

Ronald Lee
rlee@demog.berkeley.edu
October 24, 2001

Report for Roundtable Discussion of Demographic Assumptions for the Social Security Trustees: Mortality and Fertility

I. Mortality

Background: Social Security projects that life expectancy at birth in 2075 will be 83.0 (average of male and female). Using a trend extrapolation method that has been widely accepted by demographers, and has been used by US Census, I project it will be 86.0, or three years higher. Put differently, Social Security projects that life expectancy will rise by six years from its current level near 77, and I project it will rise by nine years. The difference is not large. The Social Security Actuaries, Jay Olshansky and I all agree in expecting modest increases in life expectancy rather than the dramatic gains that some foresee. Nonetheless, our differences are worth trying to resolve. This three-year difference in life expectancy would raise the 75-year Summary Actuarial Balance measure by .55%, from 1.86% of payroll up to 2.41% of payroll (based on sensitivity analysis in the Trustees Report).

Here are my reasons for preferring the higher projection for life expectancy at birth of 86 for 2075:

- **National statistical agencies in industrial countries, including Social Security, have systematically underpredicted gains in life expectancy and the growth of the elderly population.** Studies regularly find that projections by national statistical agencies in industrial nations have systematically underpredicted life expectancy gains, leading to an underprediction of the numbers of elderly. This is true of the Social Security projections since 1950 as well, except for those done in the 1980s. (On Social Security projections, see Figures 2 and 3 below. See Lee and Miller (in press) for more details.
- **Trend extrapolation projects life expectancy of 86 for 2075, and trend extrapolation has worked well so far, and would have worked well if done in the past.** Trend extrapolation for the US based on three decades or longer of experience leads to 86 in 2075, even if we start much earlier in the century (see Figures 2 and 3). This kind of projection predicts well what subsequently happened when carried out hypothetically from earlier years in the US, France, Japan, Sweden and Canada (see Lee and Miller, in press). Projections of life expectancy gains using this method published in 1992 have been on target for the US, while the Social Security projections published then have been too low (Figure 4). The US Census has adopted this method for its life expectancy projections, and the United Nations Population Division is considering using it as well.

The 2001 Trustees Report states: “Any projection of the future is, of course, uncertain. The degree of uncertainty involved can be illustrated by imagining how difficult it would have been in 1925 to project the world of 1930, much less that of

2000.” A US government projection of life expectancy done with base year 1930 (National Resources Committee, done by Thomson and Whelpton) projected life expectancy at birth of 65 years for 2000. A trend extrapolation projection (Lee-Carter) retroactively done in 1925 using data up to that year would have forecast life expectancy of 72 years at birth, which is reasonably close to the actual 77 years (Figure 3 and Lee and Miller, in press), and would have had a much smaller error than the subjective forecast.

- **According to Social Security projections, the US will not attain the current life expectancy in Japan for another 40 years.** Life expectancy in Japan is now nearly 81. According to the latest Social Security projections, the US will not reach this level for forty more years, in 2040. This seems unduly pessimistic.
- **No evidence of approaching a limit; accelerating mortality decline at old ages internationally.** Mortality decline at the older and oldest ages has been accelerating, not slowing down, even in countries with higher life expectancy than the US. In other industrial nations with higher life expectancy, the rate of increase in life expectancy continues at a faster rate than in the US, showing no signs of decelerating as some upper limit is neared. The rate of mortality decline above age 80 in low mortality countries with good data has been accelerating, not slowing down, and it is old-age mortality that matters most for future gains. A careful study of mortality trends at ages 80 to 100 in 19 countries with reliable data concludes that “In most developed countries outside of Eastern Europe, average death rates at ages above 80 have declined at a rate of 1 to 2% per year for females and 0.5 to 1.5% per year for males since the 1960s.” (Kannisto et al., 1994:794). OASSA, however, projects a future rate of decline at ages above 85 of only .5% per year (see Table 1), which is less than half the average pace in the Kannisto et al. (1994) populations. Kannisto et al., report that the rates of mortality decline at these high ages have been accelerating throughout the century. There is also little evidence that populations with lower mortality at these advanced ages are experiencing less rapid declines. A study by Horiuchi and Wilmoth (1995) of a smaller set of industrial nations reaches similar conclusions for mortality at ages 60 to 80 over recent decades.
- **Biomedical considerations do not conflict with trend extrapolation.** Some analysts argue that biological limits to mortality will make it increasingly difficult to achieve gains in the future, as deaths from infectious disease have largely been overcome and the remaining causes of death have more to do with degenerative processes. They also point to new diseases such as AIDS, drug resistant strains of old diseases, and adverse mortality trends in Eastern Europe and sub-Saharan Africa. This is a reason to expect deceleration of gains in the future. However, biology does not speak with one voice in this matter, and many if not most biomedical experts in this area believe that future gains in longevity will be more rapid than in the past. There are many important biomedical and behavioral approaches with the potential for dramatically increasing life expectancy in the future (stem cells, gene therapy, lifestyle modifications, micronutrients, etc.). A National Academy of Sciences workshop on forecasting life expectancy, including biomedical researchers, supported the approach of extrapolating rates of decline, while expressing reservations about the possibility of projecting by any means more than a few decades into the future. Given our current state of knowledge, the best guide we have to the future is past trends, which have

