935), younger cohorts are shown in red (1950-1965). Intermediate cohorts (1936-1949) are shown in purple. The cohort of 1920 is observed up to age 95; younger cohorts are observed during less ages. For the youngest cohort 1965 only age 50 is observed. Figure 3 shows the same results arranged in a different way – each line represents one age, e.g., age 65, and how employment for that age evolved by calendar year. Younger ages starting from age 50 are shown in blue, while high ages up to age 95 are shown in red.

Males generally show higher employment than females, and native-born generally spend more person-years in employment than foreign-born. Employment strongly varies with age. Employment after retirement age – age 65 or 66 for the cohorts for which employment around retirement age is observed – has increased for all groups, but is low in absolute terms and compared to employment at younger age; employment after age 70 is low, and employment after age 80 negligible.

For older native-born cohorts, employment during their 50s shows a discontinuity; for age-specific employment, this is seen for the 1970s, where there is a jump in 1978. This is due to the change in rules for earning of quarters of coverage, as described in the data section. The effect is less clear for the foreign-born. Results adjusted for this effect are discussed in the supplementary materials.

For foreign-born individuals and native-born females younger cohorts overall show higher employment, especially during age 50 to age 60. For females, increases in employment at these younger ages have stalled in recent years, while for the foreign born increases have been happening up to the last observed year 2015. In contrast, for native-born males cohort profiles seem to tilt to the right over time: Older cohorts show higher times in employment during age 50 to 55 than younger cohorts, while for ages 62 or 63 on it is the other way around. This means that older cohort worked more in younger ages. More recent cohorts of native-born males have reduced employment in

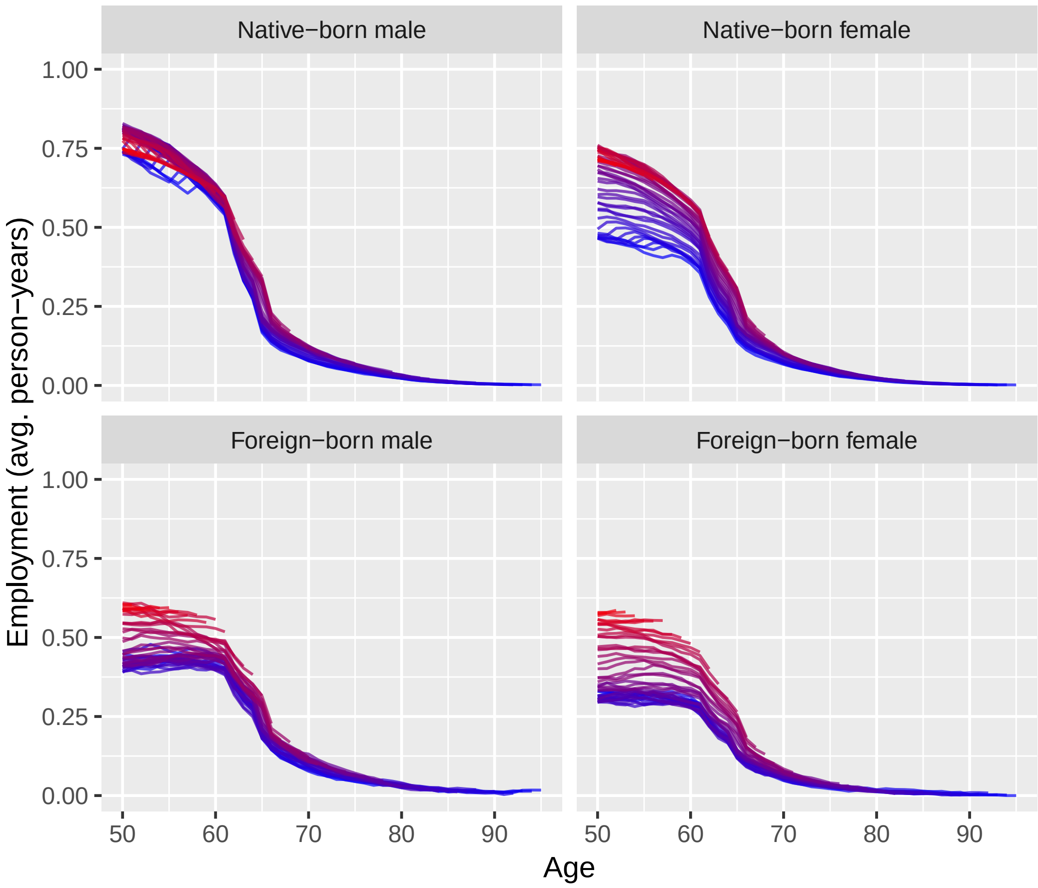

Figure 2: Cohort schedules of average person-years spent in employment, where each line represents a cohort. Older cohorts in blue, younger cohorts in red. The cohort trajectories for the younger cohorts are incomplete and miss high ages. Source: CWHS; own calculations.

younger ages, but seem to partly catch up for this in older ages. This is also reflected in the results with age-specific employment.

The cohort profiles and age-specific employment levels clearly show effects of nominal retirement age. For the cohort born in 1920, for instance, there are two breaks in the schedule: from age 61 to 62 (the first claiming age), and from 64 to 65 (the nominal retirement age). Between these breaks in the schedule there is a rapid decline of employment. From age 65 on employment is low and declines slowly but steadily. For younger cohorts, there is also a break between age 61 to 62, but the following decline is becoming less steep. Moreover, the break between 64 to 65 is shifting to 66. For instance, native-born men belonging to the cohort of 1920 at age 66 could expect roughly 0.13 years of employment, while for the cohort of 1949 it was about 0.22 years, an increase of about 2/3.

