# Financial Implications of Income Security Reforms in Sweden*

by

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**Abstract:** We use a retirement decision model developed in Palme and Svensson (2004) to simulate the implications on the net public sector spending of three hypothetical reforms of the income security system in Sweden. Each reform implies a less generous income security system. The predictions of the total effects of the reforms are decomposed in one "mechanical effect", the predicted effect under the assumption that the individuals do not change their retirement behavior, and one "behavioral effect", the effect that can be referred to the predicted change in retirement behavior from the policy change. We also study how the financial burden of the different reforms is allocated between the quintile groups of the distribution of lifetime earnings.

* We are grateful for comments at NBER International Social Security project conferences in San Sebastian and in Assmannshausen am Rhein. The work has also benefited from comments on a seminar at the Ministry of Finance in Sweden and from Annika Sundén. Mårten Palme acknowledges financial support from the Swedish Council for Social Research.

## 1. Introduction

Like most other Western industrialized countries, Sweden will in the near future face the financial burden from the combined effect of large birth cohorts reaching retirement age, increased longevity, and a trend towards early retirement. An obvious way to ease the financial pressure is to increase labor supply among older workers by providing economic incentives to stay in the labor force. Although this was one of the main motives behind the recent major reform of Sweden's public old-age pension system, there are, to our knowledge, no previous studies examining the link between the economic incentives inherent in the income security system and the finances of the public sector in Sweden.

In this study we use an econometric model of the retirement decision developed in Palme and Svensson (2004) to simulate the public finance implications of three hypothetical reforms of Sweden's income security system. In these simulations the labor supply response to the reform among older workers is taken into account. Changes in total payments from the public income security system (including labor market insurance programs) and tax payments (including payroll taxes, VAT and income tax to the state and the municipalities) are considered separately in the simulations.

One of the study's emphases is to decompose the overall change in the finances of the public sector in a "mechanical" and a "behavioral" component. The mechanical component is defined as the change in the finances of the public sector when individuals do not change their retirement behavior as a result of the reform. The behavioral effect is defined as the change that occurs as a result of changes in retirement behavior.

In the first hypothetical reform, the early and normal retirement ages (60 and 65 years in the current system) are delayed by three years. This implies that the actuarial adjustments in the pension scheme and the probability of being eligible for benefits from a labor market insurance program (disability, sickness or unemployment insurance) are delayed by three years. In the second reform an actuarial adjustment of 6 percent per year of early withdrawal before the normal retirement age is applied to all income security programs. Although this adjustment is very similar to the actuarial adjustment in the current public pension scheme and some occupational pensions, the adjustment is also applied to the labor market insurance programs under the second reform policy regime. Finally, in the third reform the current income security system is replaced by a pension benefit that replaces 60 percent of average earnings during the best 40 years if the pension is claimed at the normal retirement age at age 65. The pension can be claimed from age 60 with an actuarial adjustment of 6 percent for each year of early withdrawal. Benefits from labor market insurance programs could no longer be used to finance early exit from the labor market.

Although these reforms were chosen for the purpose of the cross-country comparison in this volume, rather than being realistic policy alternatives for Sweden, we believe that the results have relevance for the current public policy debate on the income security system in Sweden. Sweden has recently implemented a reform of its public old-age pension system. One of the main features of the reformed system (see e.g. Palmer, 2001 for an overview of the reform) is that benefits are indexed to follow the growth in the average nominal wage rate rather than consumer prices. This means that benefit levels will be reduced if the growth rate in the economy falls below the norm. Hence, the type of reductions in benefit levels considered as reforms in this study is automatic, rather than discretionary, under the post-reform pension system in Sweden. Labor supply responses studied in this paper can, therefore, be an important stabilization of public finances under the new public pension system.

There are several issues related to reforms of income security systems that are excluded from the analysis and left for further research. We do not model changes in household savings behavior, which is likely to be an important response to benefit cuts in the income security system. We also ignore potentially important “general equilibrium” effects on different prices in the economy, which may, in turn, influence public finances.