been surprisingly regular over the past century, and international experience, which suggests at least a continuation and perhaps an acceleration of long-term trends in the US, at least at older ages.

Complications

- Trustees Report Shows Slow Improvement 1982-1998.** The 2001 Trustees Report points out that there has been a deceleration in the rate of decline of mortality in the past three decades. From 1968 to 1998 it was 1.28% per year, but from 1982 to 1998 it was only .65% per year, with a similar deceleration for death rates above age 65. It is true that the decline has been slower recently than during the spectacular period from 1968 to 1982, which itself followed an earlier period of stagnation. But the particular choice of dates in the Report maximizes the contrast. The rate of decline for the century as a whole was 1.12% per year according to the Report. Using the Actuary's data, I find the rate of decline from 1980 to 2000 was .9% per year, not very different. Furthermore, the Lee-Carter projection, using data from 1900 to 1989, is exactly on target for life expectancy in 2000 using CDC data, and only slightly high using Social Security data (see Figure 4). This shows that the 1990s conform closely to the long-term trend. In the past, Social Security forecasters have been misled by paying too much attention to recent fluctuations such as the rapid decline 1968 to 1982, which led to a whole decade of over-predicting gains (see Figure 2).
- Why has female mortality declined so slowly for the past 20 years?** Although the decline in overall mortality in the 1990s has been pretty much on trend, this masks a very significant slowdown for females over the past 15 or 20 years (Figure 5 shows the slow declines for women). This slowdown probably reflects the delayed effects of an earlier increase in smoking by women, but this hypothesis needs research and analysis. In international data, mortality of women is still declining fairly rapidly (see Figure 5), although if smoking is the cause in the US, then there may well be slowdowns coming in other countries as well. It would be prudent to assume that the slowdown is temporary, and that faster declines will be resumed for females as they were for males, once the effects of smoking have been absorbed in the level of mortality.

Conclusion: Raise projected life expectancy in 2075 up to 86 years. The combination of historical trends within the US, and international trends outside the US, suggests that the Social Security life expectancy projections are too low. Biomedical considerations give a mixed message, but on net favor an acceleration of declines. No limit to life expectancy is yet in sight. However, female mortality should be monitored closely, and its relation to smoking examined.

Figures for Mortality (at end of document):

Figure 1. Gain in Life Expectancy in 1990s: US, Others, and Projected

Figure 2. Average Bias in Life Expectancy Forecasts: Soc Sec and Lee-Carter

Figure 3. Forecasts to 1998 from Earlier Dates: Soc Sec and Hypothetical Lee-Carter

Figure 4. Forecasts from 1989 to Present: Soc Sec and Lee-Carter

Figure 5. Gain in Life Expectancy in 1990s by Sex: US, Others, and Projected

II. Fertility Assumption

Background: Social Security projects an ultimate Total Fertility Rate of 1.95 children per woman, slightly lower than the most recent observed level of 2.05. Census projects an ultimate level of 2.2 (for 2025 through 2075, although 2.1 for 2150), or higher by .25 children, an important difference. With the Census projection, the 75-year Summary Actuarial Balance would improve by .3%, from -1.86% to -1.57%. Average TFR in Europe is 1.4 children, and Japan is similar.

