

# From Unfunded to Funded Pension - The Road to Escape from the Ageing Trap

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## Abstract

In response to population ageing and the growing stress on defined-benefit (DB) pension, the Swedish Parliament passed legislation in 1994 to replace the system with a notional defined contribution system (NDC). This paper deals with the aftermath of the 1994 Swedish pension reform on the economic life-cycle across generations 1900-2030 by agent-based computation. Results suggest that the DB PAYG pension would likely raise issues of intergenerational equity. Even if reform has ensured that welfare for future generations will be higher, it is likely have a disparate impact on different generations. Striking impacts, however, can be mitigated if retirement age and yield on pension assets can increase.

**KEYWORDS:** Pension Reform, DB, NDC, Pay-As-You-Go, Life-cycle Wealth

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## INTRODUCTION

The world's population is growing older. Once confined to industrialized countries, the aging process now characterizes the developing world as well. As a result, the proportion of the world's elderly (age 60+) is projected to double between 2000 and 2050<sup>2</sup>. One of the major consequences of population ageing is the threat to pension systems, particularly defined-benefit Pay As You Go (DB PAYG) systems, where the benefits for current retirees are derived from current labor contributions. Such systems will be put under enormous strain when the ratio of retirees to producers increases, as the per worker cost of providing a given age-vector of per capita benefits goes up (Lee & Edwards, 2001).

For Sweden, as a pioneering welfare state, this threat could be considerably pronounced. Given demographic conditions, the replacement rate—defined as the ratio of pension benefit to current wage—will drop from 58% in 2010 to 42% in 2050 with a constant contribution rate at 18.5% (Kruse, 2010). Such benefit cutbacks imply an eroding trust of social safety net, which might consequently induce old-age poverty. Alternatively, the contribution rate would need to be increased from 19.2% to 26.4% within next four decades if the replacement rate is held constant at 60% (Kruse, 2010). Contribution increases raise the issue of intergenerational equity since the implicit debt made by early generations will be passed on to the subsequent ones. An added concern is that increasing payroll taxes discourages labor supply; future benefits earned are not seen as closely tied to the taxes paid, in contrast to the effects of saving a part of income and investing it (Lee & Edwards, 2001). Unfortunately, there is no demographic solution to the current problem, at least not in a 30-year-perspective (Bengtsson & Scott, 2010).

In response to population ageing and the growing stress on its DB PAYG system, the Swedish Parliament passed legislation in 1994 to replace the system with a notional defined contribution system (NDC). The new system was designed to maintain financial stability, in the face of both economic and demographic changes (Palmer, 2000). Since the reform, vast literatures have forecasted the evolvement of the aggregate outcome in respect to both economic and demographic process. The total life-cycle deficit was projected to increase drastically by year 2050<sup>3</sup> (Bengtsson & Scott, 2010). Palmer (2000) illustrated the evolving trajectory of the ratio of benefit payments to contribution with three different real wage growth scenarios, and concluded that the new system is financially stable, while the old one was much more sensitive to economic and demographic changes. Similarly, the basic NDC scheme was found to be effective at preventing excessive debt accumulation (Auerbach & Lee, 2009).

Although past reform has ensured that welfare for future generations will be higher, it is likely have a disparate impact on different generations (Miles, 1999). The impact of the transition to the NDC system on the population, particularly on different cohorts, remains

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<sup>2</sup> Percentage of world aged 60+ would increase from 11% in 2010 to 22% in 2050 (United Nations, Department of Economic and Social Affairs, Population Division, 2009).

<sup>3</sup> The total life-cycle deficit is measured by the difference in aggregate lifetime consumption and labor incomes for every age category at a given year (Bengtsson and Scott, 2010)

unclear. In addition, the prospective influences on each over-lapped generation have been barely discussed, although the long-term aggregate impacts have been projected by a number of scholars. Therefore, this paper strives to examine the effect of pension reform on the life-cycle wealth with a cohort perspective. Using agent-based computational modeling enhances the flexibility of the research, allowing analysis of the evolving process over time, by cohort, and by age. This approach can help us address the following questions: How is wealth accumulated over ages for each cohort? How is the trajectory of wealth accumulation different by cohort? How is the life-cycle wealth influenced by exogenous factors over time? And finally, among all the generations, who will gain or lose throughout the reform and how large are the impacts? In addition, the simulation models are extended to examine the effects of retirement age and rate of return to pension assets.

