Can we Afford the Future?
An evaluation of the new Swedish pension system.

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ABSTRACT: The Swedish dynamic microsimulation model SESIM is used to predict income before and after retirement. Since we focus on the effects of the new Swedish pension system, income for birth cohorts covered by the old system as well as those covered by the new are included. The results are presented in terms of replacement rates for taxable and disposable income. The importance of all components of the pension income is considered; public-, occupational- and private pension. A special attention is given to the importance of other private wealth, financial and real. The modeling of private wealth in SESIM is described and a presentation of household's portfolio allocation in the start year 1999 is provided.

The results show, as expected, that the new system is less generous. In order to achieve a compensation level close to the old system the retirement age has to be delayed and the return on savings has to be high. There is a sharp reduction in public pensions but this is partly offset by an increase in occupational pension. The reduction in public pension is larger for high-income earners.

Our results demonstrate the relative importance of the second and third pillar in the pension system. Especially occupational pension will play a crucial role for younger generations. Since these systems as well as part of the public system to an increasing degree are dependent on funded systems, we can expect a large future variation in pension income depending on the returns on these funds.

INTRODUCTION

Sweden together with most OECD countries is faced with a rapid increase in the proportion of elderly in the population. This change reflects a combination of the ageing of the post-war "baby boom" generation, increased longevity and low birth rates. Although the ratio of elderly non-active to the working age population is already rising, an accelerating pace is expected in the next decade. According to Statistics Sweden (SCB), the number of individuals above 85 will double in the next 30 years and at the same time; the active population will stay the same.

Clearly, this change in the age structure of the population offers a challenge for the financial sustainability of pension systems. In 1999, as a response to this challenge, a new public pension system was introduced in Sweden.

To analyze the effects of the new pension system on household's income is the major purpose of this paper. Thus, we do not focus on the sustainability of the pension system itself but rather on the incomes generated from it. By utilizing a dynamic micro simulation model (SESIM) developed by the ministry of finance and rich micro data sets from Statistics Sweden (LINDA), we intend to address three related topics; first, a comparison of household income before and after retirement, second, the decomposition of income for each of the three pillars in the pension system, the public pension, the (1:st tier pensions), the labour market pension plans (2:nd tier pensions) and private pensions (3:rd tier pensions), thirdly, to evaluate the importance of private wealth, financial and real.

Since SESIM is of a fundamental importance for this analysis, we start by a short presentation, focusing on the modeling of financial and real wealth. After that a short description of the new Swedish pension system is given. Finally, the design as well as the results of the simulations will be presented.

THE SWEDISH MICRO SIMULATION MODEL SESIM

SESIM, a Swedish dynamic microsimulation model, was initially developed at the ministry of finance as a tool to assess the Swedish education financing system. SESIM is a mainstream micro simulation model in the sense that the variables (events) are updated in a sequence, and the space in time between the updating processes is a year. The start year is 1999 and every individual included in the initial sample (≈100 000) then goes thru a large number of events, reflecting real life phenomena, like education, marriage, having children, working, retirement etc. Every year the individuals are assigned a status, reflecting their main occupation during the year. Every status is related to a source of income, working gives earnings, retirement's gives pensions etc. The tax and benefit systems are then applied and after tax income is calculated. If this simulation is repeated for a long time period life-cycle income for individuals can be generated. To compare income before and after retirement is straightforward and replacement rates for individuals or households can be defined.

The sequential structure in SESIM is presented in Figure 1. The first part consists of a sequence of demographic modules (mortality, adoption, migration, household formation and dissolution, disability pension and rehabilitation). After that comes a module for education (compulsory school, high School (Gymnasium), municipal adult education (Komvux) and university. Next module deals with the labor market including the retirement decision. The decision to retire has been modeled as an accrual benefit model, see [6], but it is also possible to choose a specific age (it is also possible to allow for some variation around this age). In this study, retirement is set to a specific age, same for all, since we are interested in analyzing the effects of different retirement ages.

The labor market module also includes a model for unemployment and a model for imputation of labor market sector. The sector is required for calculations of occupational pensions. As we will see the occupational pension is an important component of the total pension. In SESIM, we have implemented the rules for occupational pensions as well as the choice of labor market sector. We also allow for change of sector and the occupational pension is then adjusted in accordance to the new rules for occupational pensions in that sector.

Having gone through the sequence this far, next step is to decide a status for each individual. There are nine different statuses, note each individual can only have one status each year[1]. Given status an income is generated. For status 8 (employed) an earnings equation is used to determine income. For other kind of status, e.g. unemployed different rules can be applied to obtain an income.

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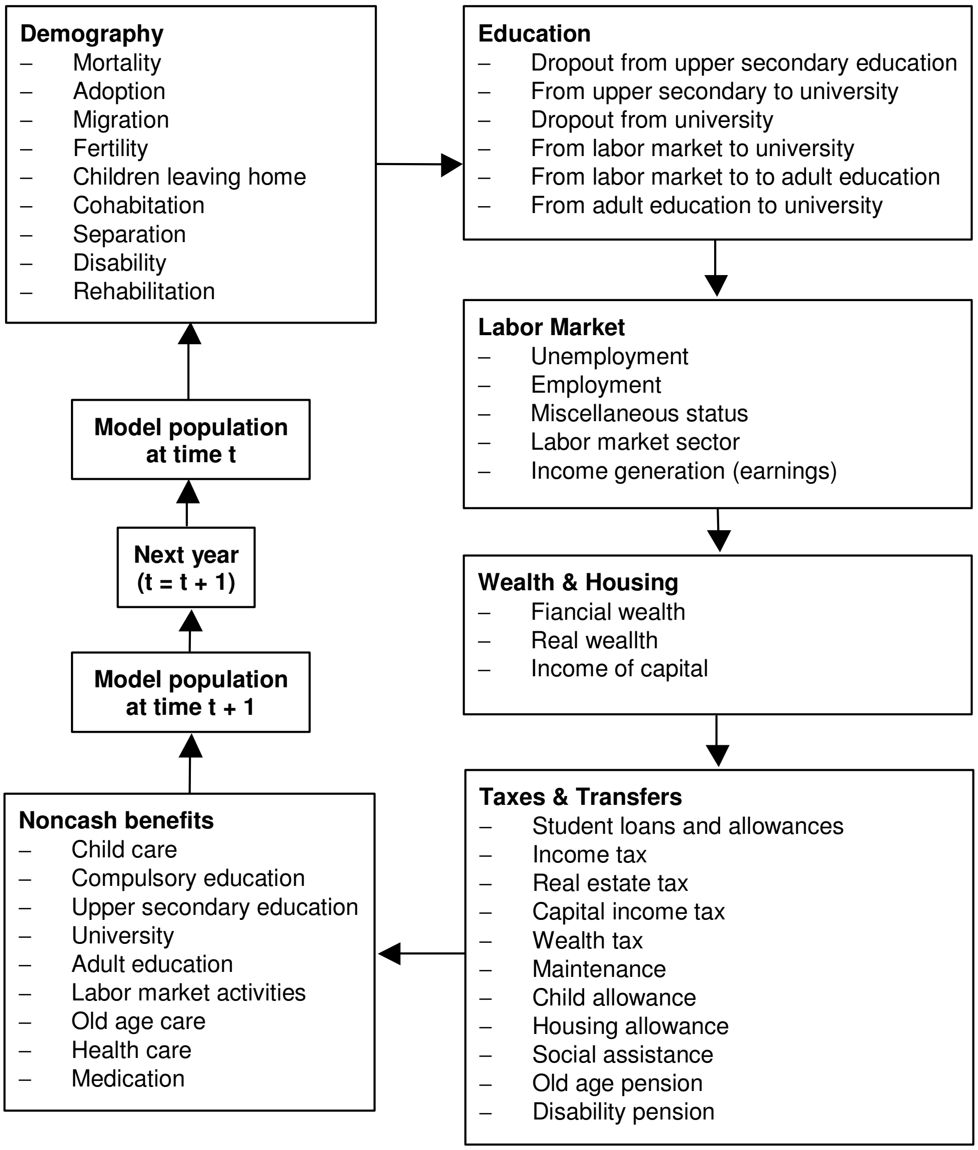
[1] 1. Child (0-15 years old), 2. Old age pensioner (from 61), 3. Student (19-45 years old), 4. Disability pensioner (16-63) , 5. Parental leave (women. 16-49), 6. Unemployed (19-64 years old), 7. Miscellaneous (19-64 years old), 8. Employed and 9. Emigrant