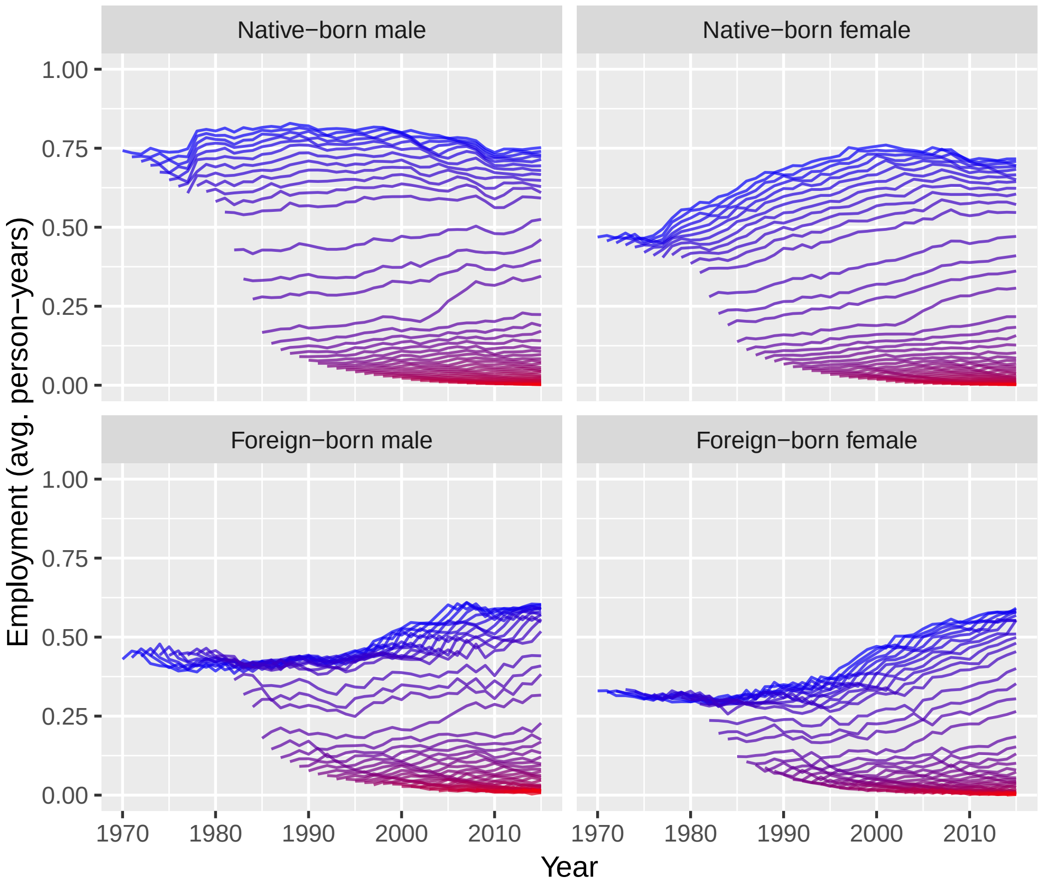

Figure 3: Trends in age-specific employment over time. Each line represents employment in a given age. Younger ages starting from age 50 are shown in blue, older ages up to age 95 are shown in red.Source: CWHS; own calculations.

4.3 Working life expectancy

Results on working life expectancy (WLE) at age 50 by cohort are shown in Figure 4 and in Table 1. Table 1 shows WLE and confidence intervals for the total population by gender for selected cohorts, and also by gender and nativity. Results for the total population closely follow those for the native-born, as for all cohorts they are at least 75% of the sample. Figure 4 has results for all cohorts; confidence intervals are not shown, as they are rather close to the point estimates, which is not surprising given the large sample size. The solid line in Figure 4 shows WLE at age 50 for completely observed cohorts (1920-1941). The dashed line shows results which are based on the extrapolation approach described in the methods section. For the cohort born in 1942 only employment for age 74 was extrapolated. The resulting WLE is thus not affected much by the extrapolation approach and likely close to reality. For the cohort born in 1965, on the other hand, only employment at age 50 is observed and the remaining

Table 1: WLE at age 50 and 95% confidence intervals for selected cohorts by gender and nativity (native/foreign). Source: CWHS; own calculations.

	Male			Female		
		Confidence interval			*Confidence interval*	
Cohort	WLE	95% lower	95% upper	WLE	95% lower	95% upper
Total population						
1920	9.5	9.5	9.5	6.4	6.3	6.4
1925	9.8	9.8	9.9	6.8	6.8	6.8
1930	10.1	10.1	10.2	7.6	7.5	7.6
1935	10.5	10.5	10.6	8.2	8.2	8.2
1940	10.6	10.6	10.7	8.8	8.8	8.9
Native-born						
1920	9.8	9.7	9.8	6.5	6.5	6.5
1925	10.2	10.1	10.2	7.0	7.0	7.1
1930	10.7	10.6	10.7	8.1	8.0	8.1
1935	11.2	11.1	11.2	8.9	8.9	8.9
1940	11.3	11.3	11.4	9.5	9.5	9.5
Foreign-born						
1920	7.2	7.1	7.3	5.1	5.0	5.2
1925	6.9	6.8	7.0	5.1	5.0	5.2
1930	6.8	6.7	6.9	4.7	4.6	4.8
1935	7.4	7.3	7.5	4.9	4.8	4.9
1940	7.6	7.5	7.7	5.8	5.7	5.8

working trajectory is predicted. The resulting WLE strongly depends on the assumptions of the extrapolation approach (see sec. Discussion). The cohorts from 1943 to 1964 are in between these two extremes.