The rest of the paper is organized as follows. Section 2 gives a brief overview of Sweden’s income security system. Section 3 describes the data, gives a short description of the empirical model and presents results from the estimation of the empirical model. Section 4 presents the hypothetical reforms of the income security system and describes the simulation methodology. The results from the simulations are presented in Section 5. Section 6 concludes.

## 2. Sweden's Income Security System

The income security system in Sweden consists of three parts: the public old-age pension system, the occupational pension schemes and the compulsory labor market insurance programs. These programs are, to about the same extent, used for financing exits from the labor market. In this section, we give a brief description of how these programs are constructed.[1] We start with the public old-age pension programs and the occupational pension schemes. We then describe the disability, sickness, and unemployment insurance programs.

### *2.1 The Public Old-age Pension System*

Sweden's public old-age pension system consisted of two parts during the period studied:[2] a basic pension and a supplementary pension (ATP). All Swedish citizens are entitled to the basic pension, which is unrelated to previous earnings. The normal retirement age for this benefit is 65, but it can be claimed from age 60 with a permanent actuarial reduction of 0.5 percent for each month of early withdrawal. If the benefit is claimed beginning after age 65, the level is permanently increased by 0.7 percent for each month of delayed withdrawal up to age 70.

All social insurance programs in Sweden are indexed by the basic amount (BA), which follows the CPI closely. In the year 2001 the level of one BA was 36 900 SEK.[3] The level of the basic pension is 96 percent of a BA for a single pensioner and 78.5 percent for married. The basic pension also contains a survivor's pension.

The supplementary pension is related to a worker's previous earnings. The amount of the benefit is calculated using the following formula

$$Y_i = 0.6 \cdot AP_i \cdot \min((N_i / 30), 1) \cdot BA, \qquad (1)$$

[1] For a more complete description, see Palme and Svensson (1999 or 2004).

[2] The description is based on the rules pertaining for persons covered in the study. Sweden has succesively introduced a reform of the public old-age pension system in the 1990s.

[3] In 2001 the exchange rate was about 10 SEK/US$.

where $AP_i$ is individual average pension points, BA is the basic amount, $N_i$ is the number of years an individual has recorded covered income greater than zero. The average of pension points is calculated as the average of annual earnings below the social security ceiling of 7.5 BA of the worker's fifteen best years. The normal retirement age for the supplementary pension is 65. The actuarial adjustment for early and delayed withdrawal are the same as for the basic pension.

### *2.2 Occupational Pensions*

Sweden has a highly unionized labor market. Around 95 percent of all employees are covered by central agreements between the unions and the employers' confederations. These agreements regulate pension programs and other insurances programs for the employees. There are four main agreements, each with its own pension scheme. The private sector has one scheme for blue-collar and one for white-collar workers. On the public side, there is one scheme for employees in central government and one for employees in county and local governments.

The private sector blue-collar workers included in our sample are under two different occupational pension schemes. Those born between 1927 and 1931 are covered by the STP scheme. The benefit in this scheme is 10 percent of the average annual earnings below the social security ceiling of the three best years of the five years between age 55 and 59. At least three years of earnings between age 55 and 59 are required to be eligible for the pension. The benefits are paid out starting when the worker is aged 65. The STP-plan is financed on a pay-as-you-go basis.

In 1996 the STP scheme was replaced by a fully funded scheme, covering workers born after 1940. The cohorts between 1938 and 1940 are covered by a transition scheme and those who are born between 1932 and 1937 can choose between STP and the transition scheme. The benefits in the transition scheme are calculated as 10 percent of annual earning under the social security ceiling after age 30 plus the amount that the worker receives from the fully funded system. The contributions to the fully funded scheme were 2.0 percent of annual earnings between 1996 and 1999. The contribution rate was increased to 3.5 percent in 2000.

