Summary

The Demographic Challenges of Pension Systems

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**A summary of a report in Swedish with the title "Pensionssystemens demografiska utmaningar" (SNS Förlag)*

In 1994 Sweden legislated a completely new pension system based on a defined contribution design that was implemented in 1999. The driving force behind the reform was the realization that the overall design of the then reigning defined benefit ATP pension scheme was not resilient to fundamental economic and demographic dynamics. So, in 1999 the existing flat-rate *folkpension* topped by the defined benefit earnings-related ATP scheme were replaced by a mandatory non-financial defined contribution (NDC) and a financial defined contribution (FDC) scheme, with a new minimum pension benefit that is means-tested against the NDC and FDC pensions.

Together the NDC and FDC schemes work as lifecycle savings accounts in which the individual account balances are converted into a universal longevity insurance with the same rules for all. Individual account values and life expectancy at retirement determine the yearly pension amount for the remainder of life. The overall design makes it possible to retain a constant contribution rate over generations, strengthens the incentive to work longer and maintains financial sustainability.

The success of the NDC and FDC schemes in achieving intergenerational fairness and long-run financial sustainability relies on projections of life expectancy that neither systematically under- or overestimate life expectancy over a succession of birth cohort "pools" of pensioners. It is only when this statistical criterion is fulfilled that financial sustainability and fairness over generations can be maintained.

Examining birth cohort data for the period 1900–2014 for eight OECD countries (Denmark, France, Italy, Netherlands, Norway, Sweden, the United Kingdom and the Unites States) and employing the two most popular projection models of official agencies and national pension schemes – the "period method" and the Lee-Carter model – the study shows that this criterion is not fulfilled over time for any of the countries. The study shows that this is because these two methods depart from an assumption that the rate of change in mortality is a constant value, whereas the empirical evidence is that the overall picture is one of steady improvement in the rate of change.

Life expectancy at retirement

The point of departure for this work is that in an earlier study we found that the segment of historical data for the countries above, also including Japan, displayed a clear picture improvement in the rate of change in mortality of the countries examined from the 1950s. For some countries, such as Sweden, this was a predominant characteristic of the data for mortality at age 65–85 from the 1950s and for Japan followed by comparable improvements in the age group 85–99. For other countries this characteristic made itself apparent one or two decades later, but it has been a clear feature of

the data for all countries from the 1980s, with the exception of the United States during a couple of sub-periods. Our studies have shown that this feature of the data began even prior to the 1950s for Sweden, which in this respect benefited by not participating in the Second World War. Despite this picture of mortality, it wasn´t until the path-breaking study of Jim Oeppen and James Vaupel (Science 2002), with 150 years of historical data, showed that there was no factual evidence for the reigning belief of the time among experts that the ceiling for the mankind's longevity was soon to be reached. Instead, these researchers showed that "best practice" life expectancy was increasing linearly with Japan being the most recent leader.

This report presents the evidence from our studies that the projection models still currently employed in conjunction with estimating life expectancy systematically underestimate life expectancy, and that the gap between projections and outcomes – using these procedures – is increasing in the six countries chosen here to illustrate the phenomenon – Denmark, France, Italy, Netherlands, Norway and Sweden. The systematic underestimation arises in Sweden because the reigning projection procedure is the period method, also employed by Statistics Sweden. The study also shows that although it performs better than the period method, the Lee-Carter model yields systematic underestimation as well.

The bottom line is that application of the "reigning methodology" will lead to systematic deficits for all the birth cohort pools of the Swedish universal NDC and FDC schemes beginning with the relatively new retirees born in 1939. For the time being the debt is implicit due to a transition rule.[1] Note that this is not a failure associated with the NDC (and FDC) scheme. In fact, the NDC (and FDC) scheme simply serve to make the impact of life expectancy – including systematic underestimation – transparent. In the old defined benefit ("ATP") scheme this would also have been noticed (ex post) expressing itself in the continuous need to increase the contribution rate in order to fulfill "unaffordable" pension benefits. Although the Swedish NDC reserve fund (AP fund) is currently large and can absorb this deficit, this may not be the case forever. At some time in the future the Swedish solvency ratio, i.e., ratio of the present value of assets to liabilities, may be forced below unity, the balancing index to "kick in" to reduce liabilities.

This report presents and illustrates the results of a new method developed in previous work of the authors that fulfills the criterion of a good estimator. The new method, given the name the PAD model, produces projections that neither under- nor overestimate "out-of-sample" outcomes based on 1,600 expired birth cohorts and 1,000 still living cohorts from the eight-country database covering the period 1900–2014. The PAD model is shown to be at least as good as (e.g., for the Netherlands where the database is closest to the underlying assumption of a constant rate of change in mortality) and otherwise a superior estimator to the Lee-Carter model. The period model retains its relative high degree of "inefficiency" at projecting outcomes, and, in fact, the scale of the divergence of the projection from the outcome increases with time.