Figure 1. Structure of SESIM



After imputation of income, a module for wealth capital income and housing is entered. Since we are focusing on the importance on wealth for the income of pensioners, we give a more detailed description below. After wealth/housing a large module describes all relevant tax, transfer and pension rules. For the old age pension system, the rules for public and occupational pension have been implemented in all relevant details. Next, a module for public consumption is entered, the details are discussed in [10]. Finally, given all information above the household disposable income can be defined.

MODELING OF FINANCIAL AND REAL WEALTH IN SESIM[2]

Data Description

Information on wealth from the LINDA[3] (Longitudinal Individual Data for Sweden) as well as complementary information on housing characteristics from HEK[4] is used to estimate relations describing the portfolio allocation as well as the cost of housing of individuals or households. As a start, it is interesting to describe the data, both at an aggregate level as well as for the different assets. In this presentation, a special interest is given to the age-profile of financial and real wealth. After all the primarily purpose of the dynamic micro simulation approach is to construct age-profiles for different variables of interest.

Data on income taxes and benefits comes from administrative records. How reliable are the data? One problem is that some assets like car, boats and other durables as well as some assets abroad is underreported. Another problem is related to household wealth, since there is a problem of the definition of a household in administrative data like LINDA. The final, but probably the most important problem, is lack of wealth information over time. Unfortunately we only have access to wealth data for 1999 and 2000, the implication being that we are not able to identify time or cohort effects.[5] Further, both 1999 and 2000 represents a period of an unprecedented high level on Stockholm Stock Exchange.

A special effort has been spent on the construction of accumulated tax-deferred pension savings. To the best of our knowledge, this is the first time in Swedish data that the value of the stock of pension savings has been calculated at the individual level. This has been achieved by accumulating yearly tax-deferred pension savings. In order to minimize the starting value problem we have used data from1980 and followed the individuals up to year 2000, the details are described below.

Table 1 gives a summary of the wealth data for 1999. These tables are constructed without any sample selection; further, the statistics are weighted by the relevant sample weights, indicating that the sums reported refer to total wealth in Sweden.

In December 1999 the total net wealth of the Swedish households was 3 073 billions SEK.

[2] For a more detailed documentation of wealth and housing in SESIM, see [5]
[3] See [3]
[4] Household Finances, SCB.
[5] [2] reports important cohort effects.

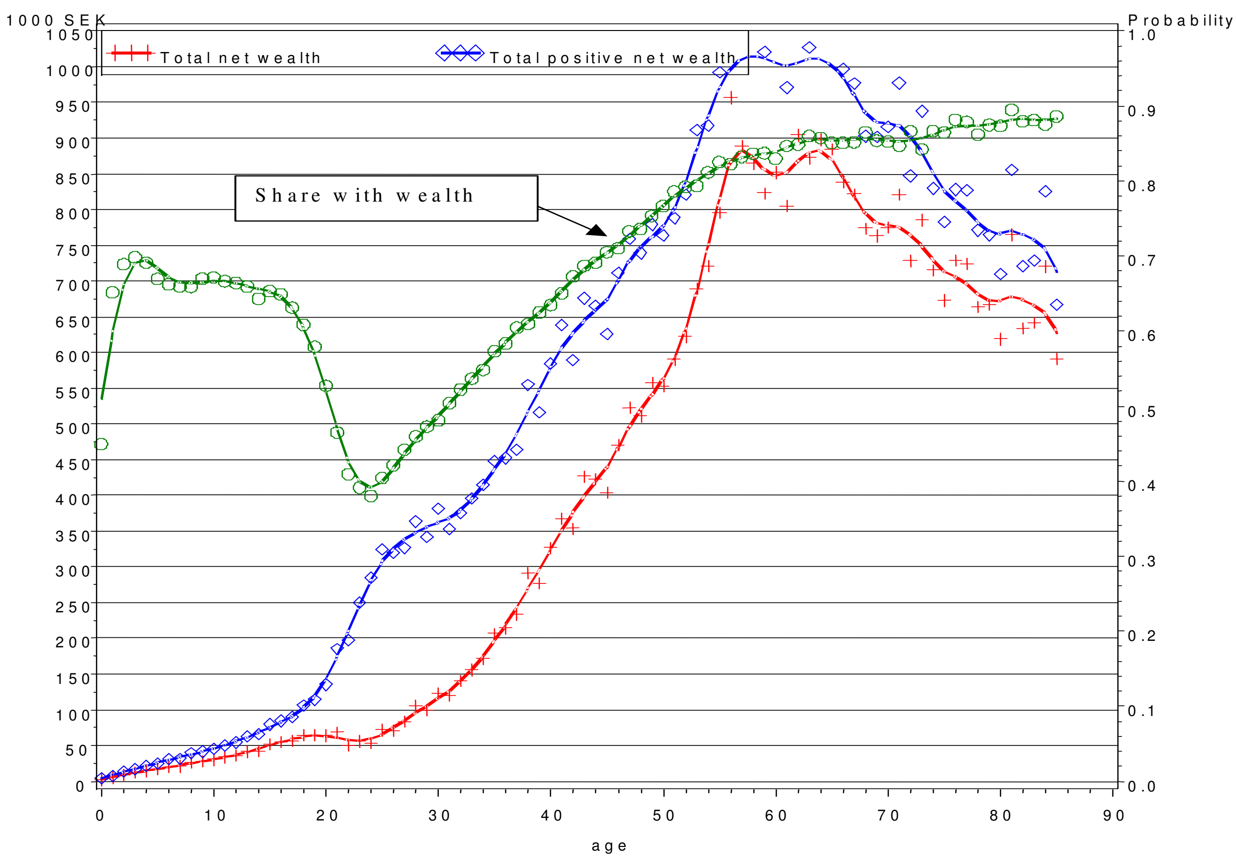
Table 1. Financial and real wealth in Sweden, December 1999.

	Sum Billion SEK	Mean all tkr. SEK	Share With Value %	Mean >0 tkr SEK	Share of total sum for top 10%	5%	1%
Total real Wealth	**2 233**	**252**	**42.2**	**598**	**60.1**	**42.5**	**18.6**
Total liabilities	1 075	121	50.9	239	57.4	39.9	18
Total net real wealth	**1 158**	**131**	**34.9**	**472**	**89.6**	**64.8**	**27.6**
Total financial assets	**1 915**	**216**	**71.5**	**303**	**72.6**	**57.4**	**30.9**
Bank deposits	365	41	38.2	108	75.1	57	25.8
Fixed income and other securities	312	35	27	131	91.3	76.9	42.6
Mutual fund shares	326	37	36.3	102	83.4	65.6	29.1
Swedish quoted shares	419	47	18.4	257	98.8	94	70.9
Pension savings (deductible)	278	31	30.3	104	85.3	66.5	28.4
Other real and financial assets	214	24	5.4	446	100	100	70.6
Total net wealth	**3 073**	**347**	**65.4**	**568**	**69.9**	**51.8**	**24.9**

Source Linda 1999: 771 771 individuals no sample selections.

