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Simulating the Future Pension Wealth and Retirement Saving in Sweden *

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Abstract
In this paper the wealth consequences of the Swedish pension system in the transition from a defined benefit to notional defined contribution system are simulated with almost exact institutional detail, using life cycle profiles estimated from detailed longitudinal micro data. Projected wealth, including different types of pension wealth, are computed and compared between cohorts, gender, wealth deciles and occupational categories. Consistent saving rates and replacement rates allowing consumption to stay constant after retirement are computed. Two different macroeconomic scenarios are considered, one using stylised values for growth, inflation etc. and another using demographically based forecasts. Some conclusions are that the cohorts born in the 1940s are relatively favoured, and so are the wealthiest deciles. Stylised macro assumptions yield more optimistic wealth projections than those corresponding to demographically based projections.

Sammanfattning
I den här arbetsrapporten simuleras förmögenhetskonsekvenserna av det svenska pensionssystemet och övergången från ATP till ett mera avgiftsbestämt system. Vi använder livscykelprofiler för inkomsterna skattade på individbaserade longitudinella data. Framskrivna förmögenheter, inkl. olika typer av pensionsfordringar, beräknas och jämförs mellan kohorter, kön, förmögenhetsdeciler och yrkeskategorier. Konsistenta spar- och ersättningskvoter som tillåter konsumtionen att förbli konstant efter pensionering framräknas. Två olika makroekonomiska scenarion beaktas. I det ena används schablonvärden för tillväxt, inflation etc. I det andra används demografiskt baserade projektioner. Några slutsatser är att fyrtiotalisterna är relativt gynnade, liksom de mer förmögna. Stiliserade makroantaganden ger mer optimistiska utfall än de demografiskt baserade projektionerna.

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1 Introduction

During the last years Sweden has implemented a new old-age pension system that will replace the old defined-benefit system with a notional defined-contribution system complemented with a smaller funded part. One of the most important reasons for the reform was the growing concern that the old system would not be able to stand the financial strain from the retirement of the large baby-boom cohorts born during the 1940s. Hence, one of the goals of the reform has been to design the system so that it will financially survive adverse demographic shocks and dramatic increases in the age-dependency ratio. An implication of the switch from defined benefit to defined contribution is that people themselves will bear a larger risk for ensuring an adequate financial status in retirement in the new system. The so-called second pillar of the new system, which is an advance-funded part where the funds are put into individual accounts and managed privately, underscores this.

Almost all of the Swedish labour market is covered by occupational pension schemes financed through employers' contributions. Occupational pension plans covering blue-collar workers in the private sector, central government employees and local government employees have to a considerable extent been shifted from defined benefit to defined contribution pension plans in recent years to better link benefits to contributions.

In spite of the new emphasis on personal responsibility for the financial status in retirement, research on the effect on Swedish households' economic behaviour of the implementation of the new system is relatively scarce. Furthermore, these studies in general only cover parts of the household's economic situation. Micro-simulations of the pension system normally exclude personal saving for example, which perhaps is understandable considering the notorious lack of agreement surrounding the question of how public retirement saving affects personal saving. But as a consequence of this we know very little about future Swedish pensioners' social security wealth, and even less about the effect on household retirement saving.

The purpose of this paper is to provide well founded simulations of the new Swedish pension system's effect on retirement saving. Our objective is mainly explorative, something that is reflected in our empirical approach.

We start by a brief overview of changes in the old-age pensions system that have the potential of significantly affecting the wealth of individuals who will be retired in the future. After that follows an estimation of the net wealth position – including wealth from old-age pension, occupational pensions and financial and real assets. We project wealth at retirement given an income history and current wealth.

Given this projected retirement wealth we then calculate how much individuals would need to save each year from now in order to maintain an endogenously computed income level after retirement. The pension formulas, earnings histories of each individual and the chosen way of projection of the financial and real wealth determines the rate of calculated saving and replacement rates. The saving and replacement rates are calculated simultaneously. In order to check the sensitivity of our results we perform the calculations with and without net housing wealth included in our wealth measure, using different definitions of the relevant pre-retirement income measure, and assuming different retirement ages.

Our approach is basically the same as in the paper by Mitchell & Moore (1997). However, we add one feature to their approach. In order to perform our wealth projections we need assumptions regarding the future values of aggregate variables such as wage growth, interest rates etc. up to 35 years ahead. Since it generally is very hard to get reliable long-run forecasts of the macro environment it is common in micro-simulations to use static assumptions regarding macroeconomic variables, and this is also the route taken by Mitchell & Moore (1997).

Recently, however, there has been much research on the possibility to use demographic information to make long-run forecasts of macro-economic variables.[1] The main point of this literature is that the behaviour of birth cohorts will change as they move through the life cycle, and since the cohorts are of different sizes the aggregate effect of these changes will influence the macroeconomic environment . Empirical evidence shows that demographically based models are quite good at capturing medium and long-run trends in many macroeconomic variables and, therefore, that they are suitable for long-run forecasting since projections of the demographic situation in themselves are quite accurate.

So, to contrast the standard static projections of macroeconomic variables, we also use projections from demographically based empirical models. Using predictions from these models has the added advantage of making the projections for the macro variables mutually consistent, something the traditional static “high-middle-low” scenarios cannot achieve.

Another important issue in this paper is to compare the actual pension saving, measured as the amount saved in private pension accounts, with our simulations of the saving needs. The

[1] See Malmberg & Lindh (2004), Lindh (2004) for some applications.

information about the amount actually saved comes from the HINK/HEK database and is a modification of the value of tax-deductions due to the pension saving.

Beginning with an examination of net financial and real wealth holdings and projected pension wealth we show that the major components of pension incomes are old-age pensions and occupational pensions and also that there are wide disparities in wealth holdings of the elderly.[2] Our results suggest that projected median old-age pension wealth differ substantially in different birth cohorts, reflecting the effect of assumptions made in the model about transition rules for the different pension schemes but also on the projections of income profiles.

Variation in pension wealth stems largely from gender-specific differences in lifetime income since benefit formulas are tied to an individual's earnings history. We find a substantial difference between the occupational pension wealth of different groups of workers. Compared to the difference in projected pension income due to old-age pension, the differences between genders become higher if occupational pensions also are included since these schemes compensate for incomes above 7,5 *income basic amounts*[3], an income bracket which consists predominantly by males.

The results from the saving needs calculations show that median saving rates fall, and replacement rates rise, with total wealth. Using an average of the best three of the ten income years prior to retirement as a measure of the pre-retirement income in the replacement-rate calculations results in a relatively higher rate of saving for almost every wealth decile. Another important result is that calculated saving needs are relatively low for the baby boom-generation, i.e. those born in the 1940s, compared to other birth cohorts.

One clear difference between static and demographically based forecasts is that the value of old-age and occupational pensions is even higher for those born in the middle of the 1940s compared to younger generations. Higher values of projected pension wealth for the baby-boom generation in the demographically based scenario result in lower prescribed saving rates and higher replacement rates.

If retirement age is set to 61 instead of 65, the projected pension wealth is lower and calculated saving needs in general higher for all individuals, as expected. Furthermore, and not surprisingly, excluding different types of wealth sources from the total projected wealth

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[2] Andersson, Berg & Klevmarken (2002) use the same methodology.

[3] Social insurance calculations are frequently based on the so called *basic amount* (basbelopp), as of 1999 *price basic amount* (prisbasbelopp), which is set annually by the government (in 2005 Skr39400 or circa $5600). As of 2001, there is also an *income basic amount* (inkomstbasbelopp) that is used for some of the calculations in the

leads to higher prescribed retirement saving. For the wealthiest deciles the inclusion of real wealth in the calculation of total pension wealth changes the sign of the saving rate from positive to negative. In general, the importance of net financial and occupational pension wealth increases in higher wealth deciles.

Most middle-aged individuals save in private pension accounts, which is consistent with the life cycle hypothesis. For both men and women, the average amount saved increases by age. In all birth cohorts, men have a greater deducted amount than women, but on the other hand more women save in private pension accounts than men. For both men and women born in the 1940s, reported pension saving is higher than the calculated saving rate, based on a replacement rate assumption of average life income, but is not sufficient to maintain a retirement income equal to the average of three best year ten years prior to retirement. Men born in the 1950s and 1960s have the highest need to increase their private pension saving.

Swedish pension reform

In the 1980s, it became more and more obvious that the National Basic Pension and National Supplementary Pension in Sweden were not well adapted to meet future economic and demographic challenges. In 1991, five of the seven political parties in Sweden came to the agreement that reform was the only way to ensure a financially stable pension system.
In 1994, after reviewing the possible options for reform, the Swedish Parliament reached an agreement to reform the system and approved implementing legislation in 1998. The new pension system in Sweden has the following key features:

- *Fixed contribution rate and partial privatisation.* 16 percent of the pension qualifying[4] income are used for the pay-as-you-go (PAYG) notional defined contribution (NDC) system. The remaining share of the contributions, 2.5 percentage points, is deposited in an individual premium pension account that is managed individually. Unlike the PAYG-part, this share corresponds to money actually saved in pension funds.
- *The lifetime earnings principle.* For workers born in 1938 or later, instead of providing a pre-determined retirement benefit based on the number of years in the workforce and earnings history, the new system provides benefits based on the fixed contributions to

social security system (in 2005 it is Skr 43300 or circa $6200). While the price basic amount is adjusted for inflation, the income basic amount is adjusted for changes in the general income level.

[4] Taxable income from work up to 7,5 income basic amount.

the system paid during the whole of the worker's career. Some redistributive features remain like pension points for military service, tertiary education and parental leave.

- *Individual accounts.* The PAYG-part of the system is a system of notional accounts, which means that money is not actually deposited, but registered for each working individual as an entitlement to future benefits. The National Social Insurance Board sends out year-end statements containing information about the balance statement on the individuals' NDC and funded pension accounts. This statement also contains a projection of the future pension income as an illustration of how the earnings history could affect the future pension wealth.
- *Transition rules for the older workers.* The new system will replace the old one gradually, people born between 1938 and 1953 will continue to receive some of their retirement income based on the rules that existed before the pension reform. The remaining part of their pension comes from the new system, which is fully effective for all individuals born in 1954 or later. Transition generations (born 1938-1953) are guaranteed a pension amount at least as big as that based on the pension points they earned under the old national supplementary pension scheme up to the end of 1994, so called *Guaranteed supplement* rule (G94). Individuals born before 1938 receive all the benefits by the old system.
- *A guaranteed minimum.* The Swedish government will continue to guarantee a minimum pension, funded by general tax revenues.
- *Annuitization.* Pension points are converted to an annuity at the age of 65 using the expected remaining life time. This annuity is then indexed to follow the growth of the average real wage.

Further details on the old-age pension system as well as the different occupational pension systems can be found in Appendix 2.

2 Data and projection technology

Data on real and financial net assets, background variables (type of collectively agreed pension etc.) in this paper are taken from the HEK (Hushållens Ekonomi) survey for the year 1997, which was sampled from the LINDA data base. It contains information on roughly 39 000 individuals. The HEK surveys are compiled annually and are administrated by Statistics Sweden (SCB). In order to get additional information on the individuals' income history we can make use of information from the LINDA (Longitudinal Individual Data for Sweden) database which goes back to 1968.[5] This information is used in the computation of the imputed life cycle wage profiles that are needed in the calculations of pension wealth. Calculations are made for a selection of roughly 15 000 individuals, born between 1933 and 1967, who received a positive income in 1999.[6]

The starting point for our analysis is an examination of the projected net wealth levels at retirement, given a specific net wealth level in 1997. The net wealth has been categorised into *net financial wealth*, *net housing wealth* and *pension wealth.* Asset values for each of these categories have been projected to a fixed retirement age (61/65).

Pension wealth for individuals are calculated using individual information collected from the HEK/LINDA databases and include present value calculations of old-age public pension and occupational pension benefits at alternative retirement ages. Pension calculations in our model are based on earnings through 1999 and projected earnings to a specific retirement age. To make these calculations tractable a couple of simplifying assumptions have to be made. For example, all individuals with positive income in 1999 are assumed to remain employed until retirement. To take into account the possibility of early retirement would complicate the analysis to a large extent. Hence, we do not allow for early retirement in the wage predictions. However, it should be noted that individual incentives for early retirement are high if the estimated saving rates are negative.

Projected values of pension wealth are calculated using different qualified assumptions about mortality, interest rate, inflation, and wage growth – assumptions are both based on static scenarios used by the National Social Insurance Board (RFV) and on our own demographically consistent projections for Sweden. For further information about assumptions, calculations and projection technologies used in this paper see Appendix 1 and 2.

[5] We were granted permission to do this connection between the databases by Statistics Sweden.
[6] We use 1999 as the base year here since the LINDA database contained information on the individuals' income up to 1999 at the time we started this project.

3 Initial and projected wealth

Initial financial and real net wealth

The data in Table 1 and 2 provide an overview of the net financial and real wealth for individuals in 1997. It shows the composition of initial net wealth excluding social security wealth from old-age and occupational pensions for men and women in different birth cohorts in our sample.

Table 1 Initial financial and real net wealth in different birth cohorts, 1997, women

	SAMPLE SIZE	MEAN VALUE	PERCENTILES (SEK)				
Year of birth		(SEK)	10	25	50	75	90
1933-1937	626						
Total financial assets		211 785	0	8 527	83 351	236 876	566 133
Total real wealth		235 989	0	0	77 491	312 137	638 229
Total Debt		-62 815	-207 543	-78 664	0	0	0
1938-1943	1 111						
Total financial assets		217 716	0	6 930	70 620	224 864	481 967
Total real wealth		328 328	0	0	161 790	466 056	846 852
Total Debt		-119 772	-303 270	-154 483	-39 971	0	0
1944-1948	1 251						
Total financial assets		136 568	0	0	36 126	134 791	332 952
Total real wealth		326 634	0	4 500	196 530	470 400	797 336
Total Debt		-141 305	-358 617	-200 031	-82 714	-440	0
1949-1953	1 106						
Total financial assets		123 102	0	0	23 432	90 711	248 566
Total real wealth		351 252	0	13 398	233 098	462 536	836 802
Total Debt		-173 627	-397 400	-243 773	-126 062	-22 031	0
1954-1958	1 113						
Total financial assets		91 677	0	0	8 084	62 367	217 978
Total real wealth		340 902	0	13 500	248 700	456 030	812 831
Total Debt		-240 522	-446 499	-290 695	-159 387	-32 190	0
1959-1963	1 128						
Total financial assets		56 669	0	0	5 622	44 413	129 028
Total real wealth		272 845	0	0	182 295	376 140	641 923
Total Debt		-203 009	-464 940	-298 448	-149 474	-42 539	0
1964-1967	993						
Total financial assets		40 997	0	0	1 546	41 085	113 442
Total real wealth		200 599	0	0	93 318	317 760	528 996
Total Debt		-193 938	-446 903	-303 337	-140 240	-27 231	0
Total (1933-1967)	7 328						
Total financial assets		121 196	0	0	21 478	101 892	289 258
Total real wealth		299 671	0	0	180 350	417 975	739 035
Total Debt		-167 913	-398 446	-239 122	-97 522	-3 687	0

Not surprisingly, older age cohorts have higher accumulated financial wealth in 1997 than the younger ones. Financial wealth is zero for the younger cohorts and reaches about a month's gross wage cost around the 75th percentile. For the older birth cohorts, the median net financial wealth is almost ten times higher than for the youngest.

Distribution of net financial wealth by gender is quite equal. Women born in the 1940s have the same value of financial wealth as men in the same age-group. Regarding the real wealth, men in the older age-groups have almost double the accumulated real wealth of women in the same age group.