The study shows that revising the projection at five-year intervals and recalculating the annuity up to a ceiling age, not unexpectedly further reduces the overall scale of errors, but at the expense of slightly reduced benefits for the recipients 85 and older. This means in the Swedish context, where there is a large reserve fund, in considering taking this step the policymaker will have to weigh the welfare loss of the older members (which in some cases may nevertheless increase the need for a guarantee supplement) against the expected loss of future retirees accompanying a slightly smaller fund. The optimal result of this is arguably to let the fund "buffer" these what are expected to be random events – with the PAD model as the projection model. This is of course a clear argument favoring a reserve fund for an NDC scheme. The results of the period method or Lee-Carter model will also benefit from recalculating the annuity with new life expectancy estimates, but this will not change the fact that their results are systematically biased in the direction of cohort pool deficits. This means that, in the absence of a sufficient reserve fund, the government budget (taxpayers) will have to bear the cost of the inefficient projection model.

1. Persons born in 1939 have received 5/20 of their pension from the new NDC scheme and 15/20 from the old system. Persons born in 1944, who turned 65 in 2009, received a ratio of 10/20 and 10/20 and persons born in 1954 are the first cohort to receive all (20/20) of their pension from the new NDC scheme. The universal public FDC scheme's first contributions were made in 1995, which means that a person reaching age 65 and claiming the FDC pension has accumulated contributions covering 24 years (and there is no prorating in conjunction with the FDC scheme).

Heterogeneity in life expectancy with respect to income status

The international literature bears witness to the fact that differences in life expectancy are contingent on socioeconomic characteristics and circumstances. This is nevertheless a relatively recently gained insight and how the implications of this phenomenon can be dealt with by policy is still very much an open issue. This component of the research presented here thus focuses on presenting the issues and challenges and the few proposals that to date have appeared in the literature suggesting options for policy.

The underlying principle of the distribution within the annuity pool is that all members have the same randomly distributed chance of living longer or shorter lives than average. The empirical data from countries tell another story, however. Generally, those with the lowest lifetime earnings also have the shortest lives, and those with the highest income the longest lives. This means that, generally speaking, those with lower account balances at retirement are among the first to die, creating a transfer within the pension pool to those with higher incomes. The empirical data also shows a similar distributional pattern with respect to level of education and occupational category, which largely mirror the distribution of earnings.

The picture is, however, more complicated than it appears to be at first sight. This is because women are in general extremely overrepresented in the lower income deciles while they survive 3–5 years longer – both in Sweden and in general in more developed OECD countries.

Women's relative low position in the income distribution is generally attributable to wage discrimination of 10 percent and more, depending on the country, gender-based restricted upwards mobility at workplaces and, above all, part-time in the formal labor force due to the gender distribution of time spent at home caring for children up onto adolescence.

According to a study of the Swedish Pensions Agency, the fact that 80 percent of the population in low-income groups are women, the discrepancy in life expectancy is counterbalanced more or less across the board through the gender redistribution associated with men's shorter life expectancy – i.e. the redistribution occurring through the use of unisex life expectancy. Obviously, a narrowing of the gap in life expectancy would reduce this distributional effect – whereas an alternative policy, namely, parents sharing of accounts from the birth of a first child would reduce the gender gap of the earnings and at-home-time-sharing gaps on future pensions – independent of the life-expectancy gap.

The proposals in the few contributions that are to be found discuss and examine the merits of segmenting the pension pool – e.g., with respect to income, education or occupation. One of the studies in our research has shown that a segmentation of blue- and white-collar unions would reduce the present transfer of about 5 percent of the pension pool income from blue- to white-collar workers. Occupational segmentation which to a significant extent is already gender-based would then significantly reduce the transfer from generally better-off men to generally worse-off women, which from the point of view of social policy is questionable.

A recent study performed by Raj Chetty and colleagues at Stanford University is the most extensive out of all the studies in the current literature examining the determinants of life expectancy outcomes. It is based on almost 1.5 billion person observations over a long series of years and identifies the most significant factors behind short life expectancy. These turn out to be life-style factors (e.g., smoking, substance abuse, and dietary habits) and less comprehensive local community public engagement (e.g., correlated with very low educational levels, low level of social help, low labor force attachment). A number of studies from other countries are also cited that confirm that the characteristics of those who live the shortest lives are already discernible at age 40 and lower. Even "geography" plays a role, which is perhaps a "component" of rural cultures with more limited educational and job mobility.

Conclusions and recommendations

The following are the conclusions and recommendations of the report:

1. The present model employed by the Swedish Pensions Agency systematically underestimates the life expectancy of new cohorts of retirees. It should be replaced by a model with proven ability to produce projections that neither systematically under- or overestimate life expectancy, where the PAD model is a logical candidate.
2. A higher age (than the present age of 65) for setting the permanent life expectancy factor should be considered.
3. Sweden should replicate the study performed by Ray Chetty and colleagues

with Swedish data in order to learn more about the socioeconomic of determinants of life expectancy, taking into account life-style factors, community support, etc. It is important to learn more about the need for various social and labor market policy instruments to deal with these factors.

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