Not very surprising, as displayed in Figure 2, wealth varies with age. Note that every symbol in the figure represents a mean value per age. For instance at 40 years the mean value of total net wealth is 325 000 SEK and the mean value for individuals with a positive wealth is almost 600 000 SEK. Also displayed is the share of individuals with a positive wealth (the right hand axes). Approximately 64% of the individuals 40 years of age have a positive total net wealth. The smooth lines give a polynomial approximation to these mean values.

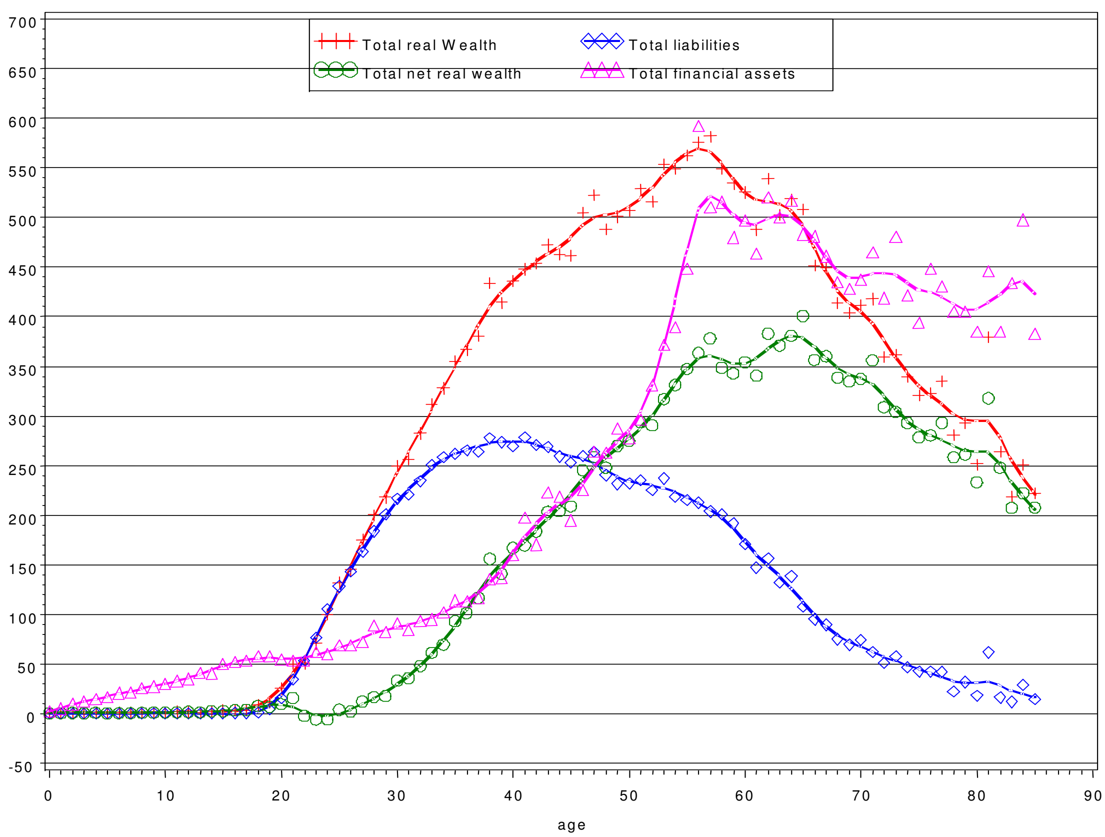
Figure 2. Total net wealth and age.



The overall age profile of total wealth is similar to what can be expected from a life cycle perspective but the peak value comes rather late at (56 years) and then it stays at that level until 65 years. The highest value is at age 64 and for individuals who have a wealth the mean value are more than a million kronor. Note that the mean value of wealth drops rapidly after 65, but the volatility in the mean values also increases. This is a consequence of a smaller sample size due to higher death rates at higher ages. The lowest value is at age 24, 38% and then it increase up to almost 90% for the oldest.

Next, we will present the components, the portfolio, of wealth for the individuals. First in Table 1 and Figure 3, we present real and financial wealth. Real wealth is the largest asset in households portfolios 2 233 billions SEK compared to 1 915 billions for financial assets. Table 1 also gives information about debts, totally 1 075 billions. In this presentation, we consider debts to represent debts on real wealth. Therefore, we define net real wealth as real wealth reduced by debts. The reason for this is that this is the way we model it in SESIM, in reality a debt is not necessary a debt on real wealth, but as an approximation we believe it has a high degree of realism.[6] Figure 3 shows how these four components change with age. Real wealth and debt shows a clear life cycle pattern. Real wealth increase steadily from age 18 to 58, the peak value is 560 000 thousand SEK including zeros, and then it drop sharply. The net real wealth shows a few negative values at younger ages and then increase steadily until the peak year 65, 400 000 SEK, and then decrease. The age profile of financial wealth is characterized by a sharper increase for individuals in early to mid fifties and thereafter slowly decreases.