In my view, Social Security has this right and Census has it wrong. I suspect that Census will be moving closer to the Social Security projection in the future. Here are my reasons:

- **Completed fertility of recent generations has stabilized at two children per woman.** If we look at the average number of births to generations of women who have completed or largely completed childbearing, that number has been stable at 2.0 or so for generations born between 1950 and 1965. The low TFRs of the 1970s and 1980s (around 1.8) were due to changes in timing of childbearing. (See Figure 6)
- **Fertility is falling fast in the countries sending immigrants to the US.** Census thinks that immigrants will make US fertility rise in the coming decades, as the proportions of Latino and Asian origin people in the population rise toward 50%. But the fertility in the sending countries is falling rapidly. The Mexican TFR has dropped from a high near 7 in the late 1960s to a current level around 2.8, with the UN predicting it will reach replacement level around 2015. Yet the Census is projecting that the TFR for Hispanic women will be 2.7 in 2025 and 2.6 in 2050. Some East Asian sending countries already have fertility lower than the US (China, Taiwan, Hong Kong, S. Korea). It is wrong to expect that immigrant women will continue to have such high fertility.
- **US women report in surveys that they expect to have about 2.0 children.**
- **Fertility in Europe is distorted downwards by rising mean ages of childbearing.** Also, women report wanting 2 children in surveys in Europe.
- **But...US TFR in 2000 was highest in 30 years, at 2.13!** A response to the economic boom?

Conclusion: There is a *great deal* of uncertainty about future fertility (see Figure 6), but the Social Security assumption is a good guess, and should be retained. 1.9 or 2.0 would be equally good guesses, in my view. The range, 1.7 to 2.2, is about right, too. Fertility might be higher or lower in individual years, but is unlikely to be so on average over the next 75 years.

Figures for fertility:

Figure 6. US Census fertility projections compared to actual Total Fertility Rate

Figure 7. Period and Cohort Total Fertility Rate since 1917

References

Horiuchi, Shiro and John R. Wilmoth (1995) "The aging of mortality decline." Presented at the Annual Meeting of the Population Association of America, San Francisco, April 6-8, 1995, and at the Gerontological Society of America, Annual Meeting, November, 1995.

Kannisto, Vaino, Jens Lauritsen, A. Rodger Thatcher, and James W. Vaupel (1994) "Reductions in mortality at advanced ages: Several decades of evidence from 27 countries." *Population and Development Review*, Vol. 20, No 4, pp. 793-810.

Lee, Ronald D. and Lawrence Carter (1992) "Modeling and Forecasting the Time Series of U.S. Mortality," *Journal of the American Statistical Association* v.87 n.419 (September) pp.659-671.

Lee, Ronald and Timothy Miller (in press) "Evaluating the Performance of the Lee-Carter Approach to Modeling and Forecasting Mortality," *Demography*.