Table 2 Initial financial and real net wealth in different birth cohorts, 1997, men

	SAMPLE SIZE	MEAN VALUE	PERCENTILES (SEK)				
Year of birth		(SEK)	10	25	50	75	90
1933-1937	681						
Total financial assets		292 958	0	5 062	87 477	270 400	702 848
Total real wealth		507 654	0	91 740	353 843	682 825	1 135 216
Total Debt		-129 814	-352 827	-180 122	-43 865	0	0
1938-1943	1 130						
Total financial assets		593 836	0	4 304	61 500	226 044	651 388
Total real wealth		565 446	9 000	115 721	390 175	744 150	1 204 624
Total Debt		-199 452	-433 449	-243 246	-111 233	-6 959	0
1944-1948	1 324						
Total financial assets		222 551	0	692	39 919	169 727	483 414
Total real wealth		554 787	9 000	122 723	381 113	665 398	1 081 960
Total Debt		-203 580	-448 730	-279 605	-152 058	-33 013	0
1949-1953	1 170						
Total financial assets		142 361	0	0	19 086	106 877	299 378
Total real wealth		470 572	4 500	77 418	343 710	577 147	938 104
Total Debt		-241 529	-504 119	-327 083	-172 664	-50 346	-75
1954-1958	1 108						
Total financial assets		330 141	0	0	10 677	83 679	277 085
Total real wealth		539 039	0	50 963	280 220	507 874	853 353
Total Debt		-282 496	-503 994	-334 225	-175 023	-52 647	0
1959-1963	1 155						
Total financial assets		105 784	0	0	6 192	70 793	232 852
Total real wealth		331 704	0	30 240	214 500	428 085	726 253
Total Debt		-218 783	-508 471	-329 390	-163 600	-35 644	0
1964-1967	1 088						
Total financial assets		58 144	0	0	4 129	46 646	154 044
Total real wealth		231 212	0	13 500	112 415	335 252	557 102
Total Debt		-190 513	-456 663	-287 927	-132 391	-27 493	0
Total (1933-1967)	7 656						
Total financial assets		245 950	0	0	21 791	122 781	376 917
Total real wealth		457 381	0	53 280	294 900	555 943	948 465
Total Debt		-214 066	-473 428	-293 985	-139 502	-26 234	0

As mentioned above, pension calculations in our model are based on earnings through 1999 and projected earnings to retirement age. The cross-generation variation in wealth from old-age pension and occupational pension wealth will largely stem from differences in lifetime income since benefit formulas depend on individuals' earnings history. Some part of the cohort effects could of course include the change associated with the increasing work participation of women. Since individuals of a different age-group face a quite different pension schedule, it is difficult to isolate the effect of earnings history from that of social security policies.

Table 3 Earnings in 1999, women

	SAMPLE SIZE	MEAN VALUE	PERCENTILES (SEK)				
Year of birth		(SEK)	10	25	50	75	90
1933-1937	272	145 868	59 520	93 743	141 360	185 535	231 235
1938-1943	1 111	184 425	87 494	133 548	177 815	225 060	275 652
1944-1948	1 251	197 027	102 969	147 684	187 860	236 220	277 884
1949-1953	1 106	208 128	125 624	162 191	197 718	243 102	282 199
1954-1958	1 113	200 424	113 981	151 032	190 464	232 872	285 324
1959-1963	1 128	184 646	101 482	141 360	172 980	213 528	273 457
1964-1967	993	178 049	95 827	130 944	167 772	209 808	269 700
Total	6 974	190 622	100 440	142 476	181 164	225 804	277 140

Table 4 Earnings in 1999, men

	SAMPLE SIZE	MEAN VALUE	PERCENTILES (SEK)				
Year of birth		(SEK)	10	25	50	75	90
1933-1937	355	208 337	70 606	140 616	196 788	260 400	350 796
1938-1943	1 130	262 816	109 814	177 072	230 082	292 485	413 255
1944-1948	1 324	285 441	138 756	195 672	247 938	323 361	446 028
1949-1953	1 170	277 033	135 780	192 696	244 776	317 037	444 391
1954-1958	1 108	277 901	145 080	200 136	245 334	315 735	442 680
1959-1963	1 155	265 556	135 259	186 743	237 336	310 248	427 205
1964-1967	1 088	254 280	133 102	185 349	233 430	288 207	385 429
Total	7 330	267 978	129 828	187 860	238 824	306 156	422 592

The heterogeneity of income in 1999 for the different birth cohorts in our sample shows up in Table 3 and 4. Not surprisingly, women's income is relatively lower for all birth cohorts and income deciles. For almost all age groups, the wealthiest individuals have approximately 80 percent higher earnings in 1999 than the least wealthy one. Those born in the 1940s and 1950s have the highest annual earnings in 1999.

Projected wealth at retirement – forecasts from static assumptions

To measure the importance of the major components of pension income, we begin with descriptive data on pension wealth for different birth cohorts. Figure 1 and 2 show the present value of total pension wealth projected to the retirement age, including old-age pension and occupational pension. The figures show that pension claims are, as expected, the dominant source of retirement wealth. For each birth cohort and percentile, old-age pension income exceeds all other sources of retirement income.

Figure 1 Projected pension wealth, financial and real wealth in different birth cohorts, women

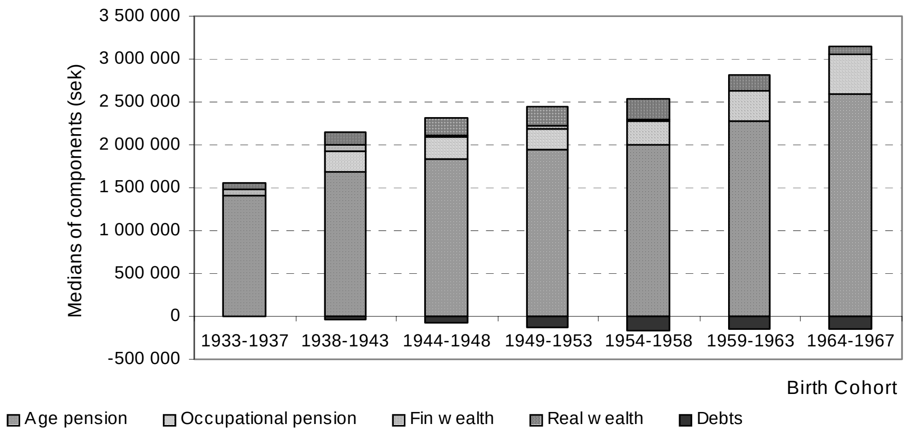
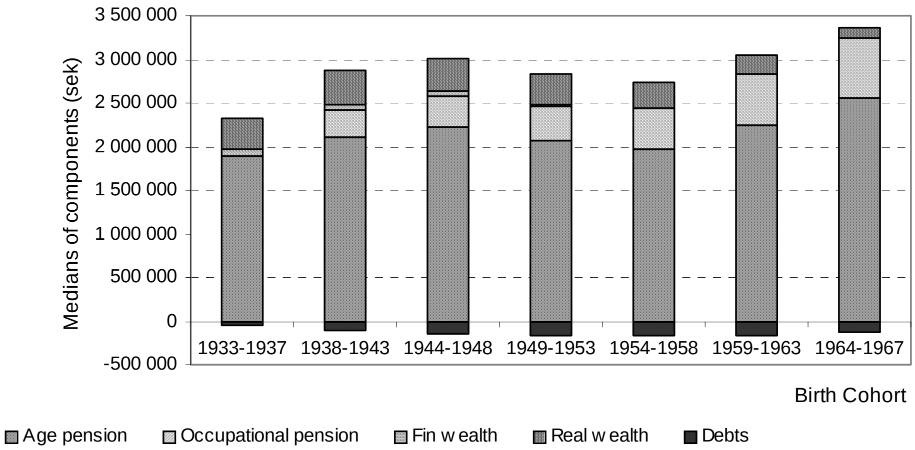


Figure 2 Projected pension wealth, financial and real wealth in different birth cohorts, men



The cohort pattern for the old-age pension is clearly increasing for the younger generations. There are substantial differences by birth year as well as by gender. In general, older individuals have higher net real and financial wealth although the differences by birth cohort are quite small up to those born in the 1950s and 1960s. Notice that we assume that the asset portfolio weights are the same as the initial ones in the projections, so we ignore the fact that the cohorts will allocate their wealth to separate assets differently over the life cycle. This is likely to yield too low an estimate of the ratio financial to real wealth.[7]

Differences in men and women's projected pension wealth follow the differences in income illustrated in Table 3 and 4. However, the level of old-age pension wealth increases relatively more for younger women than for men, which leads to decreasing differences between sexes for the younger birth cohorts. There are several reasons for this pattern:

- In our calculation we assume that all individuals with positive income in 1999 remain employed until the retirement age, thus we probably overestimate the future work-life participation of women in younger birth cohorts.
- When calculating the funded part of the old-age pensions we use the average of nominal market returns based on historical rates through 2003 and static projections through 2031. We even use a static assumption about the future rate of return on *income pension* wealth, assuming a fixed yearly real income growth. So the younger the individual is, the longer period he/she accumulates interest on the defined-contribution part of the pension wealth. In combination with the possible overestimation of the future work-life participation of women this causes a relatively high pension wealth for the youngest women in our sample.
- We use a gender-*neutral* life tables in calculation of yearly pension wealth from the defined-contribution part, i.e. the part of the old-age pension received to a greater extent by the younger cohorts. However, to get the *total* value of the old-age pension wealth we use the gender-*specific* life tables, with the purpose of capturing the gender redistribution effect of the pension system.
- In the occupational pension system, the average pension wealth increases across cohorts, which has to do with the rate of return on the defined-contribution part of the pension and of course on our assumptions about income life profiles. So the projected pension wealth for the younger cohorts includes more uncertainty from these two sources.

[7] See Andersson (2001) for a study of the portfolio allocation over the life cycle of Swedish households.

Figure 3 **Portfolio shares of projected wealth in different wealth deciles, medians**

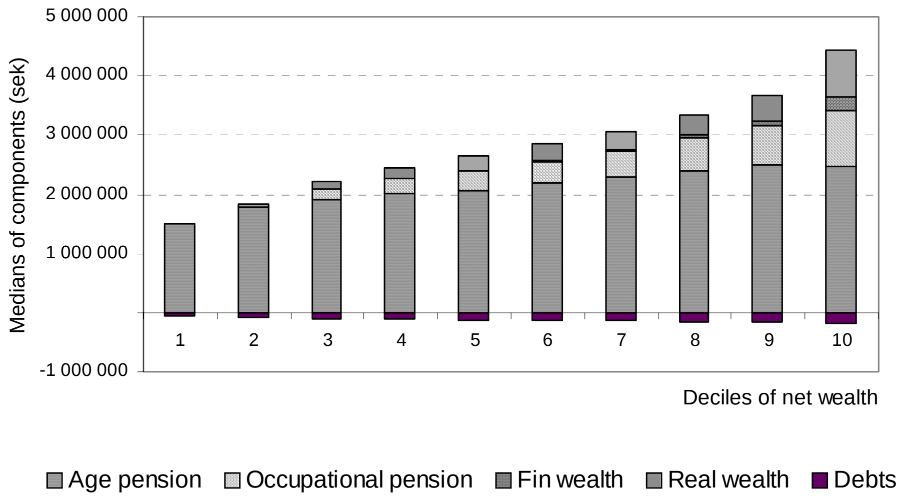


Figure 3 shows the wealth distribution and composition across the population and the inequality of the wealth distribution.[8] It also demonstrates the great importance of financial assets for the wealthiest individuals, and pension wealth for the less wealthy. Our data confirm the results in e.g. Andersson, Berg & Klevmarken (2001) that pension wealth, without a doubt, is the single most important asset for the majority of Swedes. Furthermore, these calculations are here supplemented with occupational pensions and the results show that the occupational pension wealth becomes the second most important asset. The importance of the occupational pension in the portfolio increases dramatically for deciles in the lower half of the distribution while it remains constant for those in the upper half.

For the financial assets there is an opposite pattern and the weight in the distribution increases dramatically for the most wealthy.

[8] Compared to Figure 1 in Mitchell & Moore (1997) the Swedish distribution is clearly less skewed than in the U.S.

Figure 4 **Composition of old age pension wealth in different birth cohorts, medians, women**

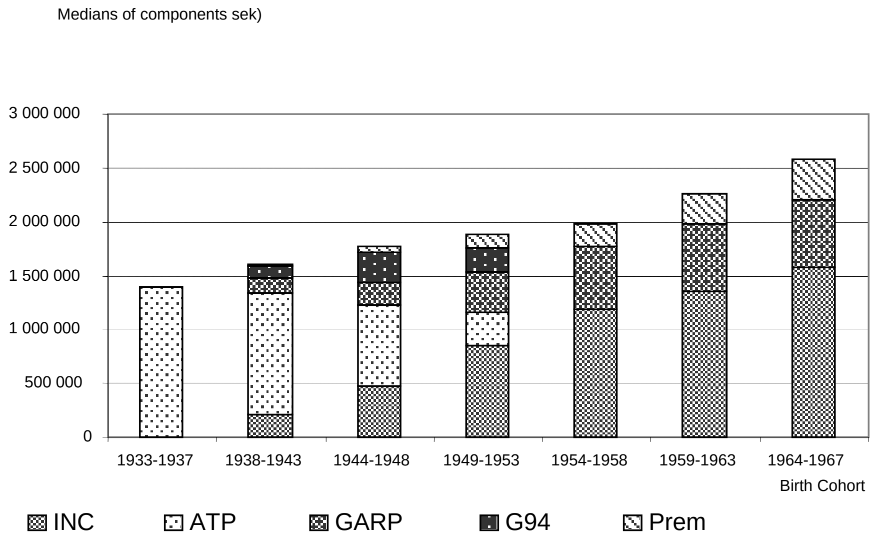
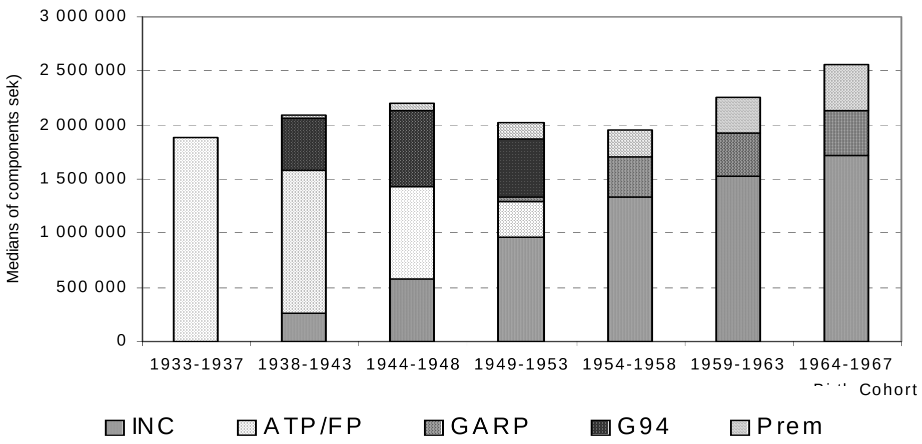


Figure 5 **Composition of old age pension wealth in different birth cohorts, medians, men**



In Figure 4 and 5 we can compare the size of the components of the old-age pension wealth for men and women. In the figures INC stands for *pension income,* the pay-as-you-go part of the new system, ATP/FP is the old system's *supplementary pension/national basic pension*, GARP is the *guarantee pension* in the new system, G94 is the *guaranteed supplement,* and Prem is the *premium pension* which is the funded part of the new system. [9]

[9] See Appendix 2 for a more detailed explanation of different components of the Swedish old-age pension system.

Old-age pension benefits, discounted back to 1997, are worth about 1.8 million Swedish kronor for women born in the 1940s and 2.2 million for men. For those born in the 1960s the value of old-age pensions is approximately 2.4 million for both men and women.