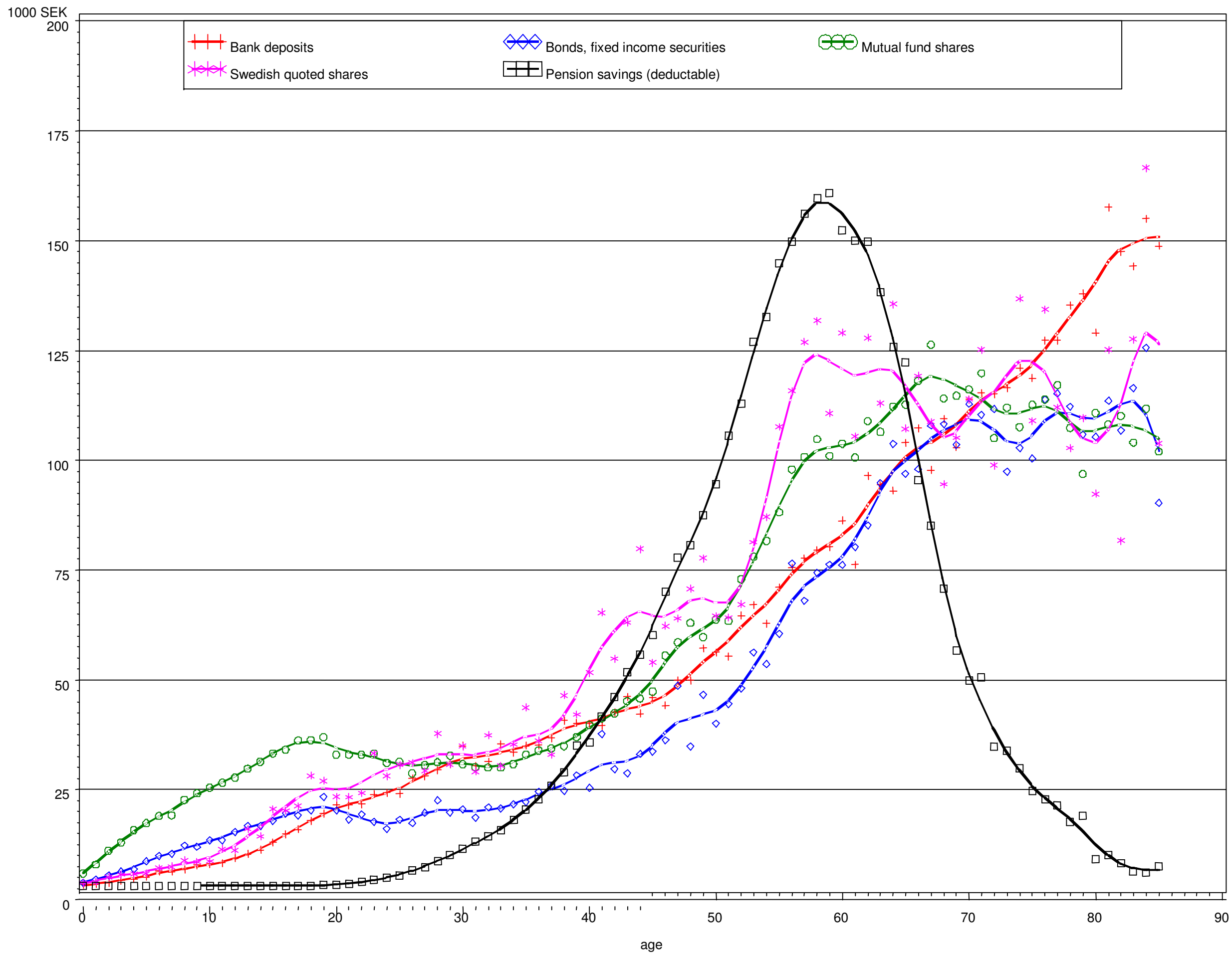
Figure 3. Real and financial wealth



[6] In Linda 2000 about 31 % of all individuals older than 18 with no real wealth have debts above 50 000 SEK (excluding study loans), the corresponding figure for those with real wealth is 67%. The average debt for those with real wealth is about 250 000 SEK and for those without only 66 000 SEK.

Finally, the financial portfolio is presented in Table 1 and the age profile in Figure 4. In 1999, the largest component is Swedish quoted shares, 419 billion SEK. As expected the distribution of this asset is extremely skewed, the top decile owns more than 98% and the top percentage owns almost 67%.[7] Bank deposits are the second largest asset with a total value of 358 billions. Bank deposits increase steadily with age whereas shares reach a peak around age 55. Mutual funds and fixed income securities has a similar pattern as shares. Pension savings is an important asset, in total 315 billions, and the age profile shows a peak around 60 and then it drop rapidly. This pattern is given by construction since no new savings are added after retirement.

Figure 4. Financial wealth



[7] The extreme skewness of this variable produces some measurement problems. The values reported in [12] are almost 60 billions higher. We believe this result is due to a smaller sample used by SCB. This problem is further highlighted if changes are considered. SCB reports 517 billions in 1999 and 472 in year 2000, our corresponding results are 419 and 415. Thus, we report almost no change compared to a decrease of almost 9 percent by SCB.

Modeling of Financial and Real Wealth in SESIM

The wealth and housing module includes a large number of variables modeled or calculated. The calculations are carried out sequentially; the order is given in Figure 5. It is instructive to start with financial wealth and pension savings and later real wealth, cost of housing and finally income of capital.

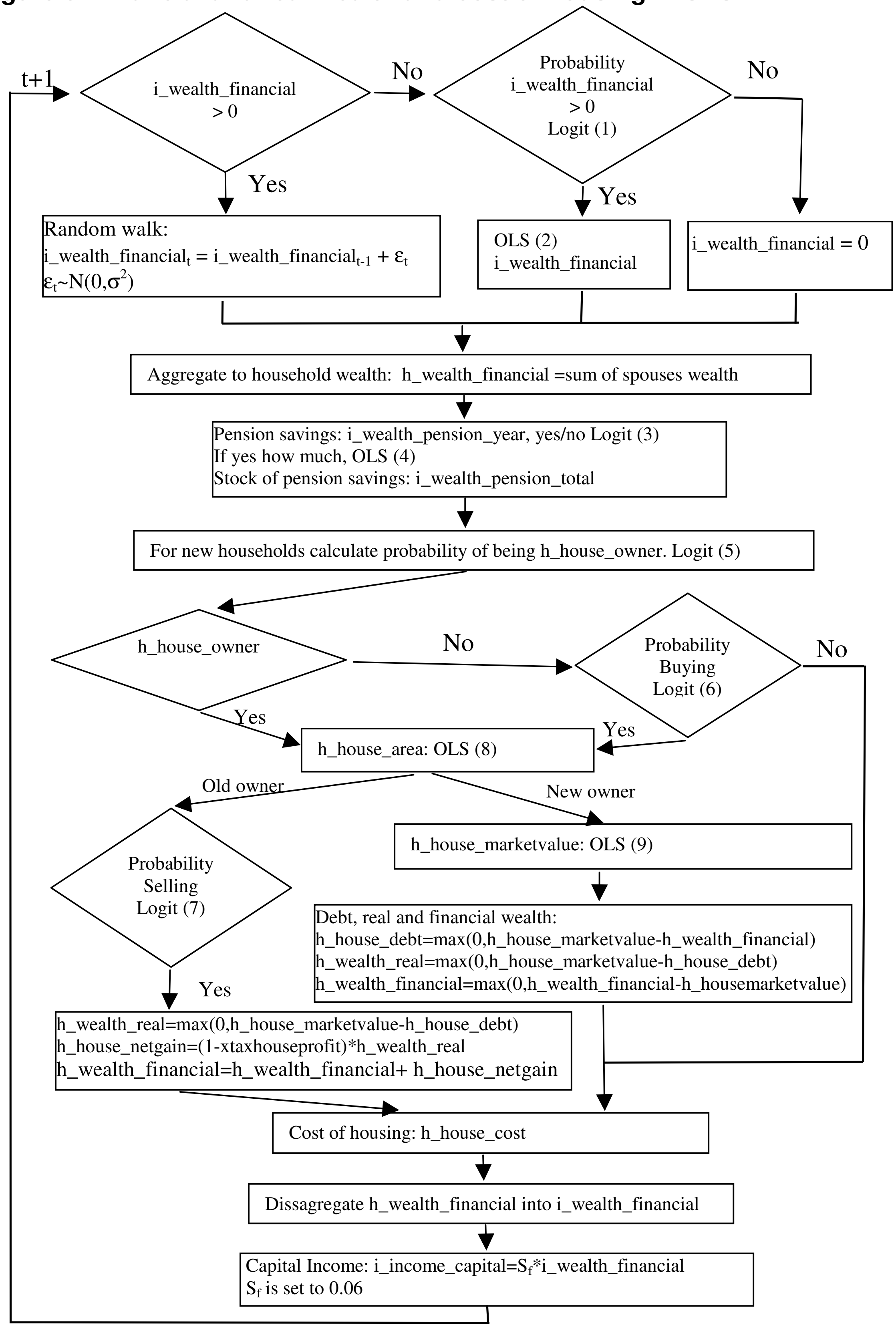
The flow chart in Figure 8 starts the process in year 2000 (the first simulated year) at the diamond-shaped box in the upper left-hand side. This is a check whether an individual had financial wealth in the start data (year 1999), if yes his financial wealth is updated using a simple random walk. If no the probability of financial wealth is imputed using model (1). The purpose of the first model (1) is to estimate the probability of financial wealth. This is given in Figure 8 as the second diamond box in the upper right hand side. Next, the prediction from model (1) is evaluated and a Monte Carlo experiment is applied[8]. If a positive wealth is predicted the next model (2) is applied in order to calculate how much. As a final step, individual financial wealth is aggregated to household wealth.

Financial wealth is modeled as a two-part model. That is, the probability of financial wealth is estimated independent of the value. The reason for using the two-part model compared to, for instance a generalized tobit or two-stage methods (heckit), is that we are not interested in explaining selectivity. Here, the purpose is to obtain good predictions, it is demonstrated in [9] that the two-part model performs at least at good as the tobit type 2. In [4] the sensitiveness of the generalized tobit model is demonstrated, errors in the specification of the selection equation produce bias in all the estimated parameters. Here we are much more concerned in robustness compared to a potential increase in efficiency.