White-collar workers in the private sector are in general covered by the ITP and ITPK schemes. The benefit formula the ITP pension replaces 10 percent of a worker's earnings the year before retirement up to the social security ceiling of 7.5 BA, 65 percent of earnings between 7.5 and 20 BAs, and 32.5 percent between 20 and 30 BAs. The normal retirement age for the ITP plan is 65, but the benefit can be claimed with an actuarial adjustment from age 60. ITPK is a fully funded scheme that was introduced in 1977. The contribution rate is 2 percent of gross annual earnings.

Until 1992, employees in central government were covered by a gross pension scheme that replaced 65 percent of annual earnings the year before retirement. This scheme was replaced with a net pension that is similar to the ITP scheme. However, the benefit is determined by the average of annual earnings during the five years preceding retirement. Employees in central government are also covered by a fully funded scheme that was introduced in 1992. The contribution rate in this scheme is 1.7 percent of the annual wage sum.

Finally, employees in county councils and local government are covered by a gross pension, which is determined by the average of annual earnings of the five best years of the seven years preceding retirement. It replaces 96 percent below 1 BA, 78.5 percent between 1 and 2.5 BA, 60 percent between 2.5 and 3.5 BAs, 64 percent between 3.5 and 7.5 BAs, 65 percent between 7.5 and 20 BAs, and 32.5 percent between 20 and 30 BAs. It can be claimed with an actuarial adjustment from age 60.

### *2.3 Labor Market Insurance Programs*

There are three important labor market insurance programs: disability insurance (DI), sickness insurance (SI) and unemployment insurance (UI). Eligibility to disability insurance requires that the individual's capacity to work is permanently reduced by at least 25 percent. Full compensation requires that the capacity is completely lost. A physician in general determines work capacity, but eligibility for disability insurance is ultimately determined by the local social insurance administration. Between 1970 and 1991 disability insurance could be granted for labor market reasons, i.e., no requirement of reduced work capacity was needed.

The disability benefits consist of a basic pension and a supplementary pension (ATP). The level of the basic pension is the same as for the old-age scheme and the supplementary pension is determined in the same way as for the old-age scheme with no actuarial reduction for early retirement. "Assumed" pension points are calculated for each year between the date of disability and age 64.

Sickness insurance replaces a share of lost earnings due to temporary illnesses up to the social security ceiling. The replacement level has been changed on several occasions during the time period covered by this study. In a reform in 1987, the replacement level was set to 90 percent of the worker's insured income. Since then, the replacement has been decreased several times. The first time was in a reform in 1991. In 1996 it was set to 75 percent of the insured income for long sickness spells and in 1998 it was raised to 80 percent.

The unemployment insurance benefit consists of two parts: one basic part, which is unrelated to a worker's insured income, and one part which requires membership in an unemployment benefit fund and is related to a worker's insured income. Unemployed workers who actively search for a new job are eligible for compensation. The main difference between the benefit level in the unemployment and sickness insurance programs is the income ceiling. The ceiling in the sickness insurance is the same as for other parts of the social insurance system, while the ceiling in the unemployment insurance is subject to discretionary changes, and is lower than the ceiling for the sickness benefit. The replacement rate for unemployment insurance has also been changed on several occasions during the time period analyzed in this empirical example. These changes have roughly followed the changes in the sickness insurance.

### *2.4 Income Taxes and Housing Allowances*

Sweden went through a major income tax reform in 1991. Before the reform, all income were included in the same tax base and taxed with a proportional local government tax (around 30 percent depending on municipality) and a progressive national tax. The maximum marginal tax rate was set to 75 percent. The main feature of tax reform was that the tax base was divided into capital income and earned income. Income from capital is taxed at the national level with a rate of 30 percent and earned income is subject to a local government tax and above a certain break point by a 20 percent national tax. The marginal tax rate was reduced considerably.