As mentioned earlier, all individuals with positive income in 1999 are assumed to remain employed until retirement. This assumption leads to relatively higher average incomes for younger women. Coupled with the method we use for calculation of the total projected pension wealth this leads to higher average *income pension* (INC) for younger women. To maintain the total pension amount the calculated annual pensions is multiplied with the average life span for men and women. That is, we use a gender-*neutral* divisor in calculating annual old-age pension, as stipulated in the rules for the conversion of pension wealth to annuities, but gender-*specific* divisors in calculating the total pension wealth.

A relatively large part of women's benefits in all birth cohorts comes from the *guarantee pension* (GARP), because of corresponding earnings differences between the sexes. For men, the cohort pattern regarding the old-age pension is not obvious. Disregarding the oldest cohort, there is a U-shaped pattern. For those cohorts that only belong to the new pension system, the younger the individual the greater the pension wealth. The pattern is just the opposite for the cohorts that get pensions from both the new and old systems. For them there is a decreasing pattern where older cohorts have a larger age pension wealth than younger cohorts. This can both be an effect of the "compensation" these transition generations get from the system, and an effect of them having a higher life-time income path.

Regarding the transition generations (born between 1938-1953) we can see that men get relatively larger contributions from the guaranteed supplement (G94) compared to women. So, here we have one explication for the pattern in Figure 2 above. It is also clear from this graph that the increasing pattern for the old-age pension wealth for the youngest cohorts (those that only draw benefits from the new system) in part can be explained by the assumptions made for the defined contribution pension schemes. This effect is partially balanced by an opposing effect from the *guarantee pension* (GARP). As expected, there is an increasing pattern for the funded part of the old-age pension for younger generations.

Figure 6 **Composition of net wealth in different occupational groups, medians**

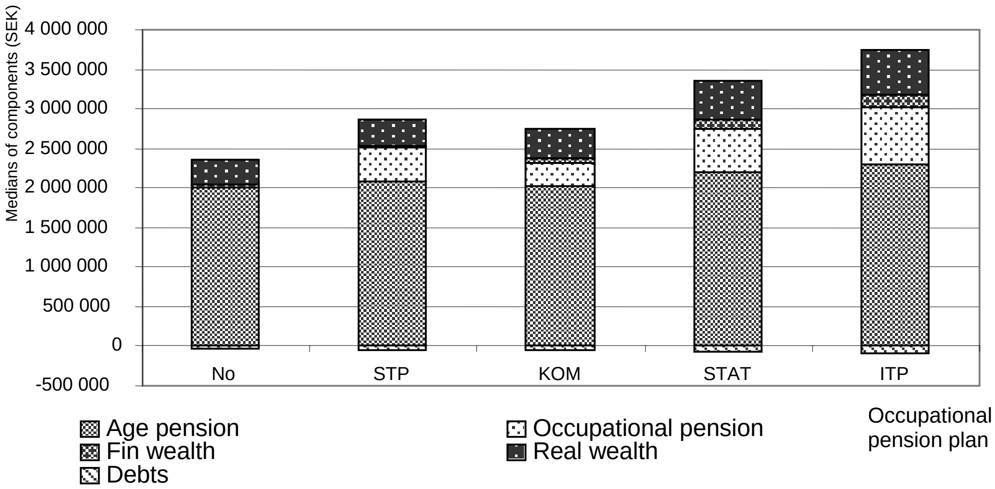


Figure 6 describes the difference in the wealth composition between groups belonging to different occupational-pension schemes. The pattern is as expected – the largest difference is between those belonging to the blue-collar collective, i.e. blue-collar and local government worker, and those belonging to the white-collar collective. White-collar workers have somewhat larger real, financial, and old-age pension wealth. The main source of wealth differences, however, actually comes from the wealth related to the different occupational pension schemes.

Gender-specific differences in working-life income is of course one important explanation for differences in post-retirement income. The gender differences are increased by occupational pensions, which compensates for incomes above 7,5 income basic amounts. i.e. the maximum benefits in the state pension scheme. A major share of those employed in local government are women in low-income jobs. At the same time a majority of white collar workers are men.

Projected wealth at retirement – alternative case with demographically based forecasts

In this section the wealth projections and the present values of benefits are calculated using demographically based projections for Sweden. For further information about the demographically based forecasts see Appendix 1.

Figure 7 shows the portfolio shares of projected assets in different wealth deciles. Compared to the projected portfolio weights with static assumptions in Figure 3 the weights for financial assets and the pension wealth components are smaller here. For real assets the pattern is similar, but the increased weight in the portfolio for the wealthiest individuals is even more dramatic. Compared to the scenario with static assumptions there is a reduced importance for old-age pension wealth and real assets here.

Figure 7 **Demographically based forecasts. Portfolio shares of initial assets in different wealth deciles, medians**

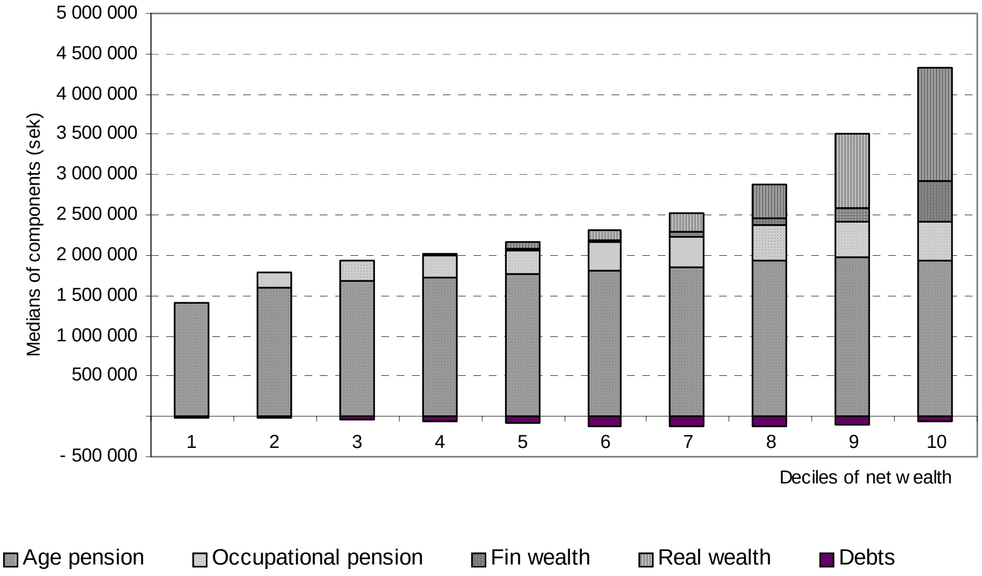


Figure 8 and Figure 9 show the composition of projected net wealth in different birth cohorts. Compared with Figure 1 and 2 for the static assumptions we can see that the patterns have changed dramatically. One clear difference is that the value of old-age and occupational pensions is even higher for those born in the middle of the 1940s compared to the younger generations.

Figure 8 **Demographically based forecasts. Composition of old age pension wealth in different birth cohorts, medians, women**

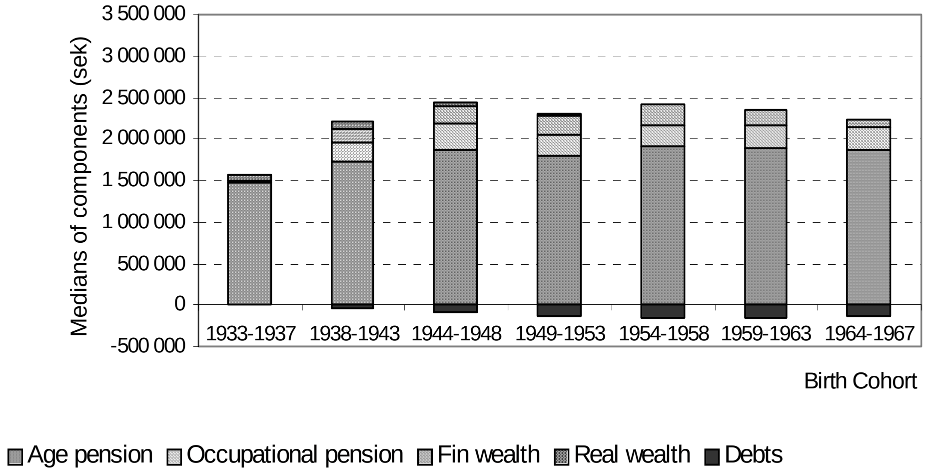


Figure 9 **Demographically based forecasts. Composition of old age pension wealth in different birth cohorts, medians, men**

Figure 10 and 11 show the components of projected old-age pension wealth in different birth cohorts. Compared to Figure 4 and 5 that show the same graph for the static assumptions the three oldest generations' values of *guaranteed supplement* are higher than in the static scenario. There is a substantial decrease in the value of *income* and *guarantee pension* wealth for the younger generations, depending on the assumption of lower future value of *income basic amounts* compared to the static scenario.

Figure 10 **Demographically based forecasts. Composition of old age pension wealth in different birth cohorts, median, women**

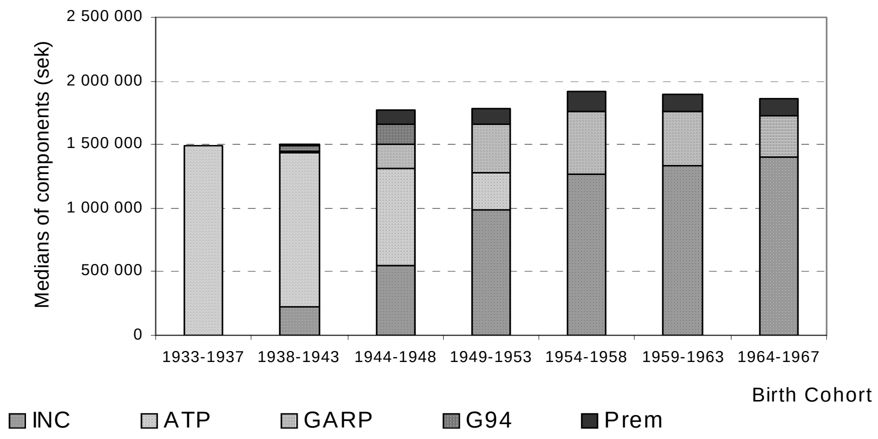
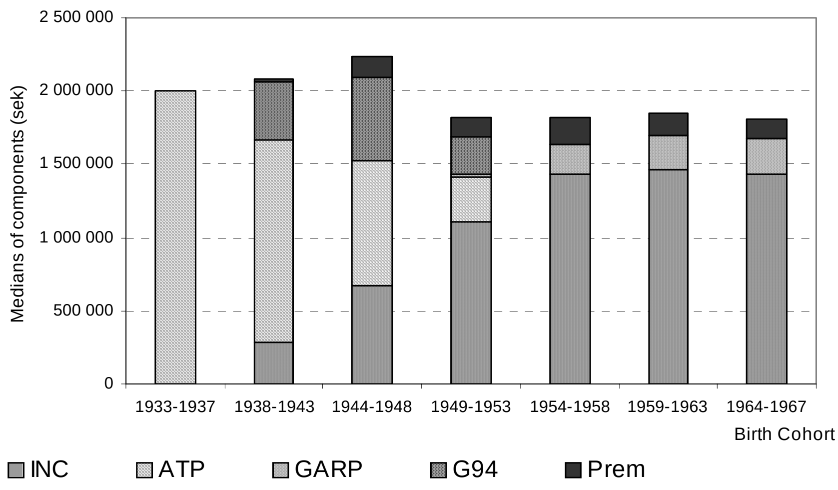
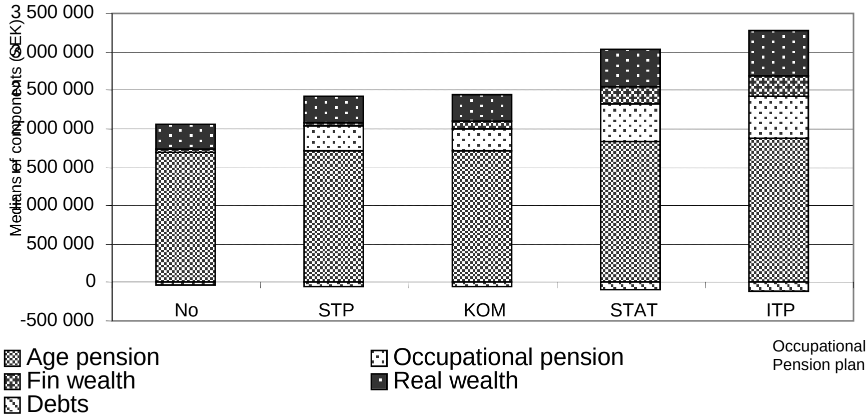


Figure 11 **Demographically based forecasts. Composition of old age pension wealth in different birth cohorts, median, men**



The composition of projected net wealth in different occupational groups is shown in Figure 12. Regarding differences between the occupational groups the results are very similar to Figure 6. However, the really big difference between the two scenarios can be seen in the values of the old-age pension wealth, which is lower than in the scenario with static assumptions – something that could be due to the assumptions about future real wage growth and inflation. The results regarding the value of occupational pension and financial assets are quite similar.

Figure 12 **Demographically based forecasts. Composition of net wealth in different occupational groups, medians**



4 Saving and replacement rates

The second step in our analysis is to evaluate saving needs, given the individual earning levels and assets projected to alternative retirement ages.

The life-cycle hypothesis is still one of the dominant economic models for analysing saving behaviour of individuals. The simplest version of this model is that individuals save during periods when labour income is relatively high to avoid reductions in consumption when the income is low, i.e. individuals maximise utility by smoothing consumption through time. However, existing household-level data provide quite limited support for this simple form of the theory (Poterba, 1994). For example, many households reach retirement age with virtually no financial assets and the decumulation of household financial assets after retirement is too slow to conform to the simplest version of the life-cycle model. There is evidence that housing equity is typically not used to support consumption of the elderly, at least not until quite advanced ages (Venti & Wise 1996).

A lot of studies try to present more complex theoretical models. For example, Hubbard, Skinner & Zeldes (1994) have developed a model for finding the optimal consumption rules of households facing different types of uncertainty and various constraints on consumption, i.e. the existence of a precautionary motive for asset accumulation.

Another alternative to the simple life-cycle model is to add a bequest motive as explanation for saving of the elderly. Several different studies rationalises the bequest motive.

For example, Bernheim, Shleifer & Summers (1985) discuss the potential role of bequeathable wealth in improving the lifestyle of elderly individuals.

In this paper we choose to use a ”retirement rate” approach in calculation of saving needs. Quite often, the discussion in Swedish media about the private saving needs are based on that particular concept. The objective here is quite simple; to equate pre-retirement and post-retirement consumption on an expected value basis, i.e. individuals are (as in a simple life-cycle hypothesis) assumed to keep consumption fixed before and after retirement.

Our technique for calculation of saving needs is based on the model discussed in Mitchell & Moore (1997). We analyse the adequacy of projected post-retirement wealth compared to the level of wealth needed to sustain some specific level of pre-retirement consumption. In the calculations account is taken of the fact that the post-retirement income is taxed more lightly because of progressive income tax rates.

However, as explained above, we add a couple of features to the Mitchell & Moore approach. In addition to the standard static projections of macroeconomic variables, we also use projections from demographically based empirical models. Furthermore, we experiment with different measures of the relevant pre-retirement income by calculating replacement rates using two different denominators, or levels of career average earnings:

1. An average of the best three of the ten years prior to retirement (3M).
2. The income average, which is an average over all years from 1960 or later to the year of retirement (AV).

Model for saving and replacement rates

The calculations of the saving and replacement rates follow the approach in Mitchell & Moore (1997) and their derivation of the model is reproduced in this section.