For the native male cohort born in 1920 we find a WLE of 9.8 years. Up to the cohort of 1941 WLE increased by 1.5 years, to a total of 11.3 years. The forecast results are only slightly above this number, or below. They show some ups and downs, reflecting differences in the partially observed working trajectories. The highest predicted WLE for native-born males is that of the cohort 1947 with a value of 11.6 years. For cohorts born later than 1947 WLE declines. For the cohort of 1965 WLE amounts to 11.1 years, which is roughly the same level as the cohort of 1933.

The WLE of native-born females increased considerably, and is predicted to level off after a small further increase, because employment below age 60 stagnated for recent cohorts. Specifically, the 1920 cohort had a WLE of 6.5 years, thus 3.3 years lower than their male counterparts. For the cohort of 1941 WLE amounted to 9.7 years, catching

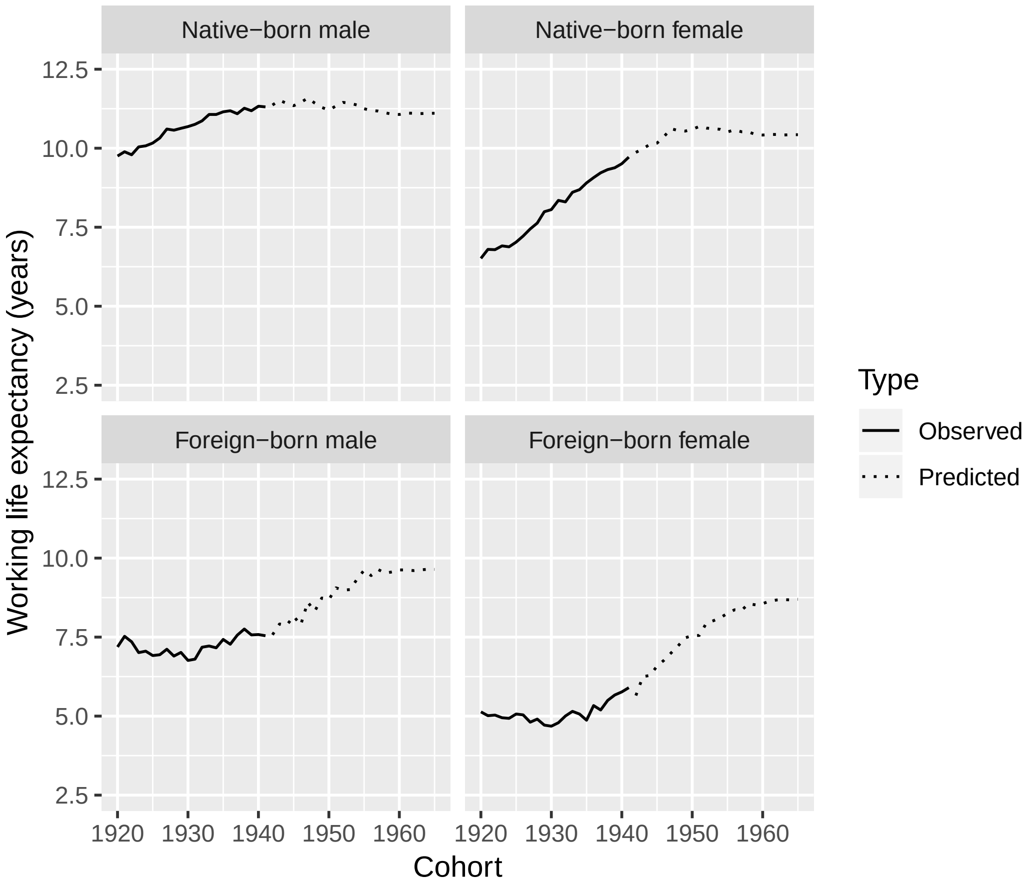

Figure 4: WLE at age 50 by cohort, gender, and nativity (native/foreign). The solid lines are based on working trajectories ages 50 to 74. The dashed line represents results partly based on extrapolating recent cohort trajectories. Source: CWHS; own calculations.

up considerably and reducing the gap to males to 1.6 years. WLE is predicted to further increase to 10.7 years for the cohort of 1951, and then will slowly decline to 10.4 years for the cohort of 1965.

For all cohorts, foreign-born males and females have considerably lower WLE than native-born males and females. For the cohorts of 1920 to 1941, WLE changed little for foreign-born males, and only increased above 5.5 years for the foreign-born females of the cohorts 1938-1941. This implies that the gap to native-born individuals slightly increased for males, and greatly increased for females. Specifically, the 1920 cohort of foreign-born females has a WLE of 5.1 years, and thus 1.4 years less than native-born females. For the 1941 cohort, WLE amounts to 5.9 years for foreign-born females, compared to 9.7 years for native-born females, leading to a gap of 3.8 years between native-born and foreign-born.

Foreign-born males and females are predicted to have increasing WLE. For the 1965 cohort, for instance, WLE is predicted to amount to 9.6 years for foreign-born males and

8.7 years for foreign-born females, compared with 11.1 years and 10.4 years for their native-born counterparts, respectively. While the gap to native-born individuals might narrow it likely will not close.

5 Discussion

5.1 Main findings

Based on a large sample of administrative data, we present two major sets of findings. First, comparing older and more recent cohorts we see that for native-born men working trajectories have shifted towards employment at older ages, with employment at older ages (55+) increasing and decreasing at the younger part of the age range we study (50-55); for native-born women employment has increased at all ages; and for foreign-born males and females there seems also to be a tendency of overall increasing employment. Second, the length of working life has been increasing for the native-born, but might have reached a peak and might level off in the future; for the foreign-born, the duration of working life remained mostly stable, but it might increase if recent conditions in employment throughout the life course prevail.