## **DATA AND METHOD**

Data employed in this study are extracted from multiple datasets, which are in two formats: time-series and age-specific cross-sectional. Age-specific population for the period 1900-2009 in Sweden is obtained from Human Mortality Database, and, for the period thereafter, population projections constructed by Statistics Sweden. Aggregate income and consumption are extracted from Historical national accounts for Sweden 1800-2000<sup>4</sup>. Price index CPI 1900-2010 is taken from Statistics Sweden. Real rates of return on assets are gauged by short-term interest yield and long-term bonds yield provided by Swedish Central Bank (Sveriges Riksbank). The age profiles of income and consumption per capita is obtained from National Transfer Accounts (NTA), Sweden, 2003. The age profile in each year is constructed by adjusting the single year cross-sectional age profile proportionately to match aggregate economic data reported in National Income and Product Accounts (NIPA).

In the base scenario, I simulate cohort life-cycle wealth with the assumption that the DB PAYG system will last until the end of simulation period. The second scenario assumes the pension reform was implemented in 1995, but the rate of return to funded part in the new system is as low as risk-free interest rate. A third scenario assumes that the real rate of return on the 2<sup>nd</sup> pillar pension assets in the new pension scheme is approximated by long-term bonds yield. The simulations of the fourth and fifth scenarios take the effect of retirement age into account, and examine how postponement of retirement can affect the wealth for individual agents in the DB PAYG and NDC regime, respectively.

## **RESULTS**

For simplicity, only results of the first two scenarios are presented in this abstract. Figure 1 illustrates the age profiles of wealth accumulation for all generations. In the base scenario, as shown on the left, those born between 1931 and 1943 benefit the most from the DB PAYG scheme. They experience relatively shorter period in debt at early working life and end up with over three million SEK when aged 80. These might be the implication of intergenerational inequity as the trajectories of wealth accumulation largely vary among

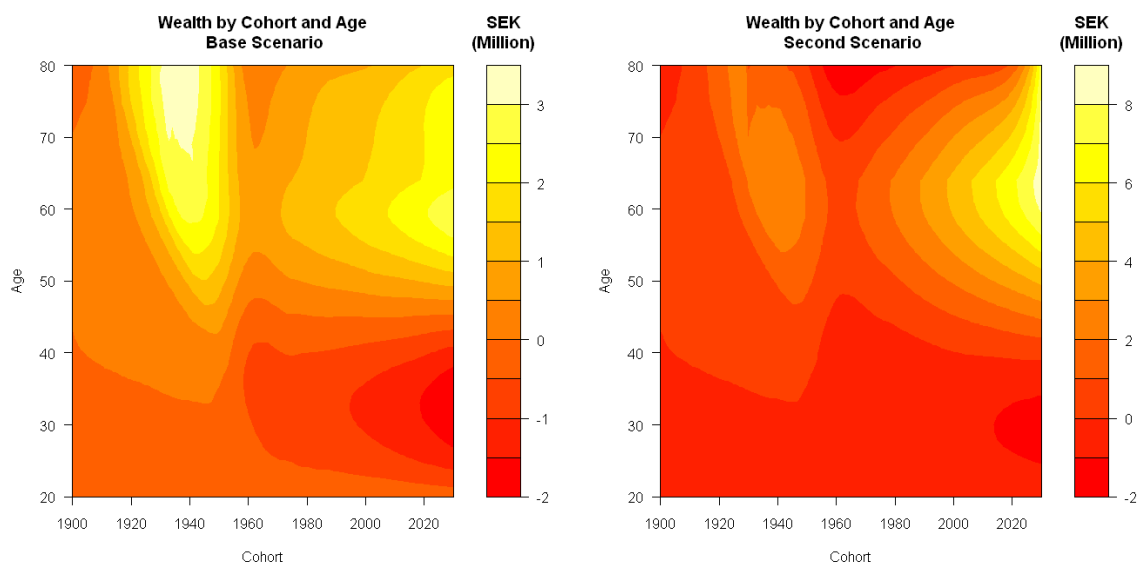
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<sup>4</sup> Historical national accounts for Sweden 1800-2000 (Historiska nationalräkenskaper för Sverige 1800-2000), which is based on methods and data presented in (Edvinsson, 2005).

generations. The most benefitted cohorts would enjoy considerable surplus, while the most disadvantaged ones would possess very limited resources in later life.