To solve for the saving and replacement-rate targets we begin with the basic replacement-rate concept. This equates consumption pre-retirement to net income post-retirement:

$$Y_P - T_P - S = Y_F - T_F \qquad (1)$$

where Y_P is one of our two measures of pre-retirement income, T_P is pre-retirement taxes, S is saving, Y_F is post-retirement income, and T_F is pre-retirement taxes. Rearranging (l) and expressing saving as a percentage of income (S = sY_P) gives the formula for the replacement rate, *RR*:

$$RR = \left(Y_P\left(1-s\right) - T_P + T_F\right)/Y_P = Y_F / Y_P \tag{2}$$

The replacement rate gives an income level such that a household may keep consumption at the same level before and after retirement.

Next, the future income stream, Y_F, is converted to a level of wealth needed to sustain that income level in retirement by multiplying by an annuity factor, *AF*. Thus, the wealth level required to maintain a smooth consumption profile in retirement becomes:

$$AF * Y_F = AF * RR * Y_P = AF\left[Y_P\left(1-s\right) - T_P + T_F\right] \tag{3}$$

The difference between this need level and the projected value of assets already held by any given household, *PROJ*, is the amount that must be saved between now and retirement, or there will be a shortfall in projected retirement assets.

The wealth shortfall will finally be used to determine a prescribed saving rate. This rate represents what the households would need to save each year until retirement to achieve the projected consumption standard. Assuming that a wealth shortfall is met by saving some level percent of earnings per year, Mitchell & Moore (1997) calculates the amount saved in retirement as:

$$\sum_{t=1}^{T} Y_C\left(1+g\right)^t\left(1+r\right)^{T-t} s = sY_C \sum_{t=1}^{T}\left(1+g\right)^t\left(1+r\right)^{T-t} = sY_C Z \tag{4}$$

or

$$AF\left[Y_P\left(1-s\right) - T_P + T_F\right] \text{ - } PROJ = sY_C Z \tag{5}$$

where

$$Z = \sum_{t=1}^{T}\left(1+g\right)^t\left(1+r\right)^{T-t}$$

Y_C is the household’s current income, and *g* and *r* are assumed rates of wage growth and return on savings, respectively. We can then solve for a rate of saving, *s*:

$$s = \frac{AF\left[Y_P - T_P + T_F\right] - PROJ}{Y_C Z + AFY_P} \tag{6}$$

Note that a specific replacement rate might imply an infeasible saving rate given a household’s earnings and projected assets. Thus, the replacement rate and saving rate are determined jointly through an iterative process in the calculations. First, an arbitrary replacement rate is selected as a starting point and then used to determine an initial level of post-retirement income and taxes. The resulting taxes are substituted into equation (6) to obtain an implied saving rate. This saving rate is then substituted into equation (2) to determine a new replacement rate. The process is iterated until saving and replacement rates converge such that both equations (2) and (6) hold.

Saving needs and replacement rates – results based on static assumptions

We report saving and replacement rates for the 14 984 individuals in our sample who reported positive earned income in 1999. Results are reported for two different denominators, or levels of career average earnings.

Values of prescribed saving and replacement rates by wealth decile are reported in Figure 13 and 14. The figures show the median saving and replacement rates for the two measures of pre-retirement income that we use. Here we can see a number of interesting results. First of all, the results show that, as expected, median saving rates fall, and replacement rates rise, with total wealth. Second, using an average of the highest three of the ten years prior to retirement as a measure of pre-retirement income requires a relatively higher rate of saving for almost every wealth decile. This is due to the fact, that the highest three of the ten years prior to retirement is higher than the income average for almost all individuals in our sample.

The differences are relatively higher for the wealthiest decile, which can be seen in the calculated saving rates; there is a fall from 0% to -5% if we use the income average as a measure of pre-retirement income instead of the highest three of the ten years prior to retirement. For the poorest decile, the saving rate falls from 12% to 9%. Almost half of the individuals have more than sufficient post-pension assets if we calculate saving rates using the income average as a measure of pre-retirement income.

The “de-saving” position corresponds to replacement rates above one, meaning that the retirement income of these individuals is greater than their pre-retirement income calculated as described above. Figure 14 displays the distribution of replacement rates corresponding to the saving rates in Figure 13. As expected, most of the individuals have replacement rates below one and the median replacement rate is 90 percent.

Figure 13 **Calculated saving rates, different wealth deciles, medians**

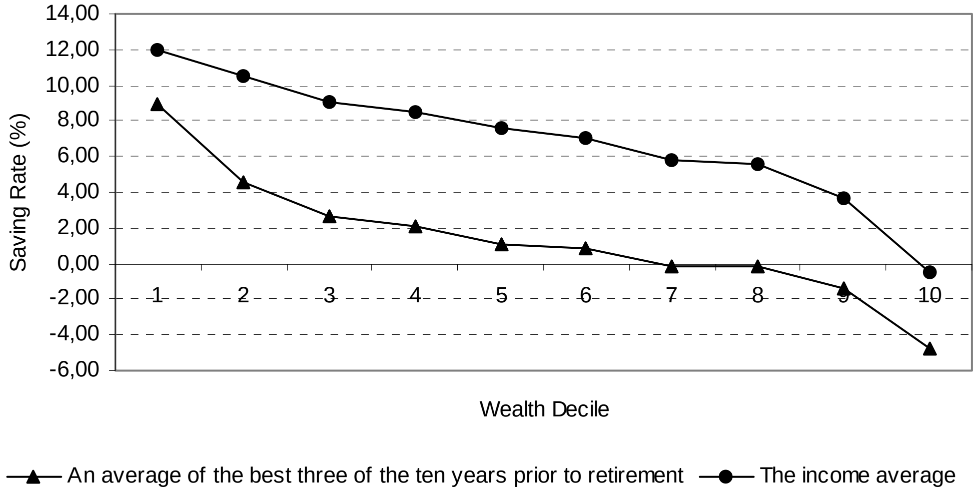
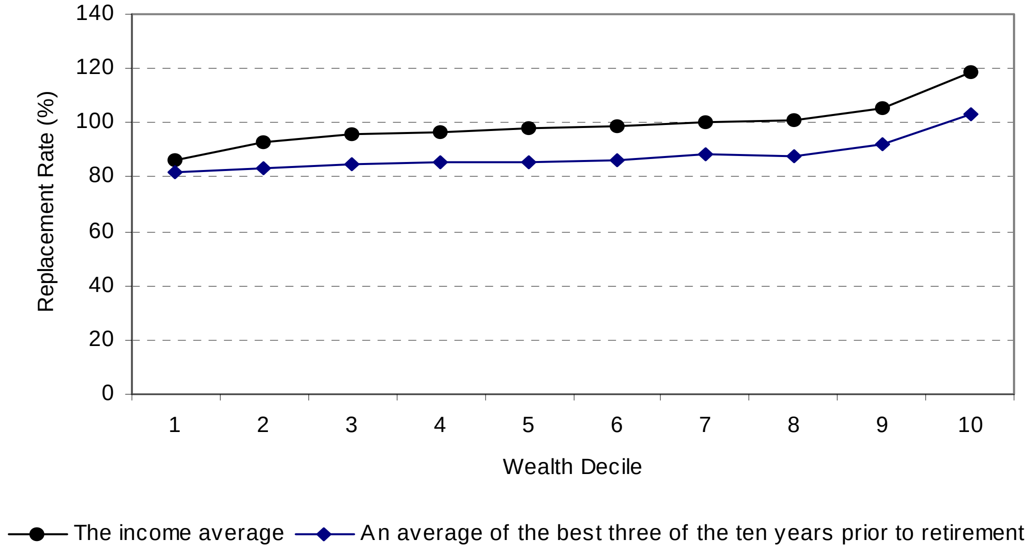


Figure 14 **Calculated replacement rates, different wealth deciles, medians**



Values of prescribed saving and replacement rates by birth cohort are reported in Figure 15 and 16. As we can see, median saving rates fall, and replacement rates rise, for the baby boom-generation, i.e., people born between 1938-1950. Individuals in this group receive some part of their old-age and occupational pensions from the old systems.

Figure 15 **Calculated saving rates, by birth cohort, medians**

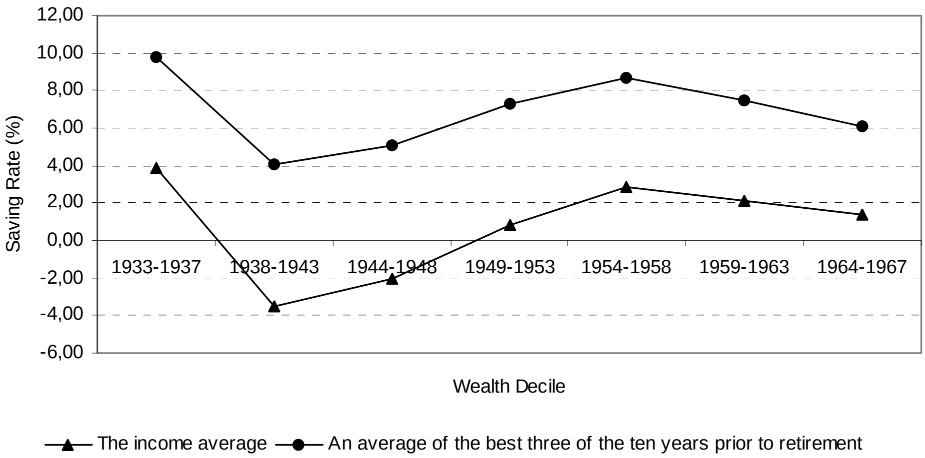
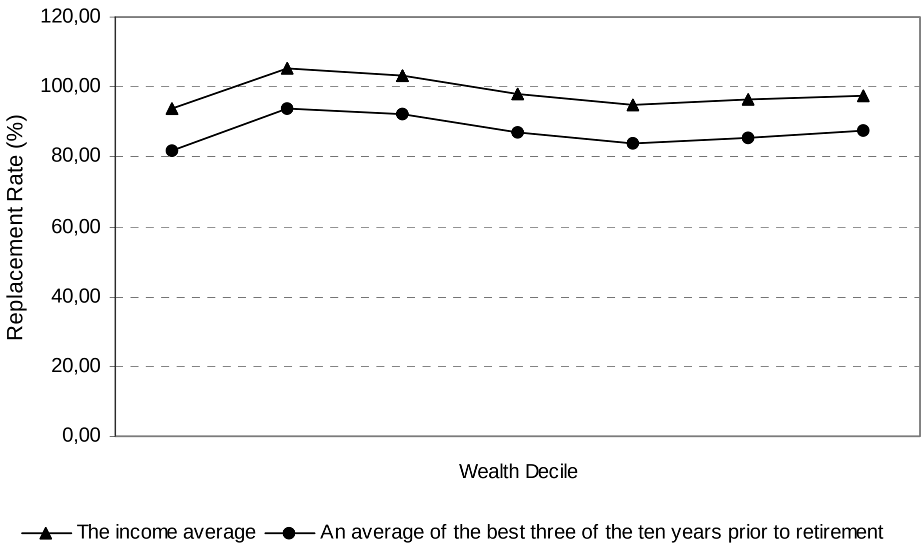


Figure 16 **Calculated replacement rates, by birth cohort, medians**



Saving needs and replacement rates – results based on demographic projections

Values of prescribed saving and replacement rates by wealth decile for the demographically based scenario are reported in Figure 17 and 18. For the median wealth decile, the prescribed saving rates in the demographically based scenario are relatively higher and replacement rates lower than in the static scenario. Retirement at age 65 would require saving 3.5% (AV-alternative) of earnings (compared to 1.1% in static scenario). This would yield replacement rates of about 94% (compared to 98% in static scenario).

Figure 17 **Demographically based forecasts. Calculated saving rates, different wealth deciles, medians**

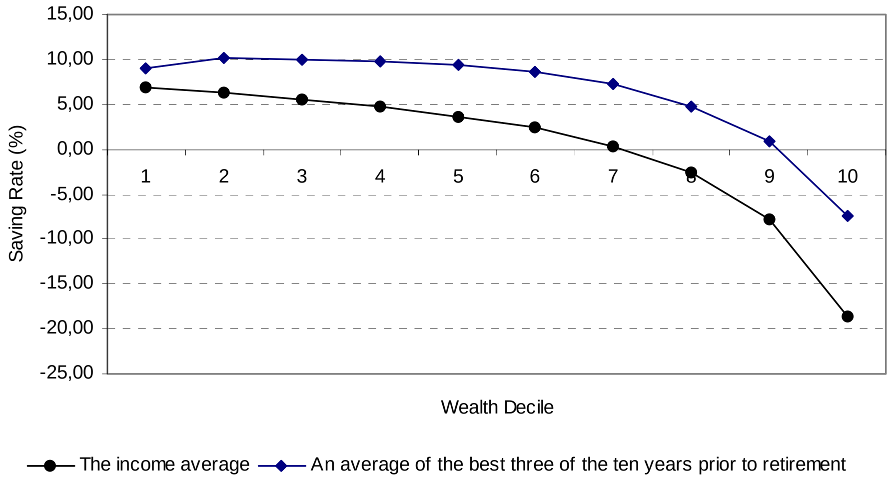
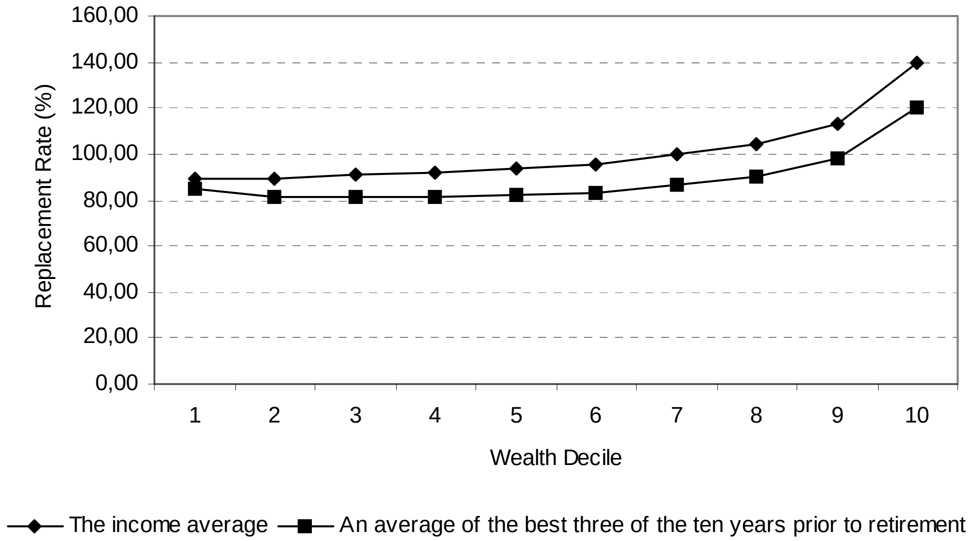


Figure 18 **Demographically based forecasts. Calculated replacement rates, different wealth deciles, medians**



Values of prescribed saving and replacement rates by birth cohort are reported in Figure 19 and 20. Higher values of projected pension wealth for the baby-boom generation in the demographically based scenario result in lower prescribed saving rates and higher replacement rates. The median saving rates fall, and replacement rates rise up to the birth cohort born between 1944 and 1948. For the youngest cohorts (born in the 1950s and 1960s), the saving rate is higher than in the static scenario.