The decrease in person-years in employment we find for native-born males below age 55 is in line with trends in labor force participation for that age group, and it can be explained with the 2007/2008 economic crisis (Perez-Arce et al., 2018). The increase of employment, on the other hand, for ages 55+ might partly reflect changes in retirement age, as for cohorts from 1943 to 1954 retirement age has been increased to 66 years. For native-born females we found a constant increase of person-years in employment over the whole age range, in line with the general trend of increasing female labor force participation (Gendell, 2008; Banerjee and Blau, 2016). In contrast to men, there was no decline of employment for ages below 55, potentially because women were less affected by the 2007/2008 recession (Engemann and Wall, 2009).

One potential explanation for the shifting age patterns in employment of foreign-born males and females are changes in composition with respect to country the of origin. In the first half of the 20th century U.S. immigration laws favored European countries of origin. This drastically changed after changes in legislation in the 1960s (Massey and Pren, 2012). While in 1960 the vast majority of the immigrant population in the U.S. was of European origin, in 2010 the largest group came from Latin America (Grieco et al., 2012). Foreign-born Hispanics, who are the largest share of immigrants from Latin America, have lower educational attainments and lower English proficiency than their native-born counterparts (Read and Cohen, 2007), which might hinder their labor market outcomes.

Foreign-born females show consistently lower employment than their male counterparts, but the gap reduced in recent years. Nevertheless, this gap might show that males and females partly migrate for different reasons, and female migrants might be at higher risk of unemployment and staying out of the labor market (Bean et al., 2001). The recent recession somewhat affected foreign-born males, but did not leave a clear mark on employment of foreign-born females. This is likely due to the industries in which they work being less affected by the recession than male-dominated industries like production and construction (Dudel and Myrskylä, 2017).

A finding consistent across groups and irrespective of gender and nativity is that employment at ages older as full retirement age (65+ or 66+ for the cohorts we study) increased, but is low in absolute terms. Employment after age 67 quickly drops to low levels, and it is negligible after age 75. For instance, for native-born men ages 65+ contributed 9% of WLE for the cohort 1920, and 12% for the cohort of 1941. This is consistent with earlier findings on post-retirement employment (Pleau and Shaumann, 2012). While post-retirement employment is not uncommon, it is often in part-time and for a limited period (Calvo et al., 2018; Pleau and Shaumann, 2012). As expected, for the foreign-born the contribution of ages 65+ to WLE is higher than for the native born, and for foreign-born males employment beyond retirement age contributes between 13% (cohort of 1920) and 18% of WLE (cohort of 1941).

For the cohorts of 1920 to 1941 for which we fully observe WLE up to age 74, WLE has mostly changed little, except for native-born females. This means that native-born females are catching up with native-born males. Given the age-specific trajectories these trends in WLE are not surprising, as age-specific employment for native-born females increased considerably, and for the other groups increases and decreases overall lead to constant or slightly increasing levels of WLE. For the foreign-born employment has mostly increased for incompletely observed cohorts, because of which further increases in WLE can only be expected for cohorts after 1941. Compared to other countries, WLE at age 50 in the U.S. is high. For instance, Leinonen et al. (2018) report WLE at age 50 to be 7.0 years and 7.3 years for Finnish males and females of the cohort 1938, respectively. Corresponding values for native-born U.S. males and females are 10.6 years and 8.7 years.

Our forecasts of WLE indicate that for the native-born a peak might have been reached or will be reached soon, despite policy efforts to increase the length of working life. This finding shows that any future increase in WLE – or even constant levels – should not be taken for granted. For the foreign-born, on the other hand, the outlook is more optimistic, and the gap to the native-born might narrow. Still, it will likely not close. Overall our findings show that the future development of the length of working life should be a concern for policy makers.

5.2 Methodological considerations

The finding that WLE has been increasing or constant for completely observed cohorts is in contrast to recent findings based on the period perspective which showed no increase in WLE at age 50 and strong year-to-year fluctuations (Dudel and Myrskylä, 2017). This contrast is not surprising, though, as results from the cohort perspective and from the period perspective have been reported to differ before (Leinonen et al., 2018; Denton et al., 2010). While results from the period perspective might be more timely, they exaggerate the conditions prevailing during one or a few years. The findings for completely observed cohorts presented here might be more realistic in describing patterns people really have experienced.

When interpreting our results it is important to acknowledge that they are based on trajectories associated with Social Security numbers (SSNs). This creates three potential challenges. First, individuals who never apply for a Social Security number are not included in our data. Second, some individuals might apply for and have several Social Security numbers, between which the working trajectories of these individuals are split. Third, outmigration is not captured in our data, which might be especially problematic for the foreign-born.

The first point – individuals who never apply for a social security number are not included in the data – is likely only a small issue, if at all, as only a minority does not apply for a Social Security number, and their inclusion in the data likely would change results only little. The same probably holds for the second point – multiple SSNs per individual – as this again is rare and can be expected to not influence results. Moreover, at least for some instances multiple SSNs are flagged in the data and we adjust our analysis accordingly.

Third, outmigration is not captured. While outside the country individuals do not have earnings in the US but might have them abroad. These earnings do not appear in the data, though, making it seem as if they were not employed, when in fact they were. Dudel et al. (2018) find the effect of a similar issue to be modest in Spanish social security data. Still, outmigration, and especially permanent outmigration will be more prevalent for foreign-born individuals than for native-born individuals, making unadjusted results for these groups hard to compare. Another issue is that individuals who outmigrate before age 50 still can be part of the sample, inflating the sample size.