The parameters of the estimated logit model and the OLS-model (presented in [5]) are generally estimated with both reasonable levels and a high precision. The estimated parameters have in general the same sign, meaning that the variables have a similar effect on the probability of wealth as well as on the level of wealth. The estimated age profile conditional on a positive wealth is strictly increasing up to 60 years and then stay rather stable up to 80 years after which it drops. Education has a strong effect, odds ratio for lowest education is only 0.44, thus the odds of having a financial wealth are reduced by 56% for those with the lowest education holding all other variables constant. There is also a strong effect of income; higher income implies a higher probability of wealth. Nationality has a strong effect, being a Swedish born imply a 180% increase in the odds of having wealth, and conditional on having wealth a Swedish born has on average almost a $(e^{0.18}-1)100 \approx 20\%$ higher value.

[8] Let P denote the predicted value from model (1), then this value is compared to a random draw from the uniform(0,1) distribution, say R. If R < P then the individual is given a financial wealth. This principle is applied on most predictions in SESIM.

Figure 5. Financial and real wealth and cost of housing in SESIM



Next pension savings are imputed, model (3) and (4). These refer to yearly tax-deferred pension savings. These savings are then added to the stock of pension savings. As with financial wealth, we assume that the stock of pension savings increase by a specific amount each year. The intention is that model (3) and (4) applies for first time savers, and then a simplifying assumption is that this amount, adjusted by consumer price index, applies each year until retirement. The construction of the pension savings model is discussed more in detail in the section below related to the pension system.

Next step involves formation of real wealth. For each household a net real wealth can be imputed. We assume that all loans are loans on your home, thus people do not have any other debts, and therefore financial wealth is never net of debts. Home ownership as well as the market value is known in the start data, however in the simulation new households are created and for those the probability of being a house owner have to be imputed, model (5). Next, we check whether the household owns a house. If yes the housing area is imputed, model (8), this has to be imputed for all households since this is not known in the data and this information is needed as an independent variable in other models as well as for calculation of housing cost. If the household does not owns a house the probability that they will buy one, model (6), is calculated. If they buy a house, the housing area is imputed, model (8). Next step for new house owners is to impute market value, model (9), and then to calculate debt, real wealth and household financial wealth. For old owners the probability of selling is imputed, model (7), and given a sale the net real wealth, net gain from the sale and financial wealth is calculated or adjusted.

Next step for all households who owns a house is to update housing and wealth variables. We assume that all house owners who have a debt and financial wealth pay mortgage, we assume that they decrease their debts by 1/50:th each year and that the financial wealth is decreased by the same amount and real wealth is adjusted accordingly.

Returning to figure 2, there are two more boxes to be explained. First, household financial wealth is disaggregated into individual. This is done in order to calculate income of capital. Income of capital is calculated as a share of financial wealth. Every year, each individual capitalize a share of his financial wealth, this share is currently set to 6%.

Finally, a short remark on the needs of calibration. In order to obtain reasonable results the estimated probabilities in several of the estimated relations have been adjusted. The method used for this calibration is to start a simulation where no inflation or economic growth is assumed. Then the relevant estimated probabilities had been multiplied by a constant factor, where the size of this factor is chosen in such a way that two conditions are fulfilled; first there is no dramatic change between the start year 1999 and the first simulated year 2000 and secondly there is no increasing or decreasing trend in the long run. The main reasons for the need of this adjustment are probably that the models are estimated on a cross-section, as mentioned above this is simply due to lack of wealth information for any other period then 1999-2000.

In the next section a description is given regarding the pension system. First the public pension, then the occupational and finally the private.

THE PENSION SYSTEM IN SWEDEN

The pressure from an aging Swedish population forced a reformation and the introduction of a new public pension system in 1999. The new system consists of two parts, a notional defined contribution pay-as-you-go system (NDC PAYG) and an advance-funded defined contribution system (DC). The former DB system is gradually being phased out, this implies that the new system covers only partly individuals born between 1938 and 1953, while it totally covers individuals born thereafter.

In the new pension system, employers and employees pay a total contribution of 18.5% on earnings: 16% to the NDC PAYG system and 2.5% to the DC system. Both systems are autonomous from the state budget and self-financing. However, general revenues from the state budget finance a minimum guarantee benefit for low-income earners and for lifetime poor.

The Notional Defined Contribution Pay-as-you-go System

The notional defined contribution pay-as-you-go system has the characteristics of a defined contribution system, but in a pay-as-you-go setting. One such feature is the full link between contributions and benefits, i.e., benefits are projected from contributions paid on all earnings during a lifetime. However, contributions are only recorded in individual accounts and the real contributions are financing payments to today's pensioners, as in any pay-as-you-go setting. However, contributions paid on earnings above the ceiling of about SEK 290,000 in 2003 (7.5 Basic Amounts (BA)) per year do not qualify for pension rights. Contributions on the individual account represent a promise of future pension and are indexed by average wage growth. Pension holdings and pension payments are indexed at a slower rate than average wage growth when average wage growth increases faster than wage sum and/or when observed average length of life increases after retirement.

A second feature of the NDC PAYG system is that the annual benefit level is calculated by dividing the total contributions in the individual account by age-specific and unisex life expectancy, which also includes an expected real rate of return of 1.6% per year.

The Advance-funded Defined Contribution System

The contributions to the financial account system in the public and mandatory DC system are paid to an individual account once a year. These contributions are invested in mutual funds based on individuals' investment decisions. This implies that pension assets will grow at the rate of return of the chosen funds and based on annual contributions.

The accumulated capital in the individual account cannot be withdrawn until retirement age, which is flexible from the age of 61. The annuity is calculated by dividing the individual account value by unisex and age-specific life expectancy at retirement day. During the years of retirement, individuals can choose a fixed or a flexible annuity rate: fixed, by moving the assets to the state annuity provider which includes a minimum annual return of 3 %; flexible, by keeping the assets in the fund reflecting the market rate of return.

The launch of the new defined contribution system in the fall of 2000 entitled the Swedish workforce, more than 4.4 million individuals, to invest pension assets in mutual funds. At this time, accumulated contributions from 1995 to 1998 were invested, which approximately corresponded to SEK 56 billion. The individuals could choose to invest in one to five different mutual funds from 460 available funds in the system. This means that the Swedish system has greater latitude for choice than U.S. 401(k) plans, which typically include only a few funds. For individuals who do not make an active investment decision, the government provides a publicly managed mutual fund.

Occupational Pensions

Most employed individuals are covered by central agreements between the unions and employers' confederations. These central agreements include occupational pension schemes financed through employers' contributions. These occupational schemes provides pension in addition to the public system, but also compensates for incomes above the ceiling. Thus, these schemes are mostly important for high-income earners. In principle four occupational plans are distinguished: blue-collar workers in the private sector, white-collar workers in the private sector, central government employees and local government employees.

Note that SESIM includes a model for prediction of which sector an individual belongs to, this is imputed first time an individual enters the labor market. In SESIM we also allows for a change of sector, when this is done the accumulated pension rights are transferred to the new sector.

Recently these four occupational systems have been reformed and in SESIM, we have implemented both old and new rules at a detailed level. In order to give some understanding of the basic design of these plans below a short description of the most important characteristics of the current rules are given.

In general, the occupational systems have been transformed, like the public system, from defined benefit to defined contribution.

For blue-collar workers the new system is a fully funded pension scheme where 3.5% of gross earnings are paid into a personal account in a pension fund. Each worker can chose about a dozen insurance companies to manage his pension fund.