Figure 19 **Demographically based forecasts. Calculated saving rates, by birth cohorts medians**

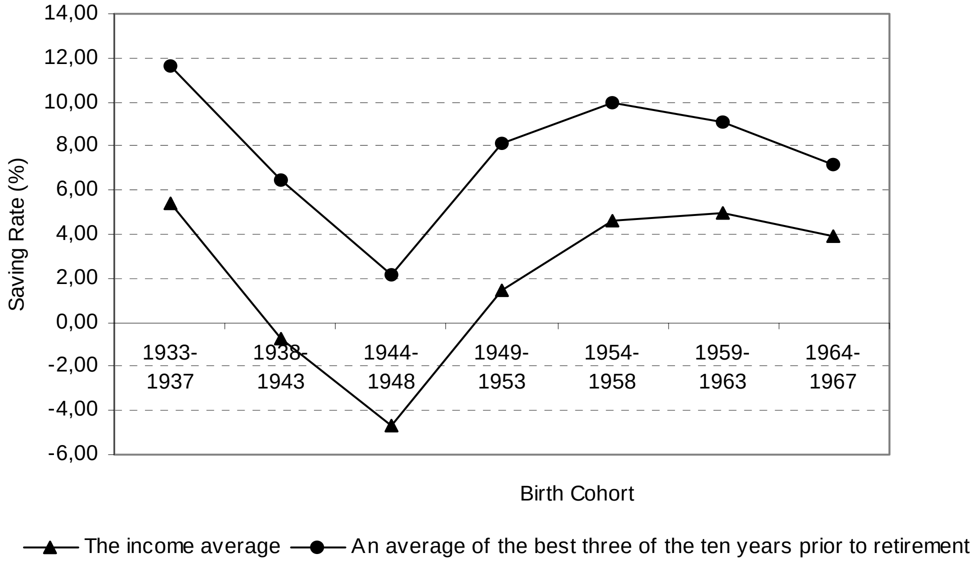
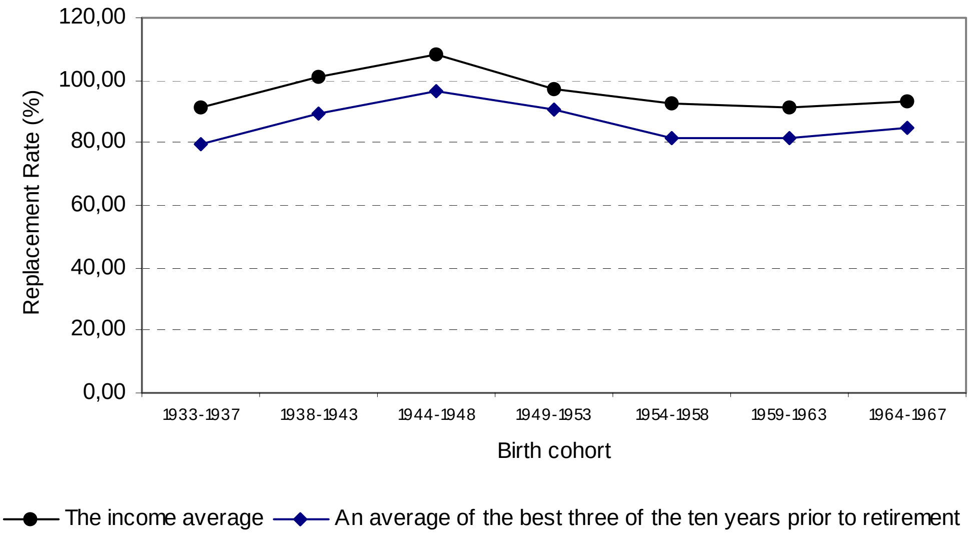


Figure 20 **Demographically based forecasts. Calculated replacement rates, by birth cohort, medians**



5 Sensitivity analysis

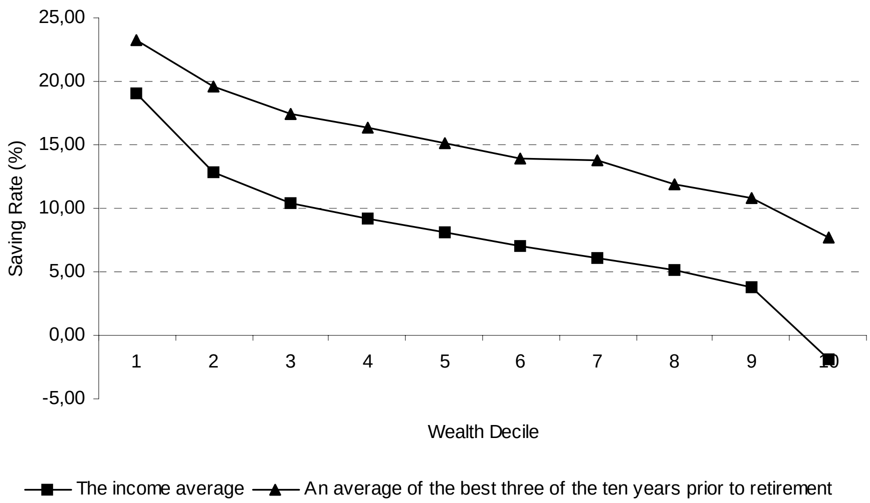
Earlier retirement age

Our assumption of a fixed retirement date have consequences for the calculation of required saving rates. Those who have preferences that favour early retirement, or who are working for firms that financially encourage early retirement (for example through special occupational pension rules), will have different saving needs. In the calculations thus far we have assumed a general retirement age of 65, which is the designated retirement age in the old system. In practice, however, the labour force participation in the age group between 60 and 64 has decreased, particularly for men, since the ATP-system was introduced in the 1960s.[10]

One of the main motives behind the old-age pension reform was to encourage people to remain in the labour force longer by linking the pension entitlements to the number of working years in a more direct way. However, this could be offset by occupational pension schemes that provide high retirement income. In order to investigate what effect earlier retirement will have on our results we have carried out the calculations assuming a general retirement age of 61. The distribution of saving and replacement rates from these calculations are displayed in Figure 21 and 22.

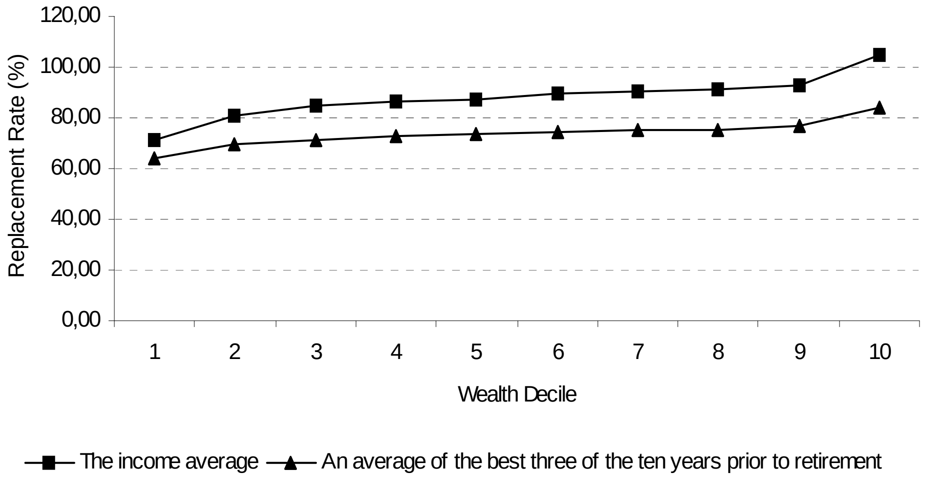
As expected, the saving rates are now in general higher while the replacement rates are lower. The median yearly saving rate is 8 percentage points higher than in the case with retirement at 65.

Figure 21 Calculated saving rates , different wealth deciles, retirement age 61, medians



[10] Palme and Svensson has written a number of articles on this subject. See e.g. Palme & Svensson (1999, 2004).

Figure 22 **Calculated replacement rates , different wealth deciles, retirement age 61, medians**



Different sources of wealth excluded from net wealth

Figure 23 and 24 illustrate the importance of different sources of pension wealth for the calculation of the saving and replacement rates. Figure 23 shows saving rates calculated for the total projected wealth, total wealth less real wealth, total wealth less real and financial wealth, and finally saving rates based only on old-age pension wealth.

Not surprisingly, excluding different types of wealth sources from the total projected wealth leads to higher prescribed retirement saving (see equation 6). As we can see, a negative sign for the calculated saving rates for the wealthiest deciles depends on including real wealth in the calculations. The importance of net financial and occupational wealth also increase with wealth decile.

The most interesting disparities, both by birth year composition and gender, are those shown by the saving rate calculated excluding real wealth. There is some evidence that retired individuals in the U.S. do draw down their housing wealth, but not at the rate that would be suggested by a life-cycle consumption motive (Sheiner & Weil, 1992). This could mean that real wealth may be more useful for a bequest motive or simply that the asset is illiquid. For example, Hurd (1990) choose to test the life-cycle model on the total retirement wealth excluding housing wealth. So, excluding real wealth from the calculation of saving rates could be quite relevant.

Figure 23 **Calculated saving rates by wealth decile, different sources of wealth excluded from net wealth**

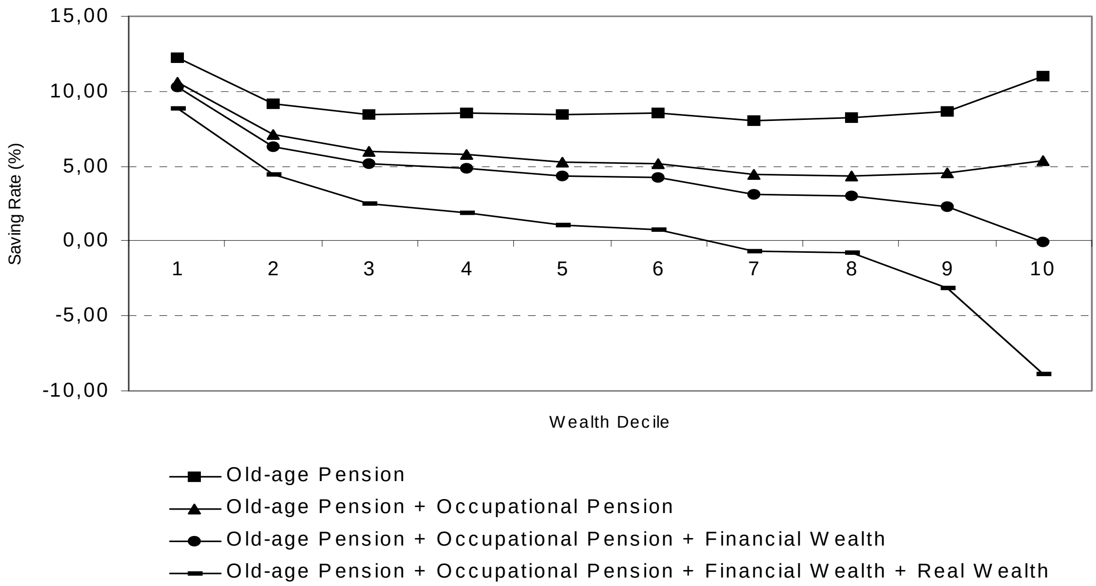
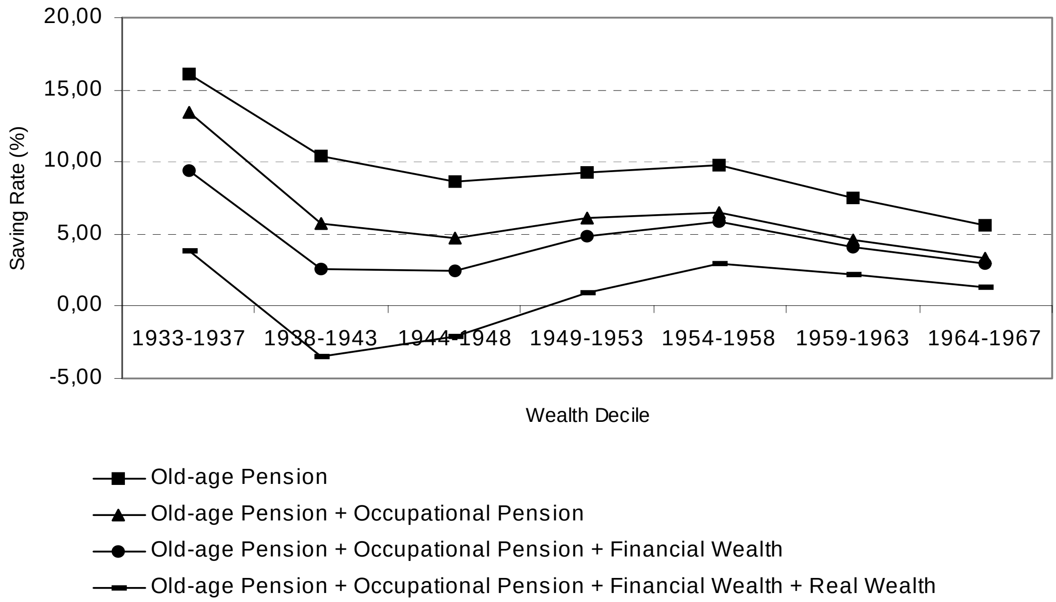


Figure 24 **Calculated saving rates by birth cohort, different sources of wealth excluded from net wealth**



As we mentioned before, individuals born between 1938 and 1950 have more real net wealth than other age groups. The importance of real wealth for this group can bee seen in Figure 24. Calculated saving rates rise about 2.5 percentage points for those born in the 1960s and the

1950s, and with as much as 5.5 percentage points for those born in the 1940s when real assets are excluded from the wealth measure.

6 Calculation of saving needs: comparison between simulated saving rates and individual pension saving

After calculation of the theoretical saving needs the next question is if, given our results, the amounts actually saved by the individuals are adequate for their retirement needs. In this chapter the amount saved in the private pension accounts is compared with simulations of the saving needs. The information about the amount actually saved comes from the HEK 1997 database and is a modification of the value of tax-deductions due to saving in personal pension accounts. The size of the allowed deduction varies with the size and type of income and also depends on whether the individual has the right to a occupational pension.

To get the saving rate, we combine information about the amount deferred from the taxes, taxable income and rules for tax-deductions. Those who take full advantage of the tax-deductions are excluded from the analysis since we would risk underestimating the amount actually saved as we do not have full information about the amount actually saved in their private pension accounts. This exclusion should not disturb the results to any greater extent considering that about 95-97 percent of the individuals that save in tax-deferred pension accounts do not take advantage of the full deduction possibilities. There is a higher proportion of women than men making full deductions, although the differences are small.

Johannisson (2001) studies tax-deferred pension saving in Sweden 1991-1997. According to her results the share of population that do save has increased over time in all cohorts. The number of individuals saving in tax-deferred pension accounts increased from 4 percent in 1980 to 29 percent in 1997.

Calculations of the extent of private pension saving for our sample of individuals are quite similar to the results for the population in general (c.f. Tables 5 and 6). For both men and women, the average amount saved increases by age. In all birth cohorts, men have a greater deducted amount than women. It is mostly middle-aged individuals who save in private pension accounts, which is consistent with the life cycle hypothesis. In our sample, individuals born 1943-1952 had the greatest share of positive deductions for private pension saving (44 percent).

The share of women with tax-deferred pension accounts is greater than the share of men. The difference can be explained by women having a greater need to secure their post-retirement income than men because of a longer expected lifetime, and also because women have a higher risk of becoming a surviving spouse. Even though women, when widowed, receive a widow's pension the amount received depends on the level of other income sources, which means that the need to secure some particular level of the post-retirement income must be higher for women in the wealthiest decile.

Another possible explanation is that women and men choose different saving forms when saving for retirement, possibly because there are differences in risk aversion among men and women (Pålsson, 1996), and also that men, to a greater extent than women, were offered pension insurance through their employers. Furthermore, women born in the 1930s and the 1940s have not been in the paid labour force as long as men and therefore need to supplement the old-age pension to a greater extent.