Fig 1: Gain in life expectancy at birth in most recent decade

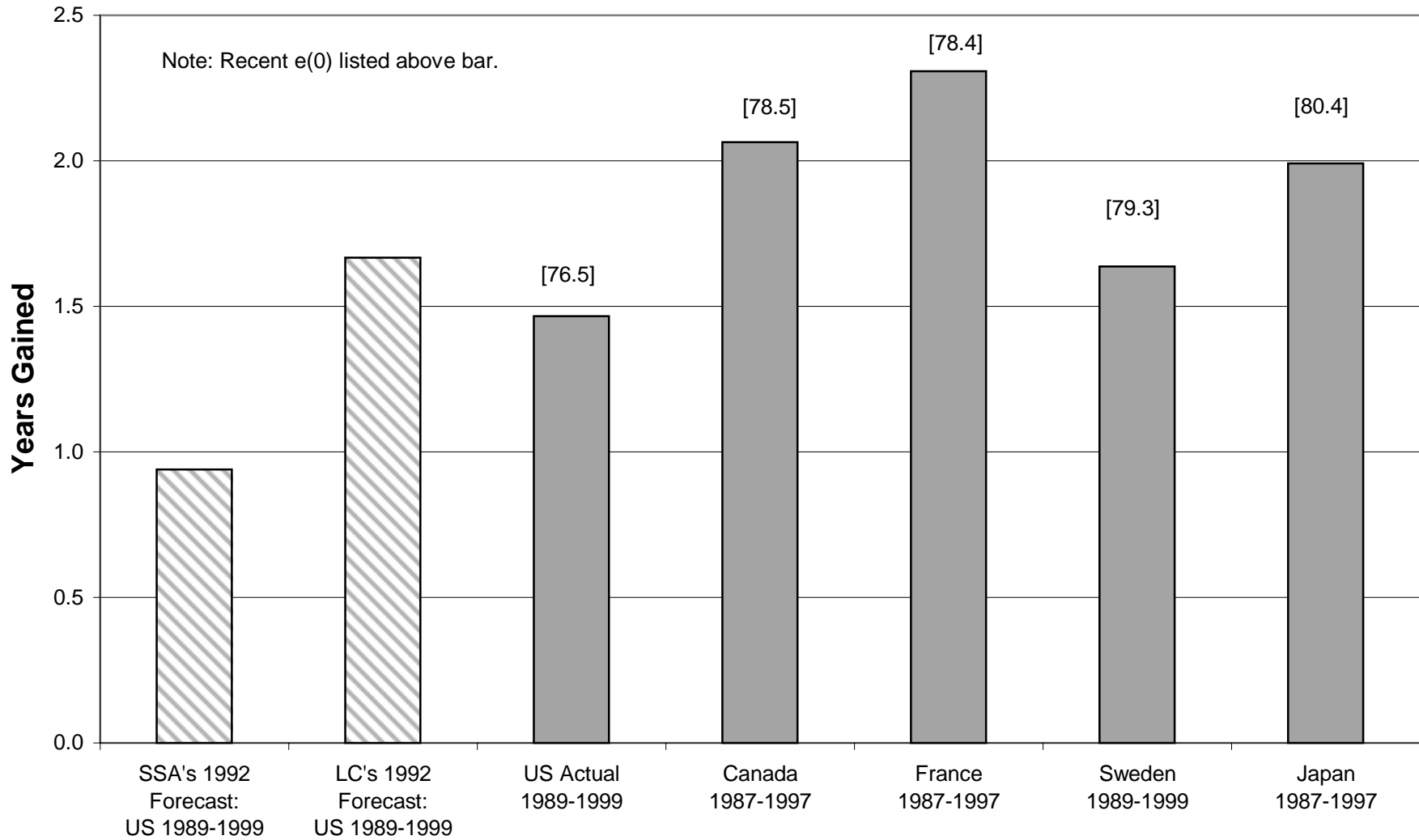


Figure 2: Average bias in forecasts of life expectancy