The contour on the right in Figure 1 depicts that a large group of generations (cohorts born 1951-2000) would have exhausted all wealth on hand before 80 years old. This suggests that the NDC system under the condition of low rate of return to 2<sup>nd</sup> pillar pension assets would be unsustainable. And intergenerational inequity still remains as certain cohorts are much worse off. Nonetheless, a promising remark here is that it could benefit future generations as there would be enormous growth in wealth levels, especially for those born after 2020. Additionally, the duration of deficit through early career for those cohorts might also be slightly shortened in contrast to the base scenario.

**FIGURE 1 AGE PROFILE OF WEALTH ACCUMULATION BY COHORTS: 1900-2030, BASE AND 2<sup>ND</sup> SCENARIO**

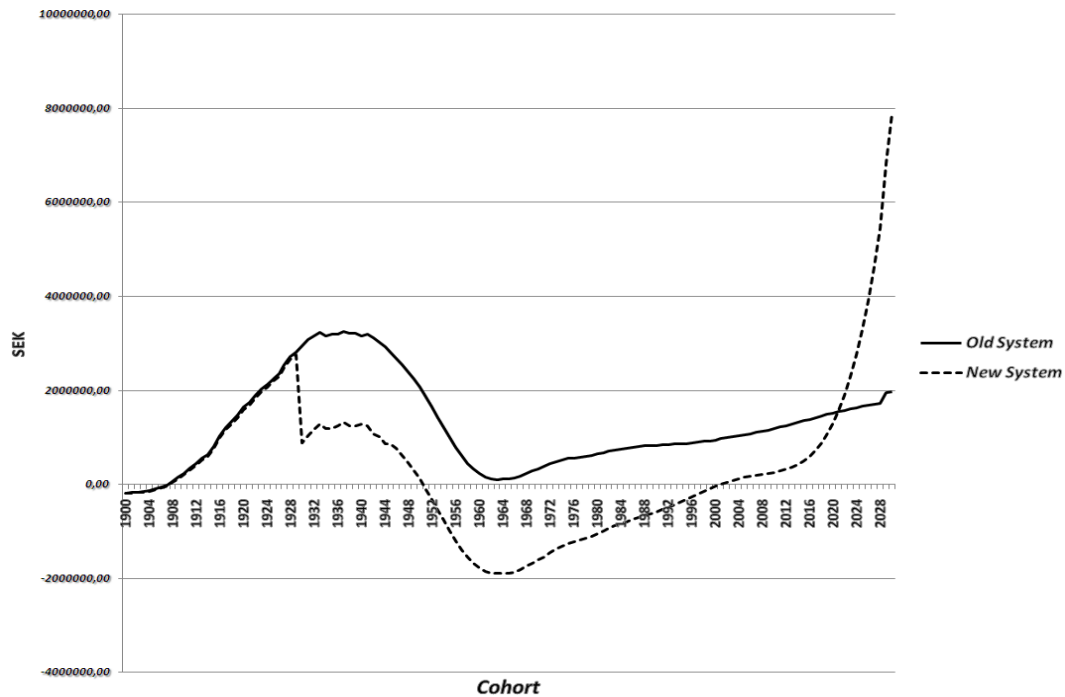


Phasing out an unfunded pension system and moving towards a partial funded one would possibly benefit future generation and achieve long-term sustainability. However, as Miles (1999) asserted, there could be striking impacts to certain cohorts during the transition. This is particularly true when the base and 2<sup>nd</sup> scenario are compared. Figure 2 illustrates that a large group of agents would be experiencing more or less losses, and more strikingly, some would experience a large deficit at age 80.