Table 5 Deduction for savings for individual private pension 1997, sample of individuals in HEK 1997, by age and gender

	WOMEN			MEN			ALL		
Year of birth	Number of person	Share, % with deduction	Average amount (KSEK)	Number of person	Share, % with deduction	Average amount (KSEK)	Number of person	Share, % with deduction	Average amount (KSEK)
1963-1967	459	37	3,2	417	31	4,0	876	34	3,6
1953-1962	999	45	4,7	724	32	6,0	1 723	39	5,2
1943-1952	1 212	51	7,3	926	37	9,0	2 138	44	8,0
1933-1942	520	35	10,1	473	30	12,1	993	32	11,0

Source: Author's calculations, HEK 1997

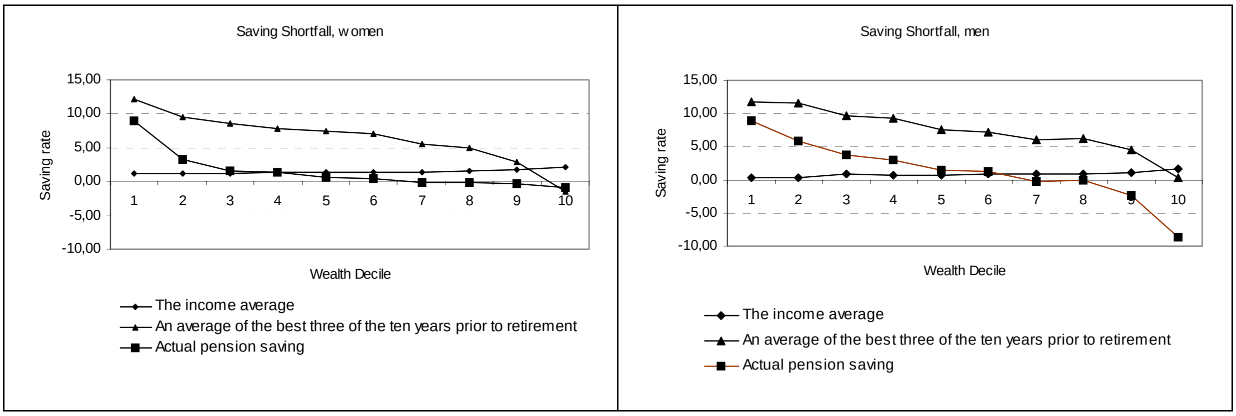
Table 6 Deduction for savings for individual private pension 1997 in Sweden, by age and gender

	WOMEN			MEN			ALL		
Year of birth	Number of person	Share, % with deduction	Average amount (KSEK)	Number of person	Share, % with deduction	Average amount (KSEK)	Number of person	Share, % with deduction	Average amount (KSEK)
1973-1979	28 228	7	1,8	26 841	6	2,1	55 069	7	2
1963-1972	184 468	31	2,9	160 119	26	3,5	344 587	29	3,2
1953-1962	229 056	41	4,6	173 820	30	5,9	402 876	36	5,1
1943-1952	277 263	45	7,3	206 569	33	9,4	483 836	39	8
1933-1942	144 015	33	9,8	120 970	27	11,9	264 985	30	10,7
1932 and before	8 785	1	12,4	15 837	2	13,9	24 622	2	13,4
Total	871 819	25	5,9	704 156	21	7,4	1 575 975	23	6,6

Source: Statistics Sweden

In Figure 25 we compare calculated saving needs (based on the average life income and the average of the three highest income years ten years prior to retirement with tax-deferred pension saving.

Figure 25 Comparison between actual pension saving and calculated saving need, different wealth deciles



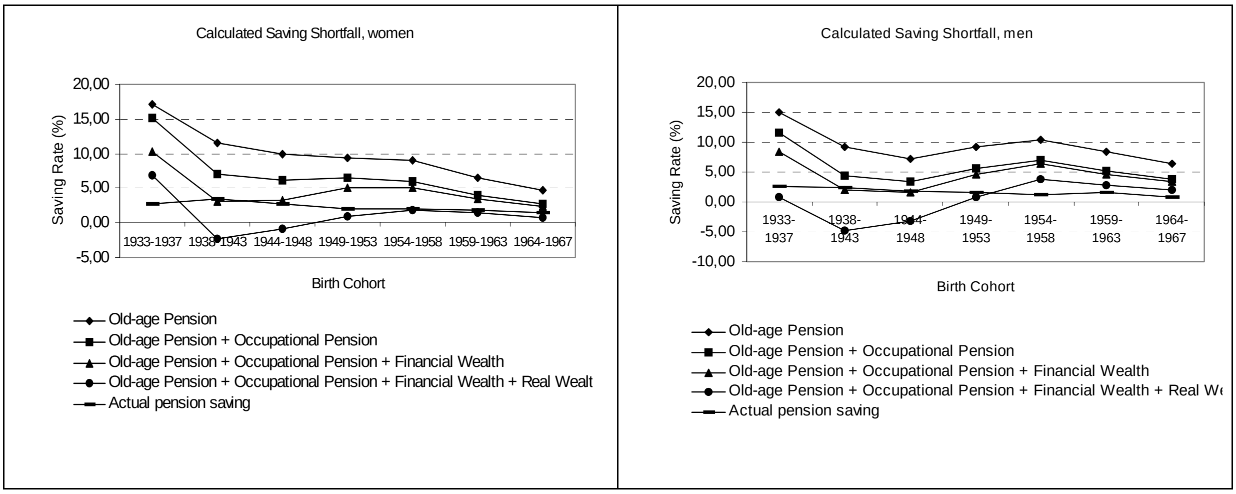
As we can see, the share of both men and women that have tax deferred saving increases by wealth. Individuals with more wealth usually have higher income and thus greater possibilities to lock in their saved capital for longer periods than low income earners. There are also tax-related incentives to push marginal taxes forward. Another possible explanation for a positive correlation between private pension saving and the total wealth is that individuals with a "taste for saving" sort themselves into jobs with generous pension plans (Poterba, 1996). The least wealthy individuals have to increase their savings with as much as 10 percentage points to get a pension wealth equal to an average life income. For the wealthiest individuals the actual saving rate exceeds calculated saving rates.

Values of prescribed and actual saving rates by birth cohort are reported in Figure 26. For both men and women born in the 1940s, reported pension saving is higher than the calculated saving rate based on assumptions of average life income but is not sufficient to maintain a retirement income equal to the average of three best years ten years prior to retirement. Men born in the 1950s and 1960s have the highest need to increase their private pension saving according to the results of our calculations.

Figure 26 **Comparison between actual pension saving and calculated saving need, different birth cohorts**

In Figure 27 we compare saving rates calculated for the total projected wealth, total wealth excluding real wealth, excluding both real and financial wealth, saving rates based only on old-age pension wealth and the actual saving rates. As we can see, actual pension saving for the oldest birth cohort does no longer exceed the calculated saving rates if we exclude real wealth in the calculation of the total pension wealth. For the youngest cohorts excluding the housing wealth results in an extra saving need of about 3 percentage points per year.

Figure 27 **Comparison between actual pension saving and calculated saving need, different birth cohorts. Different sources of wealth excluded from net wealth**



7 Conclusions and future research needs

The purpose of this paper is to forecast the future financial status of elderly individuals under the present pension rules and estimate how personal savings need respond to maintain consumption levels. Several important issues are considered. The relationship between different sources of retirement income, the relationship between total personal pension wealth and required saving needs and comparisons between the personal retirement saving and our calculation of saving needs.

Our results suggest that median projected old-age pension wealth differ substantially in different birth cohorts, reflecting the effect of assumptions made in the model about transition rules for the different pension schemes but also on projections of income profiles. Variation in pension wealth stems largely from differences in lifetime income since benefit formulas are tied to an individual's earnings history. There is evidence that there are significant cohort effects on the earnings profile in Sweden, large cohorts (e.g. the baby-boom generation) seems to have overall higher earnings than their small cohort counterparts (Dahlberg & Nahum, 2003).

We found substantial differences between occupational pension wealth among different workers. The greatest differences are between white and blue collar workers. Gender-specific differences in life income is another important explanation for differences in post-retirement income, both for old age and occupational pension wealth. Compared to old-age pension, the differences in projected pension income between genders become higher due to the occupational pensions, which compensate for an income above 7,5 income basic amounts.

A major share of those employed in local government are women in low-income jobs. At the same time a majority of white collar workers are men, so the gender-specific income differences is one of the explanations for the differences in levels of pension wealth (Eklöf & Hallberg, 2004).

In our calculations of future pension wealth of individuals we assume that there is no gender-specific differences in investment decision between men and women regarding the funded part of old-age and occupational pension. However, literature on gender and risk aversion has found women to be more conservative investors (Sundén & Sirette, 1998). Pålsson (1996) find women in Sweden to be more risk averse in investing wealth into risky assets but also that investment decisions seem to be influenced by marital status. Granqvist &

Ståhlberg (2002) find that women are more likely to choose a low risk alternative for the allocation of occupational pension rights.

There are also differences in the pension schemes that are likely to reflect the differences in accumulated benefits from the occupational pension. For example, the old defined-benefit rules for occupational pensions quite often are more favourable for men compared to the new defined-contribution rules (Granqvist and Ståhlberg, 2002).

In our calculations of projected pension wealth we assume that old-age pension and occupational pension is withdrawn at the same time and that all individuals with positive income in 1999 remain employed until retirement. Those assumptions can of course be criticised. For example, sometimes it is possible to claim pension benefits solely from the occupational pension system until normal retirement age and then start claiming benefits from the old-age pension system.

It is also important to mention that workers in Sweden frequently face far better options from occupational pensions plans for early retirement than those given by standard agreements, i.e. those calculated in our model (Eklöf & Hallberg, 2004). Because of that, calculations of economic incentives to retire in our model might be underestimated, since we do not account for those better options.

In some cases, employers have incentives to discourage older workers from continuing to work. These incentives interact with the rules of old-age and occupational pensions and other regulations (Eklöf & Hallberg, 2004). Therefore it is difficult to make inferences about labour supply behaviour due to the lack of detailed information on the real early retirement options. But by reducing the payroll tax rate and creating a direct link between lifetime income and pension benefits, the Swedish pension reform at least has created the potential to increase incentives to work (Palmer 2001). The occupational pension plans and their application seems to be the main remaining problem to deal with in order to remove disincentives for elderly labour supply.

While calculated data on old-age and occupational pension wealth will help in understanding saving needs, the underlying modelling questions cannot be ignored. An important issue is that individual heterogeneity is central to much of the analysis. An assumption that could be criticised is that the portfolio weights are the same as the initial ones in the projections, i.e. we ignore the fact that the cohorts will allocate their wealth to separate assets differently over the life cycle. We test the effect of projected pension wealth on saving calculations by modelling the effect of each of the components of pension wealth in isolation.

However when an analysis considers sources of retirement income other than pension schemes, there is an added difficulty due to the heterogeneity among individuals.

The results of our calculations depend critically on the expected rate of return on different types of assets. For the value of projected wealth and also calculations of saving as a particular rate of labour income, changes in the rate of return have particularly large effects on the wealth at retirement. In the calculation of the premium pension wealth and fix contribution parts of occupational pension, we use the average of nominal market returns based on historical rates through 2003 and static projections through 2031. This means that projected pension wealth for the younger cohorts includes more of uncertainty.

Another question is associated with the calculation of the total projected pension wealth. We use gender-*neutral* life tables in calculation of yearly old-age pension wealth. However, to get the *total* value of the old-age pension wealth we use gender-*specific* life tables, for the purpose of capturing the gender redistribution affect of public pension system. But the question is if its realistic to assume that individuals take account of differences in life expectancy in calculations of their lifetime pension benefits. Furthermore, we do not take account of life-expectancy variations between different income groups; some studies indicate that individuals with high incomes have higher life expectancy at retirement.

An important issue in this paper is the comparison of actual pension saving and our own calculations of saving needs. We identified some groups (men born in the 1950s and individuals in the lower wealth deciles) that have a potential need to increase their personal pension saving. Expectations about retirement income are crucial for individual saving choices. Some individuals may fail to accumulate assets because they do not recognise the value of future pension benefits provided by old-age and occupational pension schemes, or simply do not have enough money to allocate to pension saving.

We also identified some groups of individuals (those born in the 1940s and the wealthiest individuals in our sample) who seem to have higher actual pension saving than our simulated saving needs. Given the complexity of pension plans, saving incentives depends on whether individuals fully understand the structure of their pension plan. The uncertainty about future pension benefits may lead higher saving needs for precautionary reasons. Some individuals do not treat housing equity as a decumulable asset that can be sold and used after retirement (Hurd 1990). There is even evidence that housing equity is typically not used to support consumption of the elderly, at least not until quite advanced ages (Venti & Wise, 1996). So, excluding real wealth from the calculation of saving needs could be quite relevant.

Information about actual pre-retirement saving indicate that more women have private pension saving than men, but it could also mean that men choose other forms of saving when saving for retirement. So, for the individuals managing to reach retirement age with a significant level of wealth, an important question is the rate of decumulation of that wealth after the retirement. For the typical individual reaching retirement age, real wealth (home equity) is one of the most important component of net worth. The pattern of the decumulation of wealth after retirement therefore plays an important role in the calculation of saving needs for individuals. But do individuals decumulate real and financial assets after retirement? Data from six countries studied in Poterba (1994) suggest that in developed nations, decumulation of individual financial assets after retirement is the exception, rather than the rule., i.e. many individuals leave bequests.

So one clear message from this paper is that while a number of questions about retirement income can be clarified with our data on projected pension wealth, much work remains to understand the relative importance of different factors in determining the pension wealth of future pensioners.

Appendix 1

In this paper assumptions about mortality, interest rate, inflation, and wage growth are based both on static scenarios used by the National Social Insurance Board (RFV) and on our own demographically based projections for Sweden.

Static scenario: assumptions for the period 2004-2032

Table 7 Static scenario: assumptions for the period 2004-2032, annual changes

Real income index growth	1.6 %
Inflation	2 %
Stock index growth	3.25 %
Real interest rate	2 %
House price inflation	2 %

The demographic instability of the old-age pension system caused by an ageing society is counteracted automatically by a change in the annuitization divisor[11]. The divisor includes an imputed real rate of return (1.6 %), i.e. gives a real economic growth in advance. The amount of the annuity adjusts annually for changes in the CPI and for the discrepancy between actual real earnings growth and the 1.6 percent used in calculations of annuitization divisor. At a future real income growth of 1.6 percent, the yearly pension income in our model remain unchanged.

Demographically based forecasts: assumptions for the period 2004-2032

The forecasting method used here is based on OLS regression of the dependent variables on age group shares in the Swedish population. Extensive documentation and motivation for this methodology can be found in Malmberg (1994), Lindh & Malmberg (1999,1998) and specifically on forecasting Lindh (2004) and Malmberg & Lindh (2004). In this context it can be considered a leading indicator approach based on independent demographic projections by Statistics Sweden. 1950 up to 2002 these are population estimates and thereafter the latest projection available in May 2003.

The forecasting models for each variable have been tested for parameter stability. The choice of age groups have been adapted, and outlier dummies and lagged values of the dependent variable added to increase the robustness of the forecast model.