To deal with this potential issue we use data from the Human Mortality Database and remove excess survivors from the CWHS data. This is no perfect solution for this issue, and we conducted several alternative adjustments and robustness checks, which lead to findings qualitatively similar to our main results and to similar conclusions. They are discussed in detail the supplementary materials.

The Continuous Working History Sample is unique and is set apart from other data sources with its large sample size and long coverage of years. This allows us to provide precise estimates of working trajectories and WLE from the cohort perspective, breaking findings down by gender and nativity. To the best of our knowledge we are the first to present such population-level trends in cohort WLE for the U.S. Conducting several sensitivity checks and alternative adjustments as outlined above we find that our results are rather robust.

6 Acknowledgements

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Supplementary materials

A Basic calculations and adjustment procedure

A.1 Notation

Let $n_c(50)$ denote the total size of cohort c at age 50. $e_c(x)$ is the number of individuals of cohort c with earnings above the earnings threshold in age x. This covers three groups: individuals with earnings who do not receive social security benefits during that age and who survive until age $x + 1$, $e_c^e(x)$; individuals who have earnings but also receive social security benefits and survive until age $x + 1$, $e_c^s(x)$; and individuals who have earnings and die before reaching age $x + 1$, $e_c^d(x)$, potentially also receiving social security benefits.

A.2 Basic indicators

We use two indicators: the average person-years spent in employment by age, and the working life expectancy during age 50 to age 74. Without any adjustments, the average number of person-years spent in employment by age is given by

$$E_c(x) = \frac{e_c^e(x) + 0.5e_c^s(x) + 0.5e_c^d(x)}{n_c(50)}. \tag{1}$$

That is, individuals who are recorded to only have received earnings contribute one person-year, while individuals who in addition receive social security benefits or die contribute one-half person-year. Working life expectancy during age 50 to age 74 of cohort c is given by

$$W_c = \sum_{x=50}^{74} E_c(x). \tag{2}$$

A.3 Adjustment for outmigration

As noted in the main text, outmigration is not captured by the data. This will affect $n_c(50)$ in two ways. First, some individuals might have outmigrated before reaching age 50, thus inflating $n_c(50)$. Second, individuals might outmigrate after age 50. Using $n_c(50)$ as the denominator in equation (1) is still valid in this case, and equation (2) will capture the remaining WLE in the U.S., ignoring all employment abroad. What is potentially problematic is that outmigration differs for the native-born and the foreign-born, with the later leaving the country at a higher rate, while the majority of native-born stay in the U.S. Differences in WLE between these two groups will thus not only be due to differences in employment, but also outmigration.

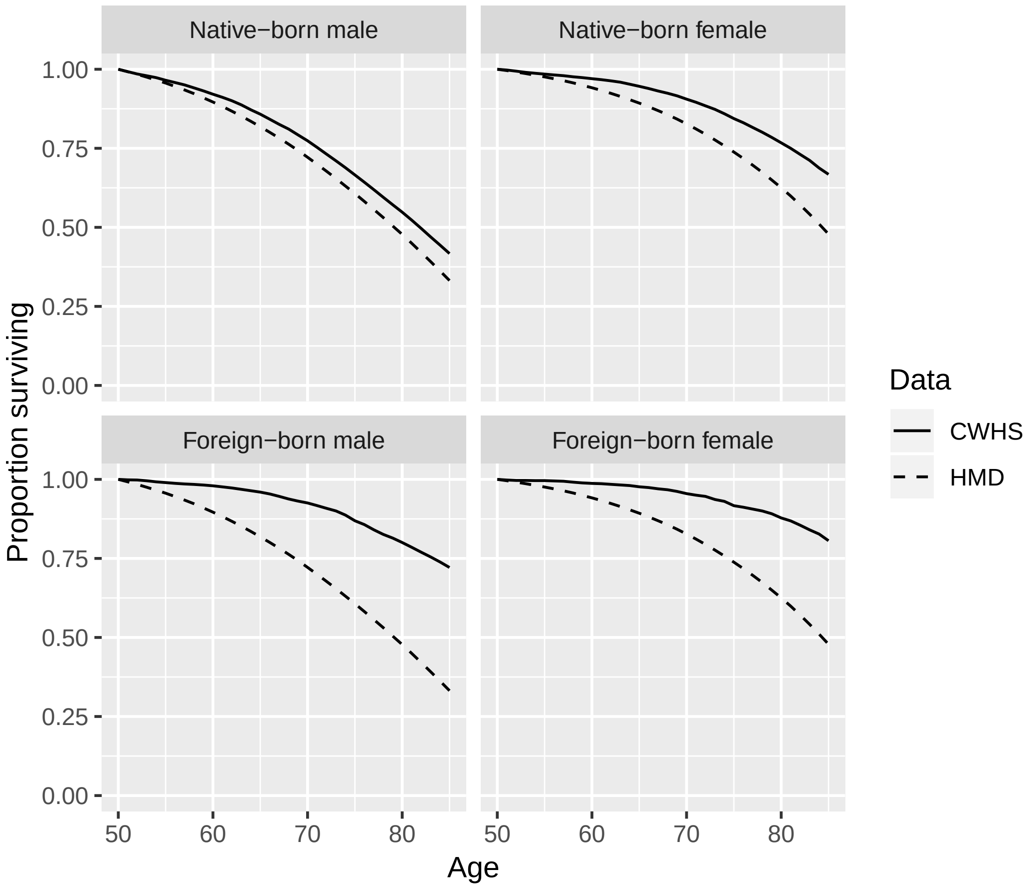

Figure 5: Survival of individuals born in 1930 from age 50 on in the CWHS (solid line) and in the HMD (dashed line, life table for the general population), by gender and place of birth. Survival in the CWHS is higher than in the HMD, due to outmigration. Source: CWHS; HMD; own calculations.