Old age, disability, and survivor's pensioners with low income are entitled to a housing allowance. In 1995, this allowance was at most 85 percent of the housing cost up to a ceiling. About 30 percent of all old-age pensioners received housing allowances in 1995.

## 3. Empirical Model

We use an econometric model to predict the behavioral responses to the policy reforms considered in this paper. For the current purpose we provide a brief overview of data sources, the specification of the empirical model, estimation results and results from the prediction of the behavioral responses to the reform. A detailed description of these issues is given in Palme and Svensson (2004).

### *3.1. Data*

The data come from the Longitudinal Individual Data panel data set (LINDA). LINDA is a pure register sample, i.e., no interviews were made when the data were collected. The three main registers used to obtain the LINDA panel are the Income and Wealth Register (Inkomst- och Förmögenhetsstatistiken, IoF). Population Census (Folk- och Bostadsräkningen, FoB),[4] and the National Social Insurance Board Registers for pension points (based on earnings).

The original sample for the LINDA panel is a random draw of about 300,000 individuals from the 1995 population register. The sampling procedure used to update the panel backwards and forwards from 1995 is designed so that each yearly cross section of LINDA is also a random sample of the Swedish population, i.e. each individual has the same probability of being included in the sample irrespective of the type of household he or she is living in.

The LINDA panel also contains information on the spouse of each individual originally included in the sample. In general, the same variables as for the original individuals are also available for their spouses. There are two, somewhat different, definitions of "spouse" in LINDA. The first definition, used by the tax authorities, includes individuals who are either formally married, or are cohabiting and having children together. The second definition refers

[4] FoB exists for every fifth year between 1960 and 1990, and is obtained from mailed questionnaires. Everyone living in Sweden is included in the FoB and participation in the census in compulsory.

to all spouses that in the mailed questionnaire have reported that they are living together, i.e., share housing. This information is only available for the years of the census (FoB). When calculating incentive variables for this analysis, we used the first definition since it is available for all years.

In this study we use two sub-samples. In the first, used for the estimation, we select individuals born between 1927 and 1940. We further restricted the sample to employees at age 50, i.e., we exclude those who were self-employed, unemployed or out of the labor force at age 50. Table 1 shows the number of individuals remaining in the sample after different steps in the sample selection procedure. In the time dimension, we restrict the sample to the period 1983 to 1997. For this period we are able to observe the retirement behavior using the detailed income components available. The second sample is used for the policy simulations. This one is restricted to individuals born in 1940. In Section 4 below we describe this restricted sample.

We define a worker as retired the first year when income from work is permanently below one BA. We have also compared this definition of retirement with one where we define the year of retirement as first year when as individual starts to receive less income from work than pension benefits. It turned out that the resemblance between these definitions for the individuals in the sample were fairly good. However, since the former definition of retirement is more in accordance with the general definition of the date when the worker leaves the labor force we used that in the empirical analysis.

*3.2 Empirical Specification*

The following retirement model was estimated:

$$R_{it} = \delta_0 + \delta_1 ACC_{it} + \delta_2 ISW_{it} + \delta_3 AGE_{it} + \delta_4 PREARN_{it} + \delta_5 EARN_{it} + \delta_6 PREARN_{it} * EARN_{it} + \delta_7 SPEARN_{it} + \beta' X_{it} + v_{it}, \qquad (2)$$

where $R_{it}$ is a dummy variable which takes the value 1 if year t is individual i’s last year in the labor force, where $ACC_{it}$ is the measure of accrual at time t; $ISW_{it}$ is the net present value of social security wealth discounted to time t; $AGE_{it}$ represents the individual's age either by a linear variable or by indicators for each age; *PREARN* is the individual's predicted earnings at time t and the square of this measure; *EARN* is a measure of the individual's lifetime earnings and its square; *SPEARN* is lifetime earnings of the spouse, its square and the spouse's net social security wealth discounted back to time *t*; *X* is a set of individual characteristics, including marital status, education level (*Educ1-Educ6*), socioeconomic group (*Occ1-Occ4*) and indicators for each of Sweden's 25 counties (cf. Section 4 for the construction of these variables).