GDP growth has been computed by the log difference of 1995 fixed price estimates of GDP. Data have been ratio linked from the available GDP data at StatisticsSweden1950-2001, using the most recent definitions as far back as possible (last revision 2002-12-05 are actual numbers back to 1993) computing average ratios from the longest overlap available. For 2002 the estimate by NIER (National Institute for Economic Research) has been used, recomputed to the 1995 base year. Inserting dummies for 1977, 1981 and the period 1991, 1992 and 1993,

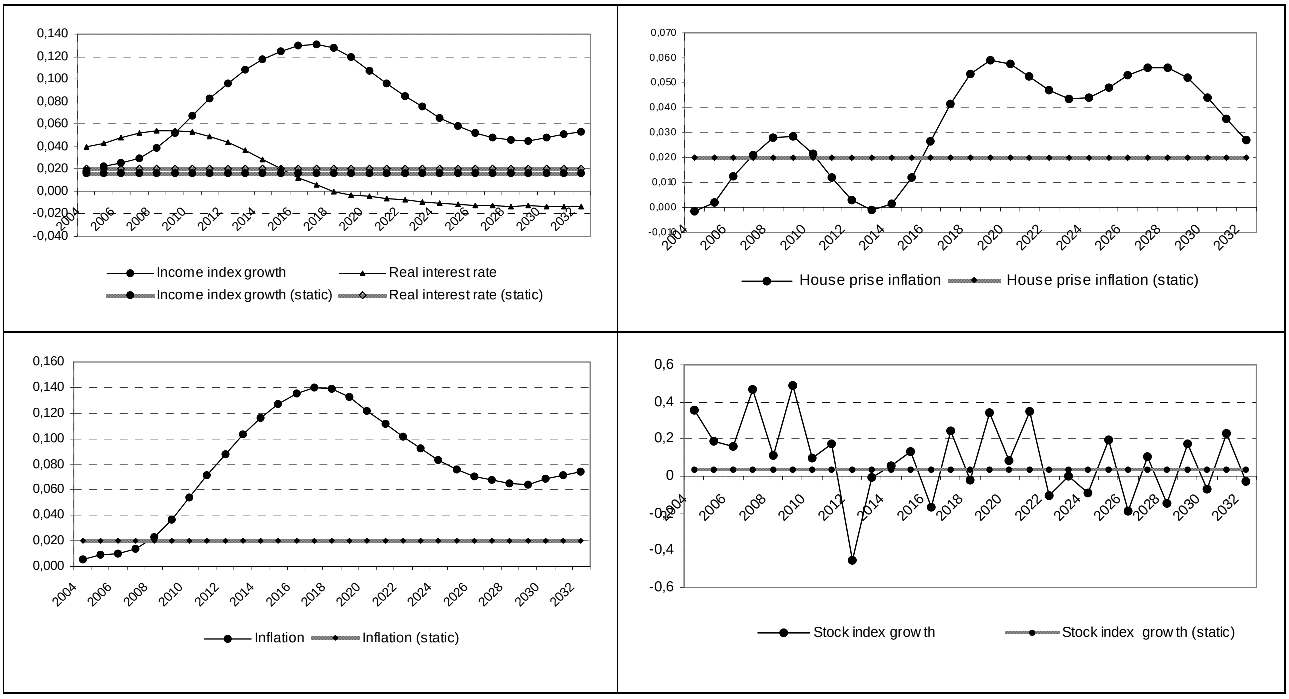
[11] For more details see Appendix 2

which are well known recession years, stabilised estimates and obliterated any signs of autocorrelation making it unnecessary to include any lags.

Table 8 Regression equations underlying the projections of growth rates, inflation rates and real interest rates. Least squares estimates.

	GDP growth coefficient	standard error	Inflation coefficient	standard error	Real interest coefficient	standard error
Age share 0-14	-0.47	*0.32*	0.21	*0.45*	-1.45	*0.53*
Age share 15-29	0.21	*0.17*	-0.82	*0.34*	0.74	*0.37*
Age share 30-49	0.26	*0.18*	-0.37	*0.25*	1.08	*0.29*
Age share 50-64	0.46	*0.23*	0.13	*0.38*	-0.19	*0.41*
Age share 65+	-0.44	*0.20*				
Age share 65-74			3.96	*0.63*	-0.90	*0.68*
Age share 75+			-1.62	*0.49*	-0.26	*0.57*
Growth dummy 91-93	-0.04	*0.01*				
Growth dummy 77	-0.04	*0.02*				
Dummy 81	-0.03	*0.01*	0.03	*0.01*		
Dummy 51			0.14	*0.02*	-0.14	*0.02*
Inflation dummy 92			0.05	*0.01*		
Adj R2	0.50		0.75		0.63	
Durbin-Watson Statistic	1.86		1.72		1.70	

Figure 28 Demographically based forecasts, comparison with the static assumptions, year 2004-2032



Inflation is the official annual Consumer Price Index log differences 1950-2002 taken from Statistics Sweden. Dummies have been used for the Korea inflation 1951, the extreme inflation 1980-1981 before the large devaluation in 1982, and the inflation episode 1990-1991 that initiated the recession in the 1990s. As in the growth case this makes it unnecessary to use lags.

The stock index is *Affärsvärldens Generalindex* (see www.afgv.se) using the index number of the last trading day of the year. The variable used is the log difference of this deducting the real interest rate and inflation. This gives a rough measure of the risk premium. What is missing here in order to get capital gains above the risk free interest (3 month short rates) is reinvested dividends but this would not essentially change the picture, so we stick to the simpler measure. The same period as previously, 1950-2002, has been used. This series turned out to be quite hard to model without lags, since there is a 9 year lag that is consistently significant no matter which dummies were inserted. The year 1983 and 2001-2002 were nevertheless significant dummies that were needed to obtain robust parameters. Although some lags below 9 can be skipped in any given estimation, these patterns are less stable than when including all 9. In spite of the loss of degrees of freedom the adjusted coefficient of determination is still rather high.

Table 9 Regression equations underlying the projections of growth rates, inflation rates and real interest rates. Least squares estimates.

	Income index		House price inflation		Stock index growth	
	coefficient	standard error	Coefficient	standard error	coefficient	standard error
Age share 0-14	-0.27	*0.80*	0.39	*0.98*	-15.09	*8.02*
Age share 15-29	-0.50	*0.49*	-0.57	*0.54*	-0.34	*3.50*
Age share 30-49	0.05	*0.33*	-0.85	*0.56*	8.74	*3.63*
Age share 50-64	0.18	*0.59*	1.35	*0.75*	8.81	*6.20*
Age share 65+			0.13	*0.60*	-4.47	*3.38*
Age share 65-74	3.34	*0.80*				
Age share 75+	-1.90	*0.65*				
Lag -1			0.73	*0.15*	-0.40	*0.16*
Lag -2			-0.34	*0.19*	-0.45	*0.16*
Lag -3			0.23	*0.19*	-0.39	*0.19*
Lag -4			-0.42	*0.15*	-0.27	*0.19*
Lag -5					-0.35	*0.20*
Lag -6					-0.28	*0.20*
Lag -7					-0.45	*0.19*
Lag -8					-0.24	*0.19*
Lag -9					-0.64	*0.17*
Dummy 83					0.33	*0.20*
Dummy 01-02					-0.47	*0.25*
Adj R2	0.47		0.61		0.38	
Durbin-Watson Statistic	1.24		2.15		1.99	

House prices are the country averages of "fastighetsprisindex för småhus" i.e. the property value index for own homes, which is calculated for tax purposes from real sales prices in order to track market prices over the country.[12] This variable has been computed the same way as the stock index, that is deducting the rate of inflation and the real interest rate from the log difference in order reflect the capital gains over and above a risk free rate of interest. This series turns out to be best modelled without dummies but with four lags. This is quite consistent with the rather long adjustment times in this market.

[12] We are grateful to Lennart Berg for providing us with a linking of older data to the Statistics Sweden data making it possible to use the period 1952-2002 for the estimation.

Real interest rates are computed by deducting the rate of inflation from nominal three month rates taken from the NIER. In this case it turns out to be sufficient to dummy out only the Korea inflation 1951 to obtain robust estimates.

Nominal income index growth is the log differenced index. Since it is nominal it turns out to be rather similar to the rate of inflation. Only, no dummies are necessary nor any lags in this case. The pure age model turns out to work satisfactory by itself.

This variable is used in calculations of the simplified version of income index. For year *t*, the income index is calculated as:

$$I_t = I_{t-1} * [\frac{(1+IG_{t-1})}{(1+IG_{t-4})} * \frac{(CPI_{t-4})}{(CPI_{t-1})}]^{1/3} * [\frac{(CPI_{t-1})}{(CPI_{t-2})}]$$

where *IG* is a nominal income growth and *CPI* is a consumer price index in years *t*-1, *t*-2 and *t*-4.

Appendix 2

Calculation of the Projected Pension Wealth and Actual Pension Saving

Pension wealth was calculated using individual information collected from the HEK/LINDA databases and is the nominal value of old-age public pension and occupational pension benefits at alternative retirement ages. Calculations are based on earnings through 1997 and projected earnings to retirement age. Averages of market returns, interest rate, inflation and wage growth are based on historical rates and, in a second step, on static and demography-based projections of asset prices. For further information see Appendix 2.

1 Estimation of income profiles

In the calculations of income profiles for the individuals in our sample both the HEK 1997 database and the LINDA database have been used. Our version of HEK 1997 has been complemented with information on each individual's "pension points" from 1960 and on. The pension points are used in the calculations of pension entitlements by the National Social Insurance Board and are based on the pension-earning income every year. The pension points are calculated by first subtracting the basic amount for a specific year from the individual's pension-earning income the same year and then dividing by the same basic amount. Because of the ceiling in the old age pension system the maximum pension-earning income is 7.5 basic amounts, implying a maximum of 6.5 pension points each year. The information we have on the individuals' pension points are thus "truncated" at 6.5.

For our calculations of pension wealth from the old age pension system the information of the truncated pension points is enough. However, for the calculations of pension wealth from the occupational pension arrangements we need information of the actual income since the ceilings in these systems are much higher. We solve this problem in two steps. First, by identifying the HEK-individuals in the LINDA-database (which is possible to do since the HEK sample was drawn from the LINDA database in 1997) we can get information on the individuals' actual income from 1983 to 1999.[13] It was possible to get information up to 1999 since LINDA is a panel and 1999 was the last year of the LINDA database we had access to when our project started. The year 1983 is not the first year in LINDA, but the richness of information in the database gets more limited further back and we judged 1983 to be the limit in terms of the possibility of constructing pension-earning income.

In the second step we create "untruncated" pension points for 1983-1999 for our sample of individuals using the income information in LINDA. For some individuals in our sample, for some of the years of the period, it is not possible to carry out these calculations based on the LINDA information. In those cases interpolations are used to fill in the gaps. Based on the untruncated pension point measure we also extrapolate values from 1982 back to 1960 for every individual. We then compare the true, truncated pension points with the extrapolated, untruncated points for this period. We use information on the true pension points in case the points are less than 6.5. If the points are 6.5 exactly we use the extrapolated, untruncated value in case this value actually is higher than 6.5. If the extrapolated value is below 6.5 we use the original value of 6.5. This gives us a series of untruncated pension points from 1960 to 1982 which can be converted to pension-earning income using

[13] We applied and were granted permission by Statistics Sweden to connect individuals in the two registers in HEK and LINDA for this project.

information on the basic amounts each year. In combination with the information from LINDA we then have a series of each individual's untruncated pension-earning income from 1960 to 1999.

Since we also need information on each individual's future income path in order to calculate total pension wealth in both the old age and occupational pension systems we proceed by forecasting these paths using a regression based on the pension-earning income information from LINDA 1983-1999, converted to pension points, and background variables taken from the HEK 1997 database. Different specifications and regression methods were tested including various fixed-effects panel methods.

However, we finally settle for a pooled OLS in which the untruncated pension points are regressed on lagged pension points and a large number of background variables including birth cohort (in five-year intervals), sex, marital status, sector, industry, socio-economic group, region, education, and origin. These variables reflect the situation in 1997, so the assumption is that these conditions have been the same during the whole period. The regression also includes the aggregate unemployment rate each year to control for time-specific factors. Finally, age variables (age, age squared, and age cubed) are included in the regression. Keeping all variables fixed except age and lagged pension points we can then predict the future path by stepping forward one year at a time up to and including the year an individual turns 64. Finally, these predicted paths are converted to income streams by using predicted measures of basic amounts each year. These follow from our inflation forecasts.

By combining the previously calculated history of untruncated pension-earning income with the forecasted values we get a complete life-cycle path of pension-earning income for each individual between the ages of 30 of 64 in the HEK 1997 database.

2 Calculation of public old-age pension

The calculated benefits from the new defined contribution system consist of *Income pension, Premium pension* and *Guarantee pension*. The new pension is based on income earned during the beneficiary’s lifetime, for income years where more than a particular percent of the price basic amount have been earned.[14]

Pension qualifying income is calculated by subtracting a pension contribution (7 percent on income) on wages, salaries and transfer payments up to 8.07 income basic amount[15].

Pension qualifying amounts are fictive income amounts which compensate for income shortage due to disability pension, child-care years, study and military service.

Pension qualifying amounts for child-care years are calculated for women who have children born before 1998. The pension qualifying amounts are calculated for the first 4 years after the birth and depends on earnings before the birth year of the child.

The pension qualifying amounts are calculated in three different ways, the highest amount of those three alternatives is chosen for calculation of the pension qualifying amounts. Those three alternatives are:

1. The total earnings before the birth year of the child (*Individuell jämförelseinkomst)*

2. 75 percent of the average pension qualifying income under the year for calculation of
pension qualifying amounts for child-care (*Generell jämförelseinkomst)*

[14] 24 percent for years before 1998, 27 percent between 1999 and 2001 and 40.3 percent of income basic amount for years after 2001.

[15] The basic amount is annually adjusted by the income index. For example, for year 2002, the amount is SEK 38 800.

3. One Income Basic amount (*Inkomstbasbelopp* , 38700 SEK for year 2003)

Pension qualifying amounts for compulsory national service for years 1995-1998 are calculated as:

PL-PGB = *Numb_mili*/40**MPGI**0.5/365

where

PL-PGB is pension qualifying amounts for compulsory national service
Numb_mili is number of days in compulsory national service
MPGI is average pension qualifying income
Pension qualifying amounts for study are calculated as 138 percent of student contributions received for each year between 1995 and 1998.

Income pension was calculated as 16 percent[16] of the yearly contribution base, which consists of *pension qualifying income and pension qualifying amounts*. The maximum pension qualifying income and amount after deduction of the employee pension contribution is 7.5 income basic amount[17].

$$Pension\ right_i = \min[(pension\ qualifying\ income_i + pension\ qualifying\ amounts_i), (7.5 * BA_i)] * 0.16$$

The sum of total pension credit (the *pension account balance*) is recalculated for every year on the basis of the change in the *income index*. *Income index* is equal to the change in average income in Sweden over the 3 years period[18]. Estimated *inheritance gains* are distributed to the surviving[19], *administrative costs (0,05 percent)* are subtracted from pension account balances.

$$Pension\ acount\ balance(T) = \sum_t^T [pension\ right_i * \prod_i^T incx_i]$$

for i= t, …,T

$$incx_i = \frac{IncIndex_i}{IncIndex_{i-1}}$$

where

T	= year of individuals 61st /65th birthday
t	=first year with pension qualifying income >0
IncIndex	=income index for year *i*

Annual pension amount from the income pension is calculated by dividing the pension account balance with the *annuitization divisor* (*Delningstal)*. *Annuitization divisor* is a gender-neutral measurement of the average life span, with consideration given to an interest rate, or norm, of 1.6 percent. With this interest rate, the divisor is always less than the average life span. The divisor is calculated by the National Social Insurance Board.

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16 18,5 percent is used for years before 1995.
17 For years 1960-2000 we use price-related basic amounts (BA).
18 For calculation methods see Appendix 1
19 The index for inheritance gains is calculated by Social Insurance Board and is multiplied to the final pension account balance.