To deal with this issue, we exploit that it leads to “immortal” individuals in the data, who seemingly do not die, as deaths abroad will often not be registered in the data (see below for a discussion). These can be detected by comparing the CWHS data with with life table data from the Human Mortality Database (2018). Such a comparison is shown in figure 5 for individuals born in 1930 by gender and nativity. The figure shows the proportion of surviving individuals by age, starting from age 50, in both the CWHS data (solid line) and as calculated from the HMD (dashed line). Differences are striking for all groups. According to the HMD, about 33% of the 1930 cohort of native-born men survived to age 85, while the CWHS shows survival of 42%; for foreign-born men the differences is even more extreme, with the CWHS data resulting in 72% surviving, again compared to 33% resulting from the HMD. The HMD estimate relates to the total male population, and thus is only an approximate benchmark for the foreign-born population. Nevertheless, results clearly indicate potential issues and differences between groups indicate that there is considerably more outmigration for the foreign-born than for the native born.

Formally, the adjustment works as follows. Let $s_c(x)$ be the survivor function for cohort c at age x taken from the HMD. Adjusted cohort size for the CWHS is then calculated as

$$n_c^a(x) = n_c s_c(x), \tag{3}$$

where n_c is the total cohort size for cohort c. Age-specific person-years in employment are then calculated as

$$E_c^a(x) = \frac{e_c^e(x) + 0.5e_c^s(x) + 0.5e_c^d(x)}{n_c^a(x)}. \tag{4}$$

WLE is calculated as

$$W_c = \sum_{x=50}^{74} E_c^a(x). \tag{5}$$

Essentially, individuals are removed once it becomes apparent that survival is too high compared to the HMD, but not earlier (see next section for a discussion). Overall, this procedure increases WLE estimates as compared to estimates without adjustment, although the effect is rather small for most native-born cohorts; for foreign-born individuals effects of this adjustment are stronger. Results without adjustment and using alternative adjustment procedures are discussed below, including results using alternative life tables for the foreign-born.

The adjustment requires that deaths abroad are not registered in the data. This is likely true for a large fraction of the foreign-born who leave the U.S., as shown by the results in Figure 5, but potentially less so for the native-born, especially if they are eligible for retirement benefits. Native-born permanently leaving the country are likely a relatively small group, though, and should not affect results too much. Temporary outmigration – that is, leaving the U.S. for shorter periods of time and then returning – is not covered by the adjustment procedure as well, but should not have a strong impact on WLE, as the number of individuals leaving the country for extended periods of time and then returning also is likely relatively small.

B Alternative adjustment procedures

B.1 No adjustment

As a reference for our main findings and for the alternative adjustment procedures described below, we calculated results without any adjustment, based on the raw data. In this case WLE is to be understood as expected WLE in the U.S., with potential additional WLE abroad but not captured by the data.

B.2 Foreign-born with lower mortality than the native-born

One might argue that the HMD life tables of the total U.S. population are not a good benchmark for the foreign-born, as they tend to be more healthy than the native-born (e.g., Engelman et al., 2017). Unfortunately, life tables by nativity are not available. As an alternative benchmark for the foreign-born we used instead the life tables of Sweden as a scenario with high survival of the foreign-born.

B.3 Retroactive removal

Using the adjustment as in equation (3) removes individuals from the cohort once it becomes clear that the cohort size is too big compared to reference life tables from the HMD. But outmigration leading to the surplus could have happened before. In a sense, our adjustment procedure is assessing the age-dependent timing of migration wrong, and likely puts outmigration at too high ages. To deal with this, we calculated a scenario where all surplus Social Security Numbers (SSNs) are not removed from the age-specific cohort size, but the total cohort size. This scenario is rather extreme as it assumes that outmigrating individuals leave as early as possible and do not contribute to employment. Together with the no-adjustment-scenario this will establish a range of results in which the true results likely will fall.

Technically, we calculate the total number of surplus SSNs per cohort as

$$u_c = \sum_{x=50}^{\max_c(\text{age})} n_c(x) - n_c^a(x), \tag{6}$$

assuming that $n_c(x) \geq n_c^a(x)$. $\max_c(\text{age})$ is the maximum age up to which cohort c is observed. Cohort size as plugged into equations (4) and (5) is then calculated as

$$n_c^{a*}(x) = [n_c(x) - u_c]\, s_c(x). \tag{7}$$

B.4 Retroactive removal as per cohort 1920

Ideally, for the procedure described by equations (6) and (7) to identify the correct number of surplus $SSNs$, all cohorts should be observed up to an age at which all or most cohort members are dead. As this is not the case for some of the cohorts we study, the procedure will affect results for different cohorts to a different extent, depending on how high $\max_c(\text{age})$ is. For example, for the cohort of 1920 $\max_{1920}(\text{age}) = 95$, while for the cohort of 1941 $\max_{1920}(\text{age}) = 74$.

To test to what extent this might affect results, we applied the results for the cohort with the highest observed age (1920) to other cohorts by calculating the surplus SSNs as

$$u_c = n_c u_{1920}/n_{1920}, \tag{8}$$

under the constraint that $n_c^{a*}(x)$ as following from (8) and (7) can not be higher than 50% of the number of inactive individuals (not employed, no receipt of social security benefits) of a cohort at age x. The reason behind this is that, first, individuals with employment in a given year or receipt of social security benefits might have left that year, but not earlier (ignoring multiple border crossings in and out); and that at least some of the SSNs counted to inactive individuals are real.