White-collar worker in the private sector are covered by a benefit defined scheme as well as a fully funded. The defined benefit scheme is determined by earnings the year before he retires. The benefits are 10% of that years's salary up to 7.5 BA, 65% between 7.5 and 20 BAs, and 32.5% between 20 and 30 BAs. Contributions to the defined benefit scheme have been around 4.5 percent of gross earnings. The contribution to the fully funded system is approximately 2 percent of earnings up to 30 BA. The worker is free to choose a company to manage his fund. The fully funded system is normally claimed as monthly payments over a five-year period after retirement.

After 1992, there exist two schemes for Central Government employees, one fully funded and one pay-as-you-go. In the fully funded 1.7% of annual salary is paid to a pension fund. The PAYSG is determined by average earnings during the five years preceding retirement. The benefits are the same as for White-collar worker but based on the five years average earnings instead of last years. The pension is reduced proportionally if the requirement of 30 years of contributions since age 28 is not met.

The new system for local government employees is fully funded and similar to blue-collar workers.

Private Pension Savings

To model income from private pension savings (the third pillar) is a challenge since the stock of accumulated tax-deferred pension savings, at the individual level, is not known in Linda (or any other data). The reason being that these savings are not taxed until after retirement, the return on these savings are added to pension income and taxed as ordinary income. Therefore, the only information available is the yearly deductible savings. For an analysis and descriptive statistics of these yearly savings, see [7] and [8].

The simple idea here is to construct accumulated savings by using repeated Linda panels. Individual savings are summed up over years and the resulting stock is increased each year by applying the average return from the life insurance companies. In order to reduce the starting value problem, we start as early as 1980, in those years private tax-deferred pension savings was rather unusual.

Table 3, below summarizes the main characteristics of pension savings during the period 1980-2000. Column (2) gives the share of all individuals with pension savings; note this is the share of the whole population, regardless of age. Thus, during this period there has been an increase from about 4 to 21%. The share with a positive accumulated savings, i.e private pension wealth, is given in column (6). In year 2000, more than 30% have a positive accumulated savings, the mean value, column (7) is 110 863 SEK and the corresponding mean of yearly savings, column (3) is 6 591 SEK. Even if the share of pension savers has increased the yearly amounts have not. The yearly savings reached the highest values in 1989 and since then it has gone down. The reason for this is that changes in the rules after 1989 have done savings less generous, also in recent years the return on these savings are quite low.

Table 3, also includes information about the share of individuals with income from private pension savings, column (4) and the mean values, given an income, column (5). The income from pension savings are relatively small, the reason for this is that this saving is a new phenomenon and the generated stock is still relatively small. However, the average amount for those 4.8% who had an income in year 2000 was 32 196 SEK.

The accumulated pension savings are given in column (8). The low value in 1980 indicates that the starting value problem is quite small; pension savings were unusual before 1980. The total pension wealth has increased to 315 billion SEK.

Table 3, Pension savings 1980-2000

	Share with pension savings (%)	Mean value given savings (tkr)	Share with income from pension savings (%)	Mean value given income (tkr)	Share with pension wealth (%)	Mean value given pension Wealth (tkr)	Sum of pension wealth (mkr)	Assumed return on savings (%)
1980	4.60	3 529	0.00	936	4.10	3 882	1 396	10
1981	4.70	3 962	0.00	1 416	4.40	8 086	3 137	10
1982	4.90	4 748	0.00	981	4.70	13 136	5 449	10
1983	3.80	6 968	0.00	2 127	4.80	19 728	8 411	12
1984	4.40	7 846	0.00	1 469	5.00	28 427	12 550	13
1985	8.20	8 321	0.00	1 427	5.40	39 080	18 828	15
1986	8.50	9 229	0.70	11 621	6.90	43 074	26 553	14
1987	9.70	9 969	0.80	14 074	8.70	46 748	36 056	12
1988	11.90	11 170	0.70	7 676	11.00	51 523	50 285	14
1989	14.40	12 955	0.70	8 027	13.60	62 291	74 903	21
1990	14.50	8 138	0.70	8 319	15.50	69 798	95 710	16
1991	12.50	9 656	2.60	21 013	17.20	73 414	111 944	10
1992	12.80	8 339	2.90	22 175	18.50	76 117	125 012	7
1993	13.30	8 465	3.30	23 476	19.50	79 001	136 367	5
1994	15.00	8 762	3.50	23 572	21.40	80 551	152 702	7
1995	16.20	6 861	4.10	22 528	23.00	82 478	168 393	7
1996	17.30	6 764	4.10	23 608	24.60	85 822	187 482	8
1997	18.20	6 705	4.20	25 272	26.10	92 546	214 326	11
1998	19.20	6 659	4.30	27 870	27.80	100 973	248 870	13
1999	20.50	6 785	4.50	30 540	29.70	104 530	275 265	8
2000	21.90	6 591	4.80	32 598	32.00	110 863	315 101	12

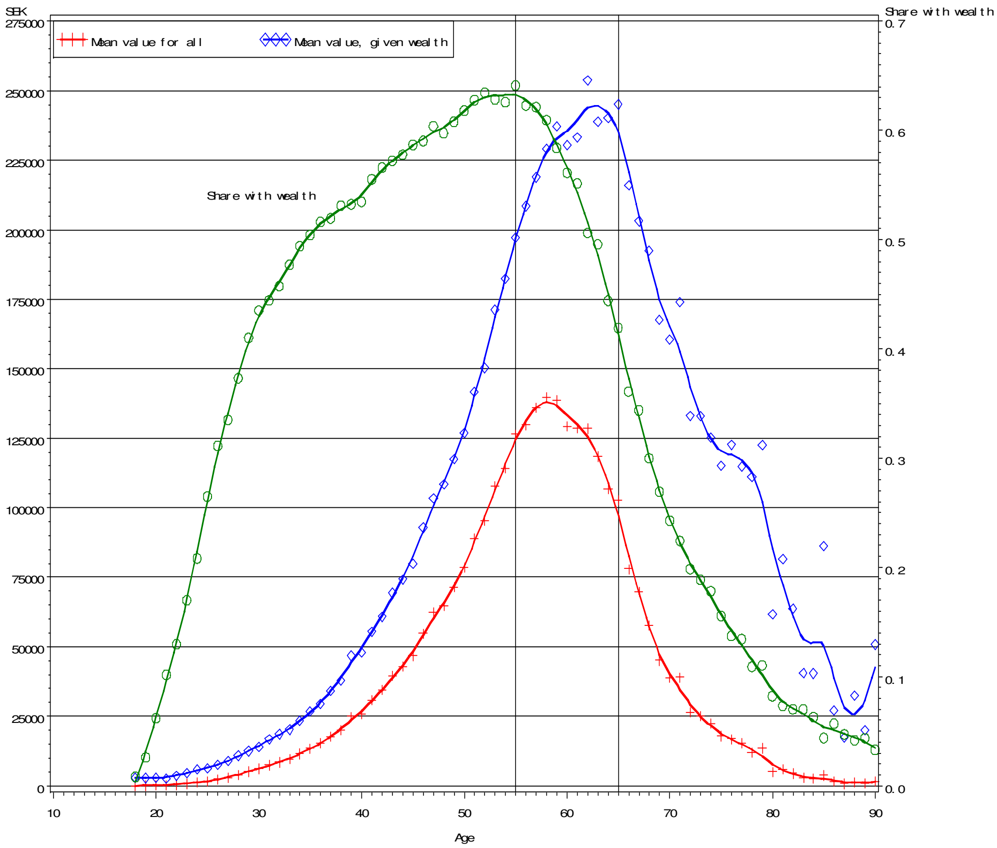
Note, own calculations based on the Linda panel 1980-2000. Information on average returns, in column (9), comes from The Swedish Insurance Federation (www.forsakringsforbundet.com). Note, these returns are returns before tax and administrative costs.