Premium pension was calculated as 2.5 percent of yearly contribution base.

$$premium\ pension\ right_i = \\ = \min[(pension\ qualifying\ income_i + pension\ qualifying\ amounts_i),(7.5*BA)]*0.025$$

The sum of total pension (*the pension capital)* changes every year due to the return on the capital. We use the average rate of return for years before 1997 and make qualified assumptions about future rates of return. Administrative cost of 0,045 percent is subtracted for every income year

$$premium\,pension\ acount\ balance(T) = \sum_t^T [premium\ pension\ right_i * \prod_i^T (rr_i + rp_i + cpi_i)]$$

for i=t, …,T

where

T	= year of individuals 61st /65th birthday
t	=first year with pension qualifying income >0
rr	= projected real interest rate under year *i*
rp	= risk premium under year *i*
cpi	= inflation rate under year *i*

A guarantee pension is calculated for those with relatively low income. The guarantee pension is related to the prise basic amount. A guarantee pension can be paid on reaching the age of 65 years old.

For people born between 1938 and 1953 a certain proportion of the pension was calculated using the old rules for national *supplementary pensions (Allmän tilläggspension/ATP)* and the *national basic pension*[20] *(Folkpension)*. For a person born in 1938, 16 twentieths of the pension is calculated as supplementary pension and 4 twentieths as income pension. For the next cohort (1939) its 15/5 twentieths and so on until those born in 1954 who receive the entire pension amount from the new pension system.

The *national basic pension* is calculated as 96 percent of the price basic amount for a single person and 78.5 percent of the price basic amount for married people.[21]

The benefit level of *supplementary pension* is, similarly to income pension, related to the individual's pension qualifying income. The difference is that the number of income years is limited to 30. We calculate pension-rights on the basis of income between 1 and 7,5 price-/income-related base amounts (BA)[22].

It requires three years of pension qualifying income exceeding 1 BA to receive an old-age pension from the ATP scheme. By subtracting 1 BA from each year's pension income and then dividing it by the corresponding year's BA we obtain the so called pension points for each year. We calculate average pensions point (AP) of an individual's 15 best year of earnings.

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[20] The national basic pension is replaced by the guarantee pension in 2002. The amount is supposed to be the same, so we simplify our calculations by calculating the basic pension also after the year 2002.

[21] We suppose all individuals in our sample have 40 years of residency in the country which gives right to full basic pension.

[22] For the years 1960-2000 we use price-related basic amount (BA). For 2001 and after, the income-related amount is used (IBA).

Finally, the ATP benefit (ATP) is calculated as:

ATP(65) =0.6*AP*min (N/30,1)*BA* T

where:

BA is the basic amounts/average income index amount for the year of the individual's 65th birthday
N is the number of years the individual received pension-rights
T is the number of twentieths (born 1937 and earlier: 20/20, 1938: 16/20, 1939: 15/20…. 1953: 1/20, 1954: 0/20)
AP is the average pension points of the individual's 15 best year of earnings

The amount payable is reduced for pension before the age of 65 with 0,5 percent for each month before age of 65.

ATP (61) =0.6*AP*[min (N/30,1)]*BA* T* Reduction

Reduction = [(100-(0,5*4*12))/100], i.e. 0,5 percent for each month before the age of 65.

where:

BA is the basic amounts/average income index amount for the year of the individual's 61st birthday
N is the number of years the individual received pension-rights before the year of his/her 61st birthday
T is the number of twentieths
AP is the average pension points of the individual's 15 best year of earnings before the year of his/her 61st birthday

Guaranteed supplement (Garantiregeln/G94) was calculated for individuals born between 1938 and 1953. These cohorts are guaranteed a pension amount at least as big as that based on the pension points they earned under the old national supplementary pension scheme up to the end of 1994.

3 Calculation of occupational pensions

In this chapter we describe the calculation of the occupational pension plans for blue-collar workers in the private sector, white-collar workers in the private sector, central government employees and local government employees.

3.1. Occupational Pensions for Private Sector Blue-collar Workers

Occupational pensions for private sector blue-collar workers are determined by the sum of the old system with defined benefits (STP) and the new, fully funded pension scheme.

Due to transition rules, the size of the STP-pension was calculated as 10 percent of the average of an individual's earnings before 1995. The benefit is reduced proportionally if the individual has contributed to the STP-scheme in less than 30 years before the year 1995. The pension is calculated on the basis of an income between 1 and 7,5 price-related basic amount (BA) for the year 1995. For the years between 1996 and the year of retirement, the pension benefits are re-indexed according to the return on the capital [23].

The new, fully funded pension scheme for private sector blue-collar workers is similar to the premium pension in the new old-age pension system. Individuals born in 1932 and after are affected by the new system[24]. For the years 1996-2000, the funded pension scheme was calculated as 1.5 percent of gross earnings up to 30 price/income-related basic amount. From the year 2000 it is 3.5 percent due to a new agreement.

The annual funded part of the pensions for every individual is calculated by dividing the aggregate pension assets from the new funded pension scheme by the gender-specific annuitization divisor.

For retirement at age 61 the pension amount from the defined contribution part is reduced with the percentage difference between the annuitization divisor for retirement at the age of 65 and the annuitization divisor for retirement at the age of 61. The funded part is reduced due to less years of contribution.

3.2. Occupational Pensions for Private Sector White-collar Workers

For white-collar workers in the private sector the pension benefits are calculated as the sum of ITP, which is the benefit defined scheme, and ITPK, the fully funded part.

Table 10 Determination of the pension benefits in the ITP-pension scheme

INCOME (IN BASIC AMOUNTS)	INCOME (SEK 2002)	DEFINED PENSION CONTRIBUTION (PERCENT OF LAST EARNINGS BEFORE RETIREMENT)
0--7,5	0-290 250	10%
7,5—20	290 250-758 000	65%
20—30	758 000-1 137 000	32,5%

The size of the ITP-pension was calculated on earnings the last year before the retirement year. The pension is reduced proportionally if the individual contributed to the ITP-scheme less than 30 years after age 28.
In ITPK, contributions amounted to 2 percent[25] of earnings up to 30 price-/income-related basic amounts, starting from 1977 or when an individual is aged 28.

The annual pensions for every individual is calculated by dividing the aggregate pension assets from ITPK by the gender-specific anuitization divisor.

For retirement at age 61 the defined benefit part is reduced with 0.5 percent for each month before the age of 65, i.e. with 24 percent. The funded part is reduced automatically due to less years of contribution.

3.3. Pensions for Central Government Employees

Prior to 2003, the Occupational pension scheme for the employees in the central government was similar to the ITP pension scheme. The only difference is that the contribution basis was determined by average earnings during five years before retirement and not by earnings the year before retirement.

[23] Same return as on the premium pension in new Old-age pension
[24] The worker joins the scheme after age 28.
[25] There is a transition rule for some of the cohorts. For years 1977-1990: 1.9 percent for people born in 1935-1936, 1.8 percent for those born in 1937-1938. For years 1991-1998: 2.3 percent for people born in 1932-1934, 2.2 percent for those born in 1935-1936, and 2.1 percent for born 1937-1938. For other years and cohorts the contribution is 2 percent.

Table 11 Determination of the pension benefits for the Central Government Employees

INCOME (IN BASIC AMOUNTS)	INCOME (SEK 2002)	DEFINED PENSION CONTRIBUTION (PERCENT OF AVERAGE EARNINGS DURING FIVE YEARS BEFORE RETIREMENT)
0--7,5	0-290 250	10%
7,5—20	290 250-758 000	65%
20—30	758 000-1 137 000	32,5%

The new, fully funded pension scheme affects different cohorts more or less due to transition rules[26].
The total pension is determined by the sum of the old, benefit defined scheme, the extra funded pension scheme (Kåpan) and the new fully funded part.

From the year 2003, the new funded pension scheme is calculated as 2.3 percent of gross earnings up to 30 price/income-related basic amounts.

The extra funded pension scheme (Kåpan) is calculated as 1.5 percent of gross annual earnings up to 30 price/income-related basic amounts for 1991-1995, 1.7 percent for 1996-2002, 1.9 percent for the year 2003 and 2 percent for the following years. Contributions are calculated after age 28 and until the age of retirement.

The annual pensions from the funded part of the pension are calculated by dividing the aggregate pension assets by the gender-specific annuitization divisor.

For retirement at age 61 the defined benefit part is reduced with 0.4 percent for each month before the age 65. The defined contributions are also reduced with the percentage difference between the annuitization divisor for retirement at age of 65 and the annuitization divisor for retirement at age 61. The funded part is reduced due to less years of contribution compared to retirement at age of 65.

3.4. Pensions for Local Government Employees

For the local government workers the pension benefits are calculated as the sum of PA-KL 85 and the PFA 98 pension schemes.

The PA-KL 85 pension scheme is *gross co-ordinated* with the state age pension, i.e. only the amount exceeding the state pension is the benefit from the Occupational pension. The pension amount due to the new rules (PFA 98) consists of a funded part and the defined benefits system for those with income over 7.5 price basic amount.

Due to the transitional rules the size of the PA-KL 85 pension scheme is determined by the average of the five best years of earnings during the seven-year period prior to 1997.

By dividing pension income by the price basic amount (BA) we obtain pension points (PP) for each year. Table 12 shows the determination of the pension benefits according to the agreement for the local government employees PA-KL 85.

[26] For further information see www.arbetsgivarverket.se

Table 12 **Determination of the pension benefits due to PA-KL pension scheme**

INCOME (IN PENSION POINTS (PP))	INCOME (SEK 2002)	DEFINED PENSION CONTRIBUTION (CO-ORDINATED WITH THE STATE PENSION)
- 1	- 38 700	(0.95*PP)*min (N_97/30,1)*BA1997- SAP
1—2.5	38 700-96 750	(0.785*PP+0.1750)*min (N_97/30,1)*BA1997- SAP
2.5—3.5	96 750-135 450	(0.6*PP+0.6375)*min (N_97/30,1)*BA1997- SAP
3.5—7.5	135 450-290 250	(0.64*PP+0.4975)*min (N_97/30,1)*BA1997- SAP
7.5—20	290 250-774 000	(0.65*PP+0.4225)*min (N_97/30,1)*BA1997- SAP
20—30	774 000-1 161 000	(0.325*PP+0.4225)*min (N_97/30,1)*BA1997- SAP

Due to the transitional rules, the pension benefits are calculated using the basic amount for 1997. The pension is reduced proportionally for those who contributed to the scheme for less than 30 years between 1960 and 1997. Only the amount exceeding the state pension is the benefit from the occupational pension. The state age pension is calculated for years before 1997.[27]

For retirement at age 61 the contribution is reduced with 0.4 percent for each month before the age of 65. In PFA 98, or the funded system, contributions in the *individual part* amounted to 1 percent of earnings up to 30 price related basic amounts with start from 1998. The *employer part* is 3.5 percent of earnings up to 7.5 price related basic amounts and 1.1 of earnings between 7.5 and 30 price-/income-related basic amounts.

The annual pensions for every individual is calculated by dividing the aggregate pension assets from PFA 98 by the gender-specific annuitization divisor. Individuals with income exceeding 7.5 price related basic amounts receives an extra, benefit defined pension. The size of the pension is determined by the average of the five best years of earnings during the seven-year period prior to the year of retirement. An unreduced pension benefit requires 30 years of employment.

Table 13 **Determination of the extra pension benefits for those with income over 7.5 price basic amounts**

INCOME (IN BASIC AMOUNTS)	INCOME (SEK 2002)	DEFINED PENSION CONTRIBUTION
7,5-20	290 250-758 000	10.625*W[28]-4.6875*BA[29]
20—30	758 000-1 137 000	0.3125*W+1.5625*BA
30--	1 137 000-	10.9375*BA

For retirement at age 61 the defined contribution in PA-KL 85 and PFA 98 is reduced with 0.5 percent for each month before the age 65, i.e. with 24 percent. The funded part is reduced due to less years of contribution comparing with the retirement at age of 65.

[27] We take into account the number of ATP-years before 1997 and use the price basic amount for year 1997 in calculation of fictive *supplementary pension (ATP-pension)* and *old basic pension.*

[28] The average of the five best years of earnings during the seven-year period prior to the retirement with beginning from year 1998.

[29] Price basic amount for the year of retirement.

4 Calculation of the total pension amount

To obtain the total pension amount (both from the old-age pension and the occupational pension) the calculated annual pension is multiplied with the average life span for men and women. The average life span is calculated by the National Social Insurance Board (RFV) and is different for men and women. Notice that we use a gender-neutral divisor in calculating the annual age pension, but gender-specific divisors in calculating the total pension wealth.

5 Projecting the wealth up to retirement age

Current values for *net financial wealth* and *net housing wealth* are those reported in the HEK 1997.

Financial Wealth

Net financial wealth includes bank deposits, investment in bonds, stocks and other financial assets.

Net financial wealth is projected using an average of nominal market returns based on historical rates and, in the second step, on static and demography-based projections of asset prices.

$$gross\ financial\ wealth(T) = gross\ financial\ wealth_{1997} * \prod_{t=1997}^{T} (1 + rr_t + rp_t + cpi_t)$$

for t=1997, 1998, …,T

where

rr	= projected real interest rate, year *t*
rp	= risk premium, year *t*
cpi	= inflation rate, year *t*
T	= year of the individual's 61st /65th birthday

$$financial\ debt(T) = financial\ debt_{1997} * \prod_{t=1997}^{T} (cpi_t)$$

$$net\ financial\ wealth\ (T) = gross\ financial\ wealth\ (T) - financial\ debt\ (T)$$

Financial debt is the value in 1997 recalculated due to the inflation rate between 1997 and the year of retirement. We do not change the real value of financial debt, i.e. we assume that the increase in financial debt due to the cost of interest rate is equal to amortisation of the debt.

Housing wealth

The process of projecting net value of housing wealth consists of increasing the market value of the house into the future and reducing the debt outstanding on the house. The debt is reduced with the average amortisation rate for each year from 1997 to the year of retirement. The average amortisation rate is calculated from individual data in the HEK database for different debt deciles. We use an average of the nominal interest rate based on historical rates and, in the second step, on static and demographically based projections of asset prices.

$$gross\,real\;\;wealth(T) = gross\,real\;\;wealth_{1997} * \prod_{t=1997}^{T}(1 + rf_t + cpi_t)$$

$$real\;debt(T) = real\;debt_{1997} * \prod_{t=1997}^{T}(1 + rr_i + cpi_t) - amort * \prod_{t=1997}^{T}(1 + rr_i + cpi_t)$$

for t=1997, 1998, …,T

where

rf =house price inflation, i.e. growth of index for calculation of the market value of the housing wealth

rr = projected real interest rate under year *t*

cpi = inflation rate under year *t*

T = year of the individual's 61st /65th birthday

amort = average yearly amortisation amount

Net housing wealth is the taxed value of owner-occupied primary housing less debt owed on the property.

net real wealth (T) = gross real wealth (T) – real debt (T)

6 Calculations of actual pension saving

The information about the amount actually saved comes from the HEK database and is a modification of the value of tax-deductions due to pension saving. The size of the allowed deduction varies with the size and type of income and is also dependent on whether the individual has a right to a collectively agreed pension.

To get the saving rate, we combine information about the amount deferred from taxes, taxable income and rules for tax-deductions. Those who take full advantage of the tax-deductions are excluded from the analyses, since we do not have full information about the amount actually saved in the private pension accounts. Hence, we would risk underestimating the amount actually saved in these cases.

For a person with labour income and with an occupational pension, the deductible amount corresponds to 0.5 basic amounts for an income up to 10 basic amounts. The deducted amount is not allowed to exceed the income. For an income between 10 and 20 basic amounts the allowed deductible amount corresponds to 5 percent of the income up to 20 basic amounts. The highest possible deduction corresponds to 2 basic amounts. Those individuals who have income from self-employment or do not have a right to an occupational pension, are covered by different, more favourable deduction rules.

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