Cohorts up to 1915 stay completely indifferent since they would have died before the pension reform took place in 1995. The wealth for cohort born between 1915 and 1929 remains roughly indifferent. These generations were retired before the old pension system was phased out, and thus the entitled initial benefit level remained unchanged. However, the word “roughly” means that slight difference might be caused by fluctuations in the rate of return on the first pillar pension. The 1930 cohort became the first to experience an enormous loss as the dash line in Figure 2 suddenly shifts downward. This is mainly because they retired in 1995, the year that new rule was applied, and the annuity was calculated based on their previous pension contribution. As a result, the amount of entitled benefits largely diminished.

And all cohorts born thereafter would experience such adverse impact up until the 2021 cohort.

**FIGURE 2 NET WEALTH AT AGE 80 BY COHORTS IN OLD AND NEW PENSION SYSTEM, RETURN ON PENSION ASSETS GIVEN BY RISK-FREE INTEREST RATE**



## CONCLUSION

This paper deals with the aftermath of the 1994 Swedish pension reform on the life-cycle wealth across all generations 1900-2030. Using agent-based modeling leads us to a rough estimate of the trajectory of wealth accumulation with a cohort perspective, and how that experience is likely to vary among generations. In addition, pros and cons of the pension reform are discussed by quantifying how much wealth each agent would gain or lose and how the accumulation process could be altered through phasing out the old system. It is important to stress that this approach accounts for the evolving process that all over-lapping generations have gone or will go through, which overcome the drawbacks of cross-sectional analysis that appear to have difficulty of reconciling life-cycle behavior with economic and structural changes.

Several broad conclusions can be drawn from the simulation results in this study. First, the DB PAYG pension would likely raise issues of intergenerational equity if the average age at retirement for all agents remains at 65. The threat on the system is mainly derived from the declining support ratio and shrinking tax base. Nevertheless, postponement of retirement might diminish the threat and substantially benefit future generations without phasing out the DB PAYG scheme if all agents quit the labor market and start withdrawing pension benefits at age 70. That, however, needs a strong assumption that the labor market condition is sufficient to absorb older workers, and given that, the extra supply does not push down the wage. Such assumptions might be too optimistic because evidence suggests that the recent

recession has had a severe impact on labor market outcomes, depressing income and employment rates in both the short- and long-runs. For instance, joblessness is widely spreading in Sweden (Bengtsson and Scott, 2010), and, in the US, average age-70 incomes for those age 25 to 64 will fall 4.3 percent from the levels that would have prevailed had the recession not occurred (Butrica, Johnson, & Smith, 2011).

Secondly, if this obstacle is unlikely to be eliminated, replacing the DB PAYG by NDC pension scheme could then be an alternative way to pursue long-term sustainability of the social safety net and benefit future new born cohorts, although it could be costly for a large number of generations.

Thirdly, striking impacts caused by phasing out an unfunded system could be diminished if the pension capital is well-managed and the investment portfolio can offer a real rate of return as high as the long-term bonds yield - 5.8% per annum. If the returns can be kept in line with the assumption here, all the cohorts born since 1960 would be better off than they otherwise would have been in the old pension regime.

Finally, moving from an unfunded to a partially-funded pension system inevitably would be associated with greater uncertainty. Scenario based simulations only inform us of the possible outcomes we can expect if certain conditions are fulfilled, yet future development could lead to a very different picture than the simulations given here. Hence it would be too speculative to suggest a social safety net should be purely dependent on the rate of return from investment in risky capital. It, however, should follow a two-way street and be built upon the essential aim of promoting both working longer and investing better. In this regard, the Swedish notional-defined contribution scheme supplemented by an advanced funded pillar hedges the risk.

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## **Data Source**

Sweden, Life tables for Male and Female, Human Mortality Database  
(<http://www.mortality.org/cgi-bin/hmd/country.php?level=1&cntr=SWE>)

Statistics Sweden (<http://www.scb.se>)

National Transfer Accounts, Sweden, 2003

Historical national accounts for Sweden 1800-2000 (Historiska nationalräkenskaper för Sverige 1800-2000)