Of course, pension savings varies with age. Figure 5 show the age profile of accumulated pension savings for individuals older than 17.

The profile for the share with a pension wealth increase sharply from age 18, and at age 35 about half of all individuals have some accumulated pension savings. The peak value at age 55, the first vertical line, is almost 65%. Note age 55 is the earliest age of payment from the insurance companies. The age profiles of people who have savings indicate that the importance of this wealth asset will increase in a near future.

The amount of savings, given savings, reaches its peak just before 65 years of age, the second vertical line. The highest value is at age 62 and more than 250 000 SEK.

Figure 5, private pension wealth.



Given this accumulated stock on pension savings, we have information for each individual the starting year 1999, also, known in 1999 is the savings that year. For individuals who made any deductions for pension savings in 1999, we assume that they will continue saving this amount (adjusted for CPI) every year until the age of retirement. For individuals who did not have any savings in 1999, a two-part model for new pension saving in 2000 has been estimated. Populations at risk are all individuals 18-64 year in 2000 who did not have pension savings in 1999. In forecasting accumulated pension savings, we have to estimate the probability and the amount saved first time. Then we assume that the individual save the same amount (adjusted by CPI) each year until age 64.

This yearly savings are then added to the stock and an assumption on a yearly return is used.

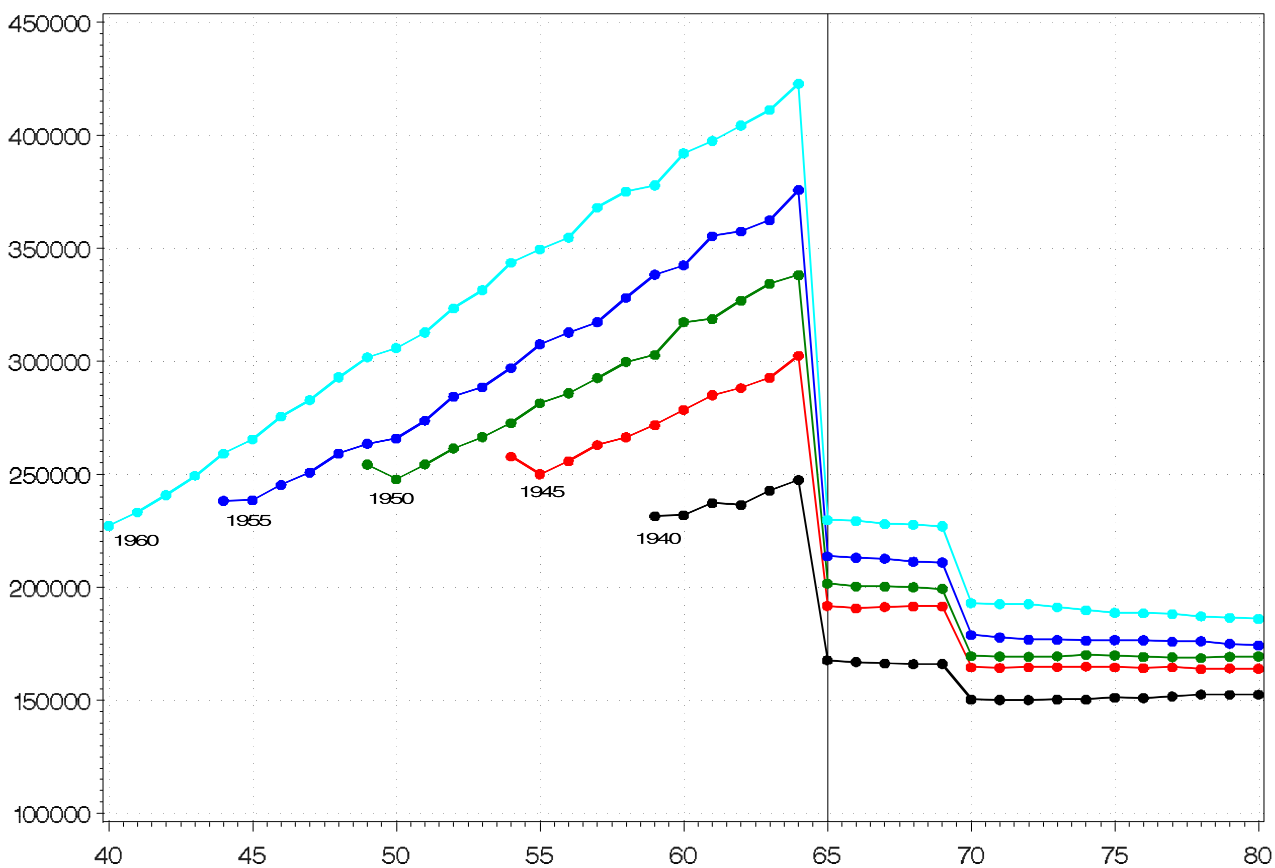
Regarding the payments stream many different options are possible, a limited time, the whole lifetime etc. In the current version of SESIM, a five year period is the norm, but we also allows for some variation in order to match the observed profiles in year 1999.

COMPARING INCOME BEFORE AND AFTER RETIREMENT

SESIM is used to simulate income for different cohorts during the period 1999-2041. The cohorts are chosen such that they belong mostly to the old pension system, partly to the old and the new and completely to the new system. The first cohort included is those born 1940 (6/20 on the new system), 1945 (11/20) on the new system, 1950 (16/20 on the new system) and 1955 and 1960 who are completely on the new system.

Figure 6 gives the overall effects on taxable income before and after retirement for different cohorts. The important assumptions used in this simulation are that everyone is working before age 65 (status=2) and that they retire at age 65. We consider the results in figure 6 as the default alternative. The important parameters are everyone retires at age 65, a yearly inflation rate of 2%, a real growth 3%, a return on financial assets of 5% (relevant for all funded pension systems, including PPM and private pension).

Figure 6. Taxable income before and after retirement for different birth cohorts in 1999 year prices.



Note: SESIM generated 1999 – 2041. All individuals have worked until age 65 and then retired.
Inflation ≈ 2%/year, real wage ≈ 2%/year and long interest rate 5%/year.

As expected, younger cohorts have much lower replacement rates, these rates also drops after the first five-year period after retirement. The reason for the drop after age 70 is that pension from most fund based systems is received only during a five year period. However, it must be remembered that the sample used for this comparison is based on individuals who worked before retirement. Thus, the sample used here has a relatively high income and if the comparison also includes other groups, unemployed, disability pensioners etc. then the drop in income after retirement is less dramatic.

Next in order to present the effects on replacement rates for cohort, age and income a sub sample of individuals are analyzed including only individuals who have worked at least five years before retirement, then retired at 65 and survived at least to 75. For this sample, the average taxable income in age 60-64 is calculated. Then average taxable income as well as average public, occupational and private pension is calculated first for age 65-69 and then for age 70-74. In order to analyze the replacement rates for different incomes we classify average taxable income in age 60-64 in three groups, below the first quartile, between the first and third quartile and above the third quartile. Table 4 summarizes the results.

Table 4. Replacement rates for different birth cohorts and income levels.
Average income in age 65-69 and 70-74 related to average taxable income in age 60-64.