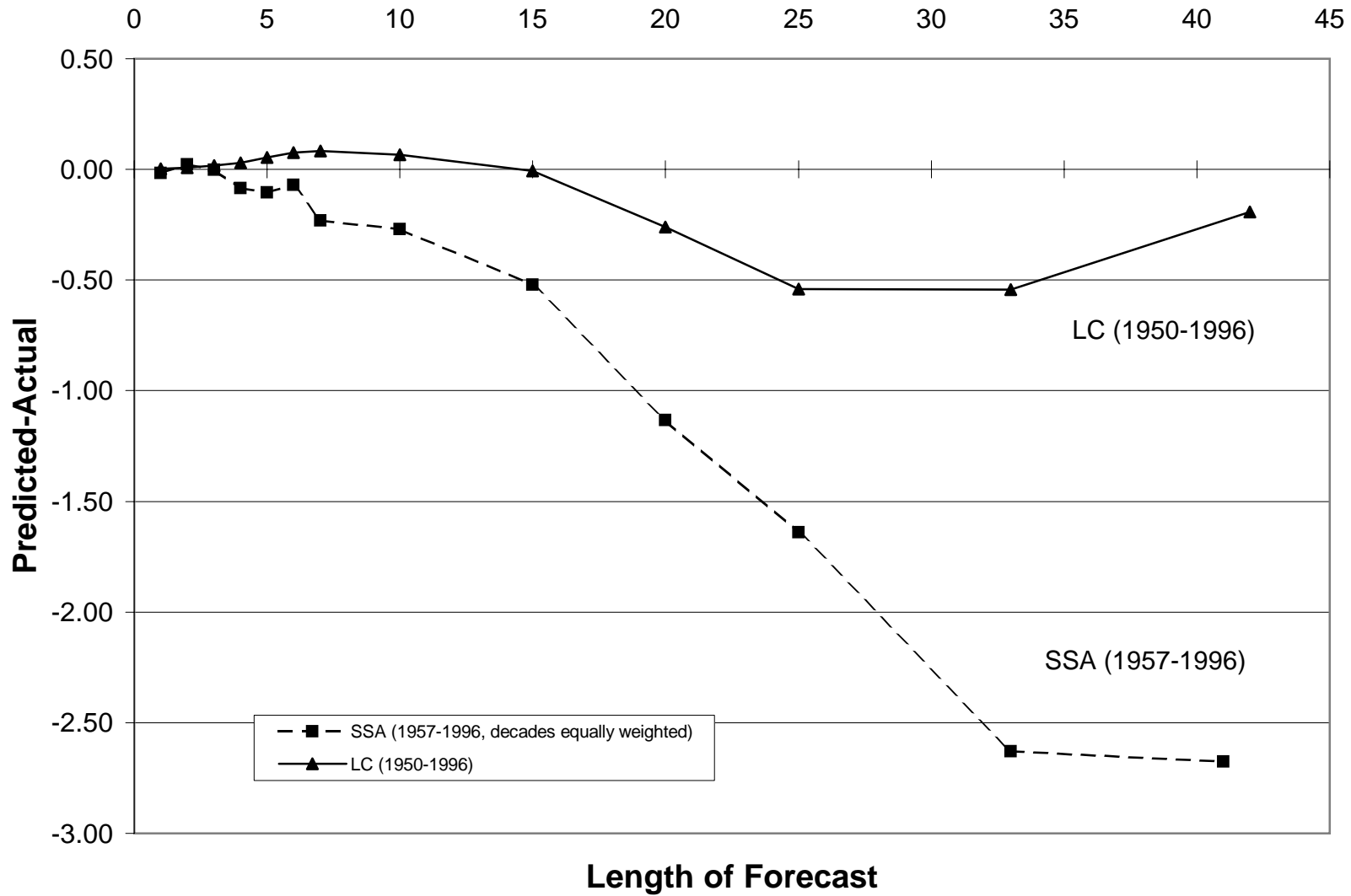


Figure 3: LC and SSA e(0) Forecast for 1998, by Forecast Date

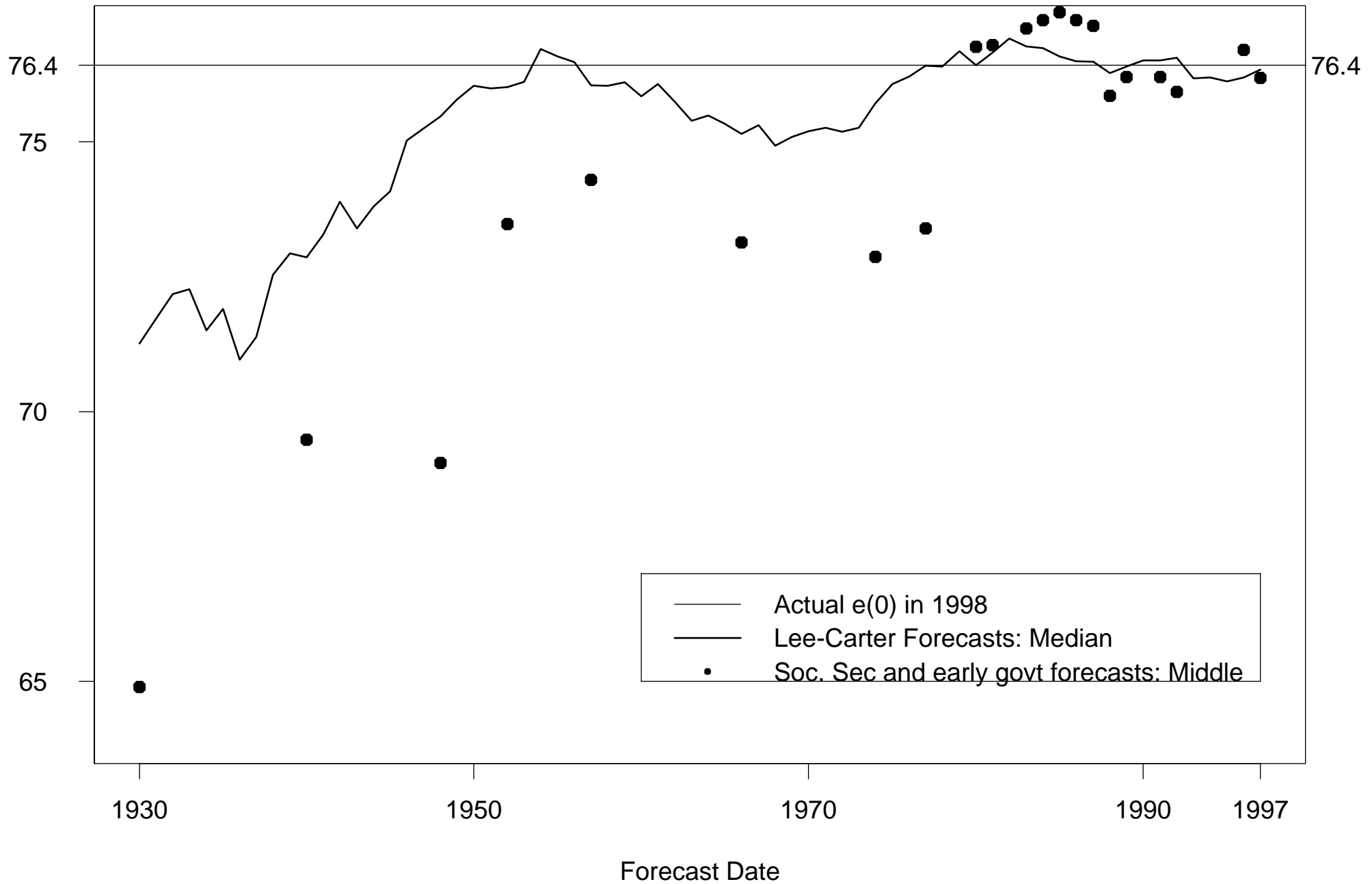