B.5 Adjustment for changes in SSP coverage and QC requirements

As briefly discussed in the main text, the earnings covered by the CWHS changed over time, with the general tendency of increasing coverage (Compson, 2011). For instance, before 1978 only earnings covered by the Social Security Program were covered, that is the maximum taxable earnings for Social Security taxes; as the threshold of one quarter of coverage (QC) is considerably below the maximum taxable earnings this should not affect our analysis, though. There were also several other changes in earnings coverage, with coverage becoming more complete over time. Because of this, for more recent years in the data earnings should be complete or almost complete and employment estimates reliable.

In 1978 also the way QCs were awarded changed. Before 1978, 400$ or more in annual earnings from self employment earned four QCs. From 1978 on, earnings from self employment were treated roughly similar to earnings from dependent work; i.e., in 1978 250$ of annual earnings gave one QC, irrespective of whether earnings were from self employment or dependent employment. This decreased the QC threshold for the self employed, while it constantly increased for employees. In our main analyses, we defined employment according to the rules applicable in a year, thus using the 400$ threshold before 1978 and potentially limiting comparability across years.

To deal with these potential challenges in a consistent way, we use a simple procedure working as follows. We calculate ratios of the time spent in employment in consecutive years by cohort; e.g., the ratio of the time spent in employment in 1977 and 1978 for the cohort born in 1920. In a second step, we assume that the ratio occurring when coverage changed is indicative of the increase in coverage and use it to scale up employment before the change.

Ratios as used in this approach can be seen in figure 6 for the years from 1970 to 1981, shown by gender and by place of birth (native/foreign). Each solid line represents a cohort. Most values are below 1, as in the age range we study employment mostly decreases with increasing age and thus from year to year. As can be seen for native-born males and females, the ratio of the years 1977 and 1978 clearly stands out and shows the effect of increased earnings coverage. The effect is roughly of the same magnitude for all depicted cohorts. We average this for all cohorts, arriving at a ratio of roughly 1.05 for native born males, and 1.03 for native born females. This ratio is then used as a multiplier for the time spent in employment before 1978. For foreign-born males and females the effect is less clear.

This procedure was also applied to several other changes (1973, 1983, 1984, 1985, 1987, 1988, 1991, 1995, 1998, 1999). The effect of the adjustment is only notable for 1977/1978 though, meaning that only older cohorts are affected.

B.6 Four quarters of coverage instead of one

In our study employment is defined as receiving enough income to earn a "quarter of coverage" (QC) under the Social Security program. This threshold is likely low, and should cover most employment. For instance,in 2015 1, 220 dollars earned one QC. This also means that part-time work and irregular work might count the same as full time work, depending on how much income they earn. As an alternative, we used four QCs (1978: 1, 000 dollars; 2015: 4, 880 dollars) as a threshold instead of one QC. While this is still low it, first, should capture much of part-time work which is very relevant for females and for older workers; and second, the native-born tend to earn higher incomes than the foreign-born such that high thresholds might capture work of the native-born, but not for the foreign-born population, biasing the comparison between groups.

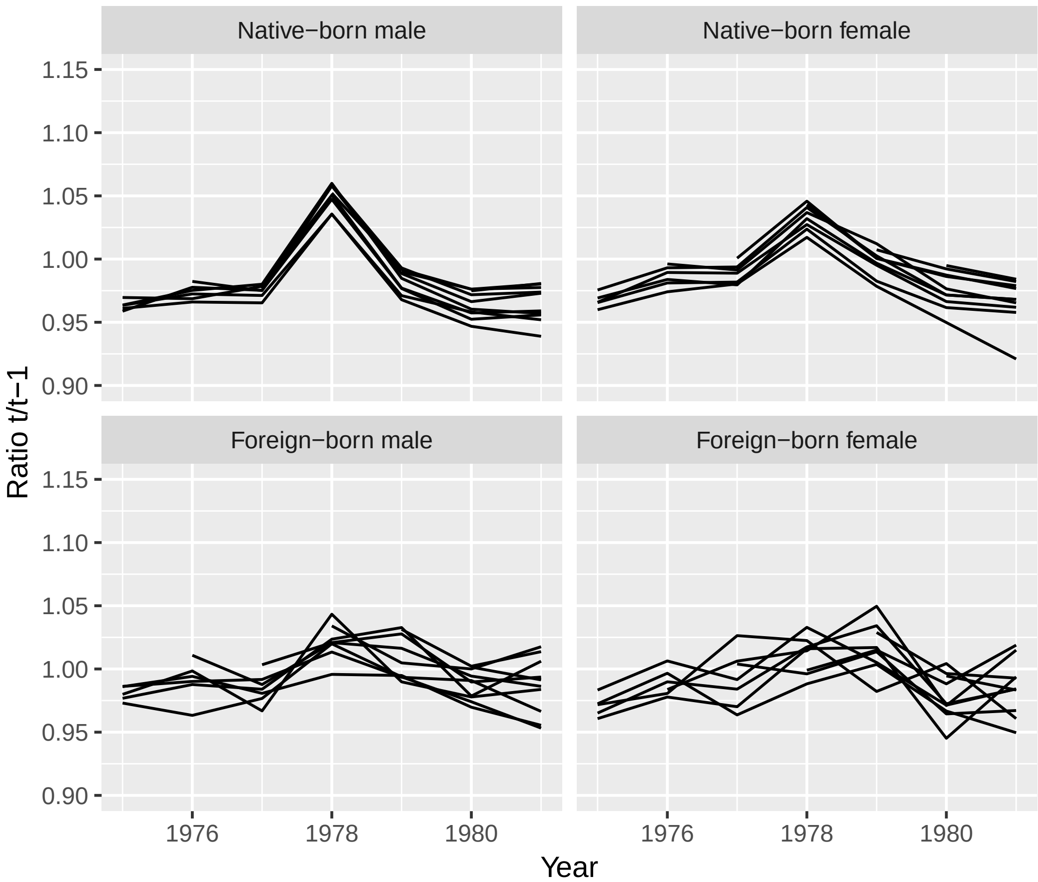

Figure 6: Annual differences in the time spent in employment by cohort for the years from 1970 to 1981, shown by gender and place of birth (native/foreign). Source: CWHS; own calculations.