The key variables are the measures of economic incentives described by ISW and ACC. ISW is measured for each individual for each potential retirement age as

$$ISW(r,t) = \sum_{s=r}^{\max age} \delta^{s-t} E_t B(s,r), \qquad (3)$$

where δ is the discount factor and $E_t B(s, r)$ is the expected benefit at age s if the worker retires at age r, i.e.,

$$E_t B(s,r) = p(s \mid t) q(s \mid t) BM(s,r) + p(s \mid t)(1 - q(s \mid t)) BS(s,r) + (1 - p(s \mid t)) q(s \mid t) S(s,r,t) \qquad (4)$$

where *BM(s, r)* is the worker's pension benefit at age s if he is married and retires at age r; *BS(s, r)* is the worker's pension benefit at age s if he is not married and retires at age *r*; *S(s, r, t)* is the survivor's benefit when the worker would have been aged s and retired at age r; p(s | t) is the probability of survival at time s conditional on survival at time *t*; *q(s | t)* is the probability of the spouse surviving at age s conditional on survival at age t. *S(s, r, t)* depends on the spouse at time t as well as the retirement age r, while *BM(s, r)* and *BS(s, r)* are not dependent on t since we assume perfect foresight about wages. We also disregard the possibility of divorce.

Three alternative measures of ACC were used in the estimation. In the policy simulations we use “peak value” and “option value”. Peak value is defined as the difference between the current ISW and the maximum ISW the worker can expect in the future provided that he or she stays in the labor force. It is “forward looking” not only in the sense that it considers all future expected benefit payments, but also in the sense that it considers all future possible gains of staying in the labor force. This is also true for the option value measure, but this measure includes additional parameters for the subjective discount rate, the valuation of leisure and a risk aversion parameter. The accrual is then defined as the difference between the utility stream of retiring the current year versus at the “optimal” future date, i.e., it measures the value of the option of staying in the labor force. Palme and Svensson (2004) describes how the additional parameters are estimated.

*3.3 Estimation Results*

Table 2 and 3 shows the estimates for the models that we use in the policy simulations for males and females respectively. Each table contains four different specifications: for each of the two alternative accrual measures, one equation applies a linear specification in age and one uses dummy variables for each age.

The coefficient estimates for the variables measuring economic incentives – income security wealth for the sample individual and the spouse as well as the to alternative accrual measures - are of key importance in the policy simulations. Table 2 shows that the coefficients estimate for each accrual measure have the expected (negative) sign and are significantly different from zero in both models. The estimates for ISW, both for the sample individual and the spouse, are, as expected, positive and significantly different from zero in all four models.

The estimates for the sample of women are, as can be seen in Table 3, somewhat different. Again, the estimates for the accrual measures are significant with the expected sign in all specifications. However, the estimates of the ISW coefficient are only significant with the expected sign for the sample individual in the peak value specification with age dummies. The estimates for the husband’s ISW are insignificant in all specifications and the ISW coefficient for the sample individual in the option value models is significantly different from zero with the unexpected sign.

## 4. Simulation Methodology

The aim of the simulation exercise is to study the financial implications of three hypothetical reforms when taking the change in retirement behavior as a response to the reform into account. To do this, we will follow one particular birth cohort, those born in 1940, going through four alternative policy regimes: one following from the current Swedish income security system and three following as a result of the hypothetical reforms of the system.

Since the LINDA panel is a random sample of individuals,[5] our sample constitutes a random sample of individuals born in 1940 with the additional requirement that they should be employed or temporarily unemployed at age 55, i.e., self-employed and those who were not in the labor force were excluded. This selection resulted in a sample size of 2,148 (1,109 men and 1,039 women). Using the sampling weights of the data set it can be shown that this sample represents 66 percent of the 1940 birth cohort living in Sweden at age 55. In the calculations, as we will explain below, we will also use information from 1,561 spouses of the individuals in the sample.