Figure 4: Forecasts of life expectancy from 1989

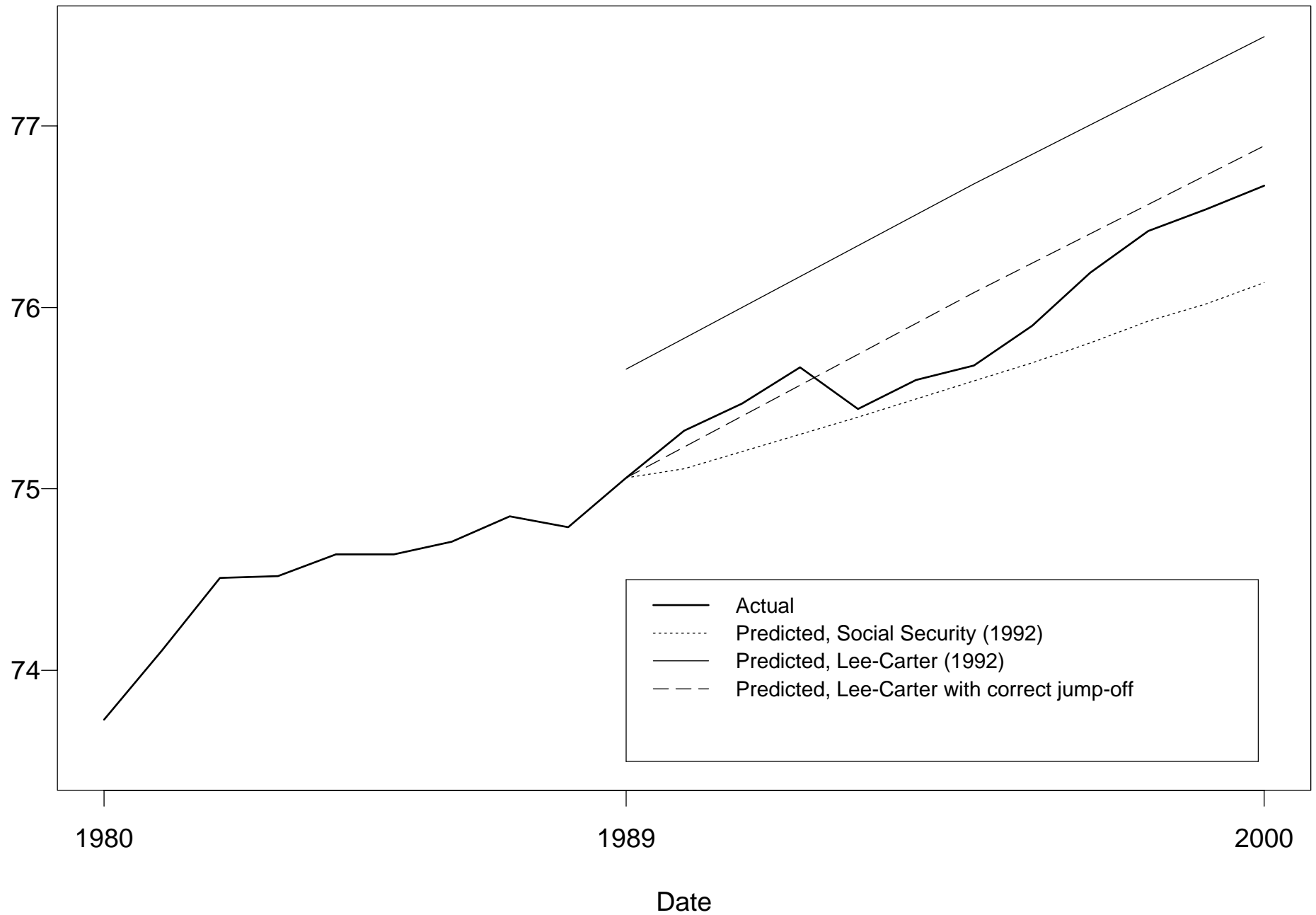


Figure 5: Gain in life expectancy in most recent decade, by sex