C Results of alternative adjustment procedures

Results of the additional analyses are captured in Figure 7. The upper left panel shows the results by group from the main paper, and the other panels follow the order from this subsection; i.e., unadjusted results, results using Swedish data, etc.

Overall, most results are close to our main findings. Especially trends and differences between groups seem to be extremely robust. The only partial exception to this are results based on the retroactive adjustment (section B.3), where trends somewhat differ. As this adjustment procedure affects different cohorts to a different extent (section B.4) this is not surprising, though, and likely only an artifact of the adjustment procedure.

With respect to the level of WLE, the retroactive adjustment following the procedure described in section B.4 leads to levels considerably higher than our main findings. For instance, for the native-born males born in 1920 our main analysis estimates WLE at 9.8 years, while the adjusted result is about 11.8 years. Thus, the level of our main results could be biased downward somewhat. As the assumptions underlying the adjusted results are rather extreme, the difference between results shows the maximum possible bias, which is unlikely to occur. The other adjustment procedures lead to results for which the level is relatively close to our main findings.

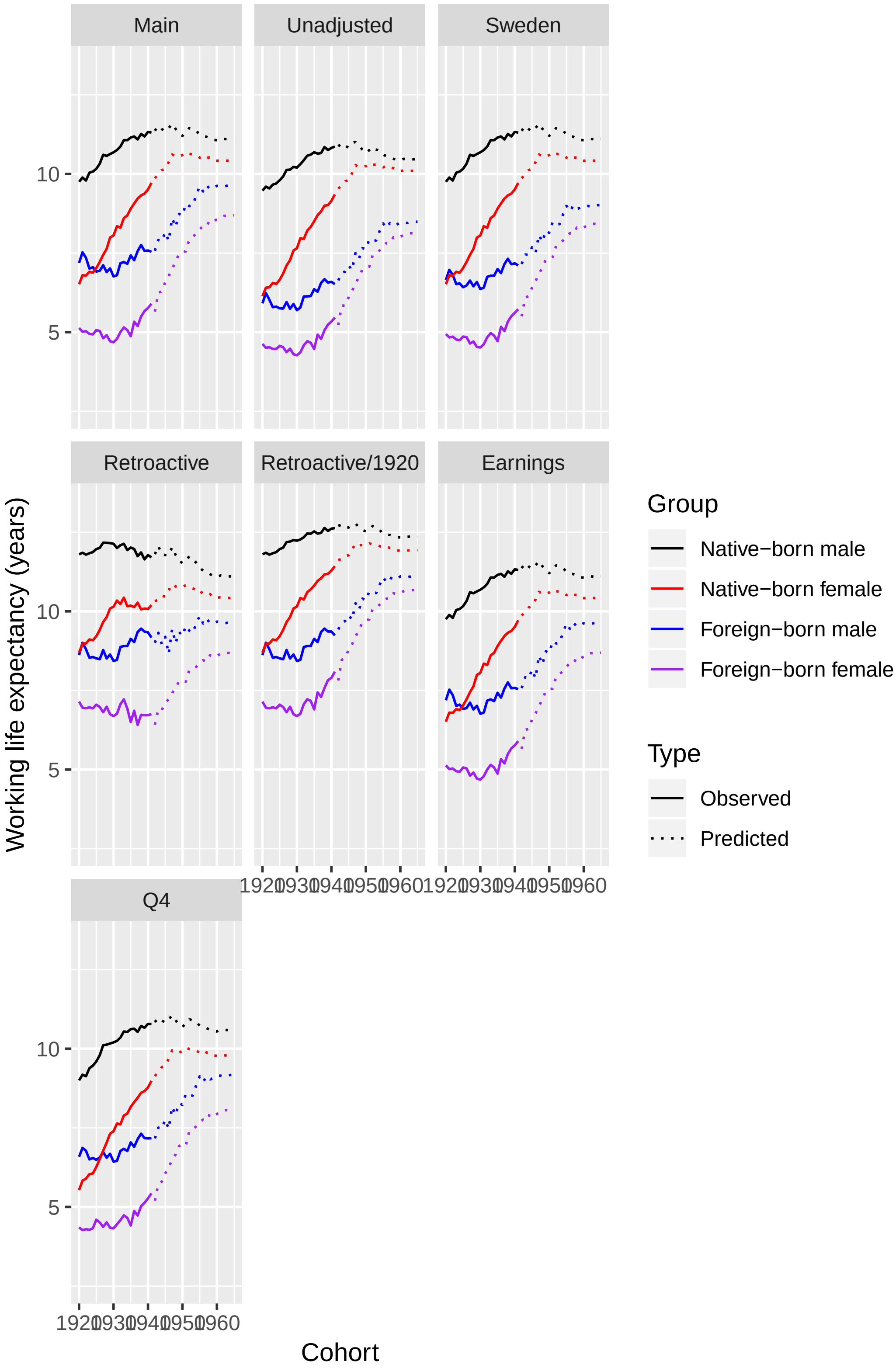

Figure 7: Results of the different adjustment variants. Source: CWHS; own calculations.