### *4.1. Different States and IS Flows*

We consider individual retirement behavior starting at age 56 up to age 79. In each year, the individual can exit from the labor force to either retirement, in most cases financed through the income security system, or to death. Since these alternative states have very different financial implications we will consider the two alternative states (retired or dead) for each of the 24 years, i.e., 48 different states, ex post, for each individual in the sample.

If the individual exits to retirement there are, as we explained in Section 2, different possibilities for financing the retirement through the income security system. Ideally, it would have been desirable to consider all of the different paths to retirement and assign a probability to each of them. This would, however, as is explained in Palme and Svensson (2004), involve an unrealistic number of alternatives. Instead, as we did in the estimation of the retirement choice models, we combine the paths that involve labor market insurance into one “stylized”

[5] The individual rather than the household is the sampling unit.

path. This means that the retirement state is further divided into two pathways to retirement: the old-age and the labor market insurance pathway.

Each state has different financial implications for the public sector. To calculate these, we consider all expected income and payroll tax payments, VAT and payments from the income security system between age 55 and 108. All future payments are discounted back to age 55 using a three-percent real interest rate. For workers for whom we cannot observe labor earnings we use a three-year average of earnings before the exit from the labor force to predict this missing information. In addition to that, for workers younger than age 55, we upgrade the earnings by the age specific average increase in earnings.

*4.2 Predicting the Probability for Each State*

In order to predict the income streams we also need the probabilities for each individual to end up in each state. Since there are three different states at each age, these calculations have to be made stepwise.

We use the estimated econometric model described in Section 3 to predict individual retirement hazards at each age. That is, we use the characteristics of each individual and use the estimated probit equation to obtain the conditional probabilities. The covariates include the economic incentive variables, i.e., we are able to predict the probability of exiting to retirement for alternative income security policies. Using the predicted retirement hazard and gender specific life tables, we can calculate the probability of exiting to retirement or death at each age.

For the probability to finance the exit from the labor market by labor market insurance, rather than old-age pension, we assign the probability observed in the data to that path *conditional* on exiting from the labor market at a particular age. Note that this is different from the strategy we used in the estimation where we used the probability of being granted benefits from a labor market insurance program *unconditional* on applying for such insurance or leaving the labor force. Both these sets of probabilities are shown in Figure 1. The Base probabilities are also used for the Actuarial adjustment and Common reforms.

*4.3 Handling Spouses in the Simulation*

In the estimation of the retirement choice model, the economic position of the spouse were allowed to influence the retirement probability of the sample individual through the lifetime income and the social security wealth. On the other hand, we made the simplifying assumption retirement *behavior* was fixed. Assuming fixed behavior of the spouse is obviously not satisfactory in simulations of financial implications of policy reforms, since some of the financial impact may come through behavioral changes of the spouses, through changes in the size of the sample individual's income security wealth.

In the Swedish income security system this interaction goes only through survivor benefits and housing allowances. The income of the spouse does not influence income taxes paid by the individual. The rules for housing allowances are very complicated and the overall importance of housing allowances for incentives and benefit flows is rather limited. For this reason we have treated them as if they were individual benefits as part of a simplified model of housing allowances. Given this simplification it is possible to calculate the taxes paid and the benefits received for our sample on an individual basis. We use information about the spouse (including predicted behavioural responses to reform) in order to estimate survivor benefit payments to the primary sample individual, but the estimate of financial effects are only based on the cohort 1940 primary sample. This strategy means that men and women are treated in the same way, which is desirable since labor force participation for women in the 1940 cohort is almost the same as that for men.

To take this behavioral change into account we follow a procedure in three steps. In the first step, we calculate the ISS flows for each age of the sample individual *conditional* on retirement of the spouse at each age between 55 and 70. In the second step we predict retirement probabilities of the spouse, using the same model as for the sample individual. Finally, in the third step, for each age of the sample individual, we average the ISS flows of the individual in the sample using the weights of the predicted retirement probabilities of the spouse.

### *4.4 Hypothetical Reforms of the Income Security System*

We will simulate the financial implications of three hypothetical reforms of Sweden's income security system. The reforms are rather different in their design. The first reform delays eligibility of all pension benefits by three years. The second one introduces an actuarial adjustment in the labor market insurance programs. All other rules of the baseline system, including eligibility ages, are retained. The third reform replaces the entire income security system with a pension that replaces 60 percent of average earnings during the best 40 years. This reform is referred to as the “Common reform” since it allows for cross-country comparisons with results from the other papers in this volume.

*4.4.1 Reform1: Delaying Eligibility by Three Years*

As we explained in Section 2, most Swedish old-age pension benefits has normal retirement age at age 65 but can be claimed from age 60. Also the labor market insurance programs depend on age. The probability of being admitted DI increases with age and prevalence of older workers being admitted to long-term sickness as well as unemployment insurance is also greater than in younger age groups. In addition, rules on mandatory retirement age on the Swedish labor market will also affect the dependence between age and labor force participation rates.

Delaying eligibility ages in the old-age pension system and probability of being eligible for labor market insurance programs decreases the value of the ISW since each worker can either expect fewer benefit payments or a larger actuarial adjustment compared to the current system. Since we estimated a positive effect of ISW on retirement probability we expect the reform to delay retirement.

In simulating the effects of delaying the eligibility ages in the income security system a key issue is how to separate the effects of economic incentives - both through the old-age pension programs and labor market insurances through changes in the probability of being eligible for benefits - from the effects from mandatory retirement ages and latent retirement behavior specific to age. Our strategy to deal with this issue is to do a sensitivity analysis that produces a lower and an upper bound for the effect on retirement behavior from the reform.

To carry out this sensitivity analysis we do three different simulations. In the first simulation (S1) we use the model with a linear specification in age (M1). In the second one (S2), we use the model with age dummies (M2). In the third simulation (S3), we again use the M2 model, but now we shift the age dummies by three years. The S2 simulation constitutes a lower bound for the predicted effect of the reform since it implicitly assumes that the over-parameterized dummy variable specification in age *only* reflects the latent retirement behavior by age and rules on mandatory retirement ages on the labor market. The S3 simulation constitutes an upper bound for the predicted effect by implicitly making the equally unrealistic assumption that the dummy variable specification *only* reflects the unmeasured economic incentives generated by the income security system.

*4.4.2 Reform 2: Extension of the Actuarial Adjustment*

In this reform the actuarial adjustment is changed to 6 percent for each year of early withdrawal before the normal retirement age at age 65. This means that the actuarial adjustment is maintained in the public pension system (for ages 60-64) as well as in the occupational pension schemes for white-collar workers in the private sector and employed in central government. Also, the pension plan for blue-collar workers in the private sector is maintained, since it cannot be claimed before age 65.

The actuarial adjustment in occupational pension system for employees in the municipalities is somewhat increased and the actuarial adjustment in ages 66-70 in the public system is reduced from 8.4 percent per year. However, the major change implied by this reform is that an actuarial adjustment is applied also for the disability insurance and for those who exit from the labor market through the unemployment or sickness insurance. This change is likely to increase the accrual in individual income security wealth of staying in the labor force and thereby increases the economic incentives of staying in the labor force.

*4.4.3 Reform 3: Change to a "Common" System*

In this reform the entire income security system is replaced with a pension system where the benefit is calculated as 60 percent of average earnings during the best 40 years if the worker retires at a "normal" retirement age at age 65. It can, however, be claimed from age 60 with a life-long actuarial adjustment of 6 percent per year of early withdrawal, and delayed until age 70 with a symmetric actuarial adjustment. All labor market insurance programs are abolished in this hypothetical reform.