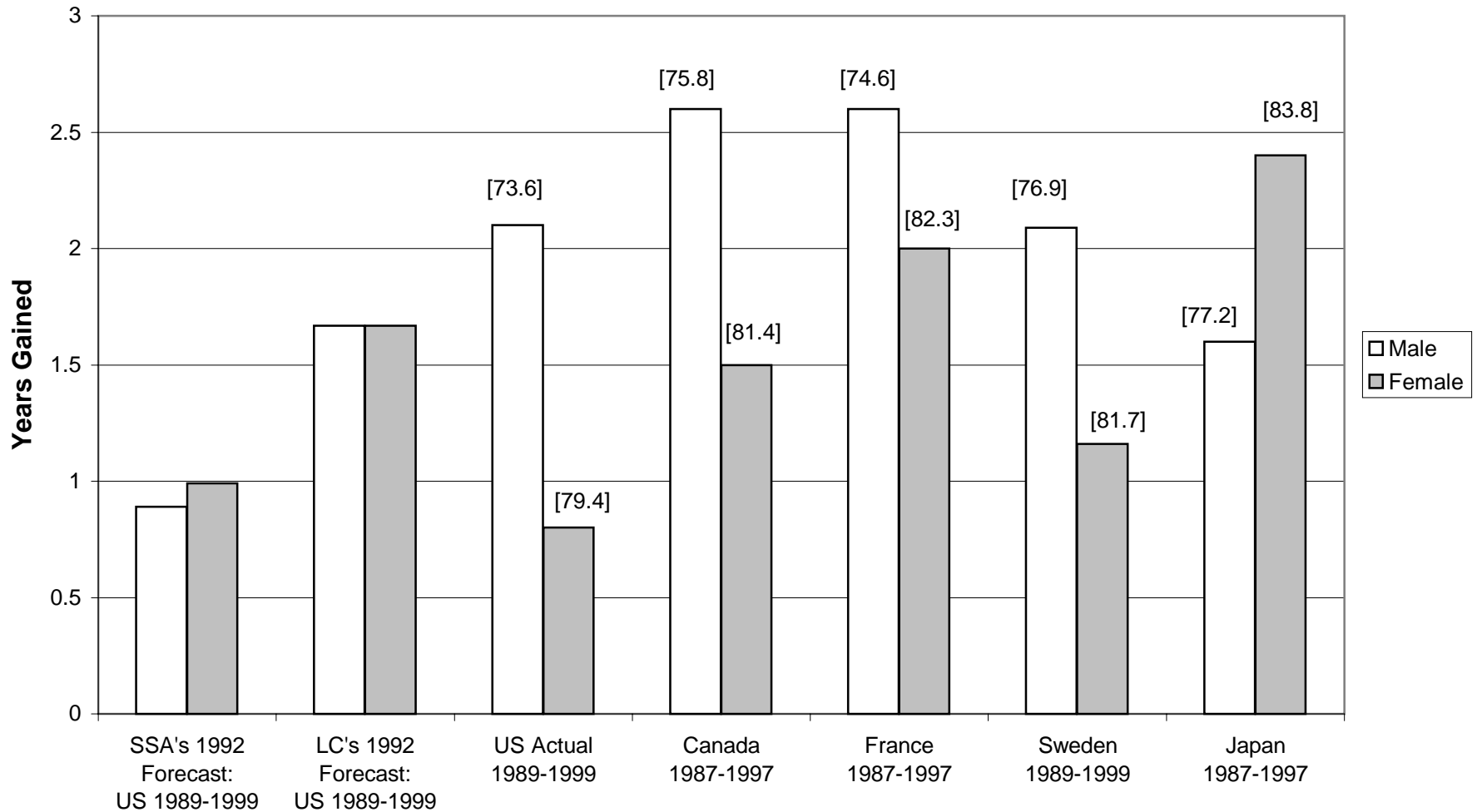


Figure 6: TFR: Actual and Middle Series Projections 1940-2005

(Source: U.S. Census Bureau, Current Population Reports, Series P-25)