Cohort	Income class	Age 65 - 69				Age 70 - 74			
		Taxable Income %	Public Pension %	Occupat-ional Pension %	Private Pension %	Taxable Income %	Public Pension %	Occupat-ional Pension %	Private Pension %
1940	< p25	110	85	8	16	99	86	7	5
	p25-p75	75	55	10	8	68	56	8	2
	> p75	67	39	16	10	60	40	14	4
1950	< p25	82	59	12	10	72	60	9	1
	p25-p75	68	46	13	8	58	47	10	1
	> p75	60	28	23	8	49	28	18	2
1960	< p25	77	55	13	7	67	55	11	0
	p25-p75	62	41	15	5	53	41	10	0
	> p75	55	28	22	4	45	28	15	0

Note: SESIM generated 1999 – 2041.
All individuals have worked from age 60-64, retired at age 65 and survived at least until 75.
Inflation ≈ 2%/year, real wage ≈ 2%/year and long interest rate 5%/year.

For individuals born in1940 and an income in the midrange the average taxable income during the first five years after retirement is 75% of the average taxable income during the five years period before retirement. The major component is public pension (55% of taxable income before retirement), the occupational and private pension have about the same importance (10 and 8% of taxable income before retirement). The replacement ratio during the second five-year period drops to 68% and the main reason being the drop in the private pension. The occupational pension drops only slightly since, for this cohort, most systems are based on defined benefits and paid during the lifetime.

Replacement rates are lower for younger and the composition is different. Individuals born in 1960 with a midrange income can expect 62% of the pre-pension income the first five period, and only 53% the second. The reason for this drop is the drop in occupational and private pensions. The drop in occupational pensions, from 15% to 10%, is related to the transformation in those systems toward fully funded systems and those are typically paid out during a five-year period.

Private pension is more important for older cohorts. This might imply an underestimation of private savings for younger. Remember that the individuals born in 1940 are 59 year old when the simulation starts, thus, most of their savings are known in the data, for younger most of their savings have been imputed during the simulation. Note, those private pensions are quite important for low-income earners.

For high-income earners covered completely by the new pension system, the public pension component covers less than 30% of pre-pension taxable income. The reason being that many of the individuals are not fully compensated since they have incomes above the ceiling. However, the occupational pension partly compensates for this.

Apart from the three pillars in the pension system there is also an important potential income source coming from other private wealth. In order to get a measure of the importance of this source a hypothetical value is constructed. Assuming that all individuals with a positive real value (a house) sell this at age 65, then the sum of the net value of the house (net of debts and taxes) and financial wealth is calculated. This wealth represents the maximum private wealth at age 65. Next, assume that this wealth is distributed over 20 years; here we just divide the sum by 20. Then the question is how much is this hypothetical income from capital in relation to average taxable income during the five year periods before retirement. The idea is to get some measure of the hypothetical income stream that could be generated from private real plus financial wealth. In Table 5, this is denoted potential income from wealth. The largest impact is for the lowest income, especially low income "baby-boomers", where the ratio is .24. Thus, individuals belonging to this group has a large potential to increase their post-retirement income.

Table 5 also list changes in the share of house owners before and after retirement. In general, especially for the oldest cohort, there is a larger propensity for low-income households to sell their house when they retire. Thus, the house serves the purpose of a buffer for retirement. In the model for predicting house sales, there is a significant effect on income on the probability to sell. A low-income household has a much higher probability.

Table 5. Wealth before and after retirement for different birth cohorts and income levels.

Cohort	Income class	Share house-owners 60-64	Share house-owners 65-69	Potential Income from wealth
1940	< p25	**0.44**	**0.37**	**0.24**
	p25-p75	**0.46**	**0.42**	**0.12**
	> p75	**0.54**	**0.48**	**0.12**
1950	< p25	**0.41**	**0.35**	**0.19**
	p25-p75	**0.46**	**0.39**	**0.13**
	> p75	**0.54**	**0.47**	**0.10**
1960	< p25	**0.37**	**0.30**	**0.19**
	p25-p75	**0.44**	**0.37**	**0.11**
	> p75	**0.49**	**0.42**	**0.10**

Note: SESIM generated 1999 – 2041.
All individuals have worked from age 60-64, retired at age 65 and survived at least until 750.
Inflation ≈ 2%/year, real wage ≈ 2%/year and long interest rate 5%/year.

Apart from taxable income and wealth, it is also interesting to evaluate the effects on disposable income. Thus apart from taxable income, income from capital as well as transfer payments and taxes are considered. In Table 6, the replacement rates have been calculated similarly as for taxable income, first and second five-year period after retirement compared to the five-year period before. All calculations are based on disposable income divided by number of adult's members in the household.

Table 6. Retirement age and disposable income.
Average income first and second year period after retirement in relation to average income five year period before retirement (in percentage).

Cohort	Income class	Age of Retirement 65		Age of Retirement 67		Age of Retirement 63		High return 7%		Low return 3%	
		Age 65-69 (1)	Age 70-74 (2)	Age 67-71 (3)	Age 72-76 (4)	Age 63-67 (5)	Age 68-72 (6)	Age 65-69 (7)	Age 70-74 (8)	Age 65-69 (9)	Age 70-74 (10)
1940	< p25	102	104	111	112	97	100	109	107	104	100
	p25-p75	83	76	88	81	83	73	85	76	82	73
	> p75	78	68	83	72	76	63	82	71	77	64
1950	< p25	86	82	88	86	77	74	93	88	81	76
	p25-p75	77	65	81	69	69	61	83	73	74	65
	> p75	71	58	79	66	69	56	77	63	70	55
1960	< p25	77	70	85	77	69	66	86	79	70	63
	p25-p75	74	63	76	66	67	56	84	73	65	55
	> p75	69	55	76	62	65	52	78	64	66	54

Note: SESIM generated 1999 – 2041.
All individuals have worked at least five years before retirement and survived at least 10 years after.
Inflation ≈ 2%/year, real wage ≈ 2%/year and long interest rate 5%/year.

Column (1) and (2) lists the rates for the two periods. Again same message as for taxable income, higher rates for older cohorts. For instance, mid income rates during the second year period are 76% for individuals born 1940 compared to 63% for those born 1960.

Finally, in order to investigate the sensitivity in the results reported above we calculate replacement rates for different retirement ages and for different assumptions regarding return on financial assets. The results are also reported in Table 6.

Columns (3) and (4) reports replacement rates for a late retirement (67) and columns (5) and (6) for an early retirement (63). There is an interesting lack of symmetry in the results. For the old cohort a late exit increase the rates but an early exit does not have any effect, except for high-income earners. However, for the 1960 cohort an early exit reduce the rates. This reflects differences in the design of the new and old system. The annual benefit level in the new system is calculated by dividing the total contributions in the individual account by age-specific life expectancy and this is affected by the retirement age.

Since the new pension system has many components that are dependent on the returns on savings, we can expect the replacement rates to change accordingly. Columns (7) to (10) report results based on an assumption of high return (7%) and a low return (3%). As expected, only a minor change for the old cohort and a relatively large effect for the younger. For instance the replacement rate for the middle income and the 1960 cohort is 84% given a high return compared to only about 65% given a low return.

CONCLUSION

Using the Swedish microsimulation model SESIM income before and after retirement is calculated. Since the focus is on the effects of the new Swedish pension system, income for individuals covered by the old system as well as those covered by the new are included. The results show, as expected, that the new system is less generous. In order to achieve a compensation level close to the old system the retirement age has to be delayed and the return on savings has to be high.

Our results also demonstrate the importance of the second and third pillar in the pension system. Especially occupational pension will play a crucial role for younger generations. Since these systems as well as part of the public system to an increasing degree are dependent on funded systems, we can expect a large variation in income depending on the returns on these funds.

A serious simplification in this evaluation is that everyone has the same return on his savings. As a consequence the variability in pension income for younger cohorts is underestimated. To model the household's choice of pension funds and allow for heterogeneity in returns on these savings is an interesting challenge for future research

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