The effect of the reform on the economic incentives is less transparent compared to the three-year-delay reform. In general, most workers will experience a substantial reduction in their income security wealth since the current system in general, except for the very high-income earners, has a higher replacement level including the occupational pensions. There is also an effect from the abolition of the labor market insurance programs on the income security wealth. The actuarial adjustments are very similar to those in the current old-age pension system. However, the abolition of the labor market insurance programs implies that we can expect an effect on the accrual measures as well.

*4.5. Decomposition of the Total Financial Implication of the Reforms*

To measure the total financial effect of a reform in the income security system we use the individual Income Security Wealth (*ISW*) as defined in equation (2). The total financial effect is then defined as the aggregate differences between the *ISW* under the pre-reform policy regime and the post-reform regime respectively. Within a given policy regime the individual *ISW* depends in each period on whether or not the individual remains in the labor force and on survival. It is, however, possible to calculate *ISW* conditional on that the individual is each of the 48 states and for the pre- and post reform policy regimes respectively. In the sample the total effect can be calculated as,

$$Total\ effect = \sum_{i=1}^{N} \sum_{s=1}^{48} P_{is}^{R} ISW_{is}^{R} - \sum_{i=1}^{N} \sum_{s=1}^{48} P_{is}^{B} ISW_{is}^{B}\ , \tag{5}$$

where $P_{is}$ denotes the probability of each of the 48 states between age 56 and 79 of being in the labor force, retired or dead for a particular individual *i*. The superscripts B and R denote the pre- and post-reform policy regimes respectively. That is, at age 55 all members of the sample is alive and in the labor force. At age 56 each individual will have a probability of being dead and a probability of being in the labor force under the pre-reform policy regime, which is different from that in the post-reform regime. This is true at age 57 and each age until 78. At age 79 we assume that all individuals have retired.

The total financial effect of a reform of the income security system can be decomposed in two components. We call the first component the *mechanical effect*. This is the predicted financial implication of the reform under the assumption that the workers do not change their labor supply behavior as a response to the reform. The second component, the *behavioral effect*, is the financial effect that can be referred to the predicted change in the workers’ labor supply behavior. This effect is ignored in financial predictions of reforms in the income security system that does not take labor supply considerations into account.

By adding and subtracting $\sum_{i=1}^{N} \sum_{s=1}^{48} P_{is}^{B} ISW_{is}^{R}$ to equation (3) we obtain the following decomposition:

$$Total\,effect = \left( \sum_{i=1}^{N} \sum_{s=1}^{48} P_{is}^{R} ISW_{is}^{R} - \sum_{i=1}^{N} \sum_{s=1}^{48} P_{is}^{B} ISW_{is}^{R} \right) + \left( \sum_{i=1}^{N} \sum_{s=1}^{48} P_{is}^{B} ISW_{is}^{R} - \sum_{i=1}^{N} \sum_{s=1}^{48} P_{is}^{B} ISW_{is}^{B} \right), \quad (6)$$

where the first right hand side term within parenthesis is the *behavioral effect* and second term the *mechanical effect*. For the mechanical effect the pre-reform state probabilities, which reflect pre-reform labor supply behavior, are maintained, while the *ISW* in each state is calculated under the pre- and post-reform regime respectively. Conversely, for the behavioral effect the *ISW* under the post-reform is used for both terms, while the first term uses state probabilities for the post-regimes and the second term pre-reform ones.

## 5. Results

The predictions of the over all financial implications of the hypothetical reforms are shown in Tables 4 and 5. Table 4 shows the outcomes measured in expected present value per person in 1995, i.e., at age 55 for the individuals in the sample. Throughout the analysis we use a 3 percent discount rate. Euro