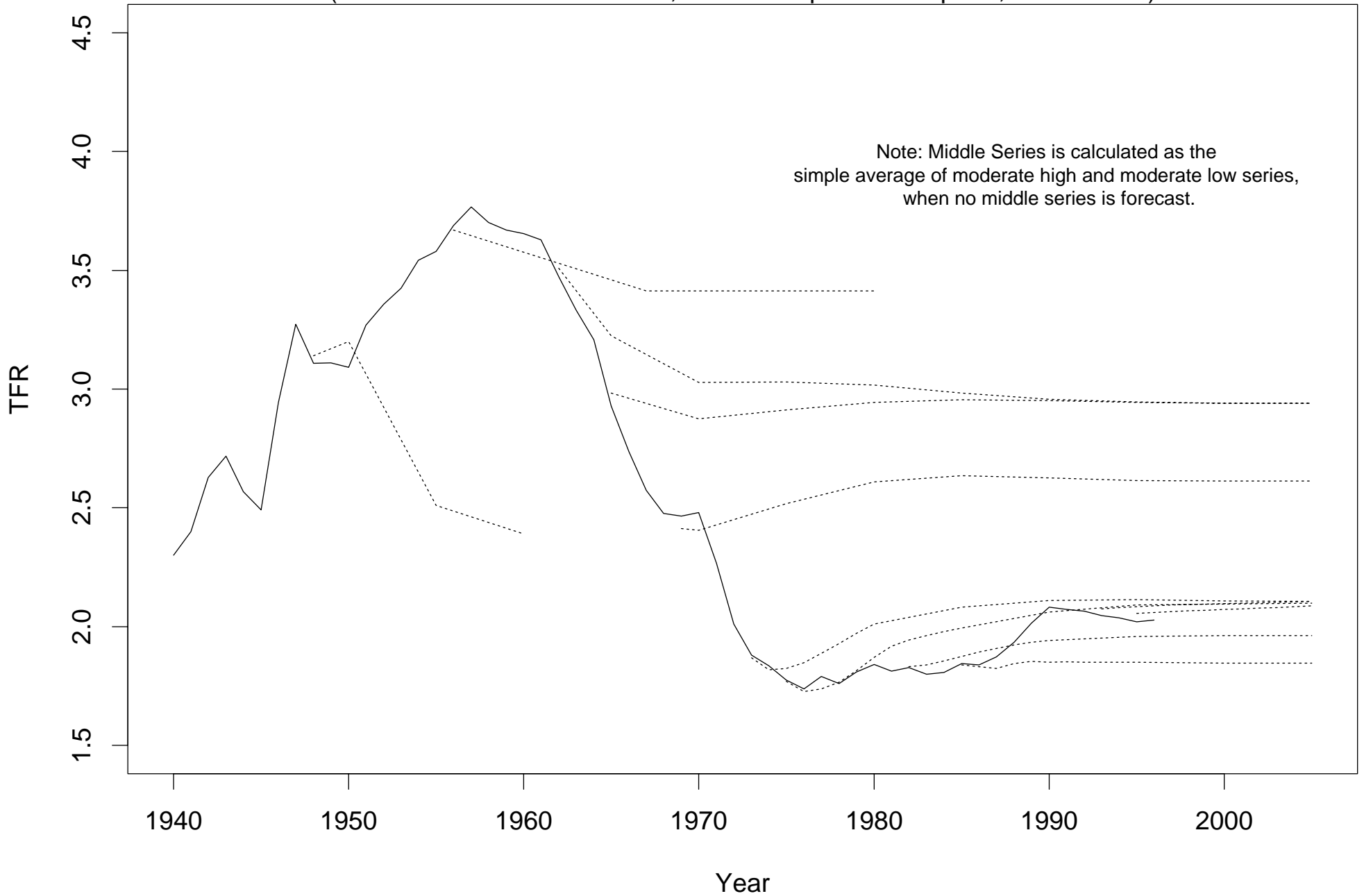


Figure 7: Period Total Fertility Rate, 1915-2000, and Cohort Total Fertility Rate for birth cohorts 1903-1963, lagged by their average age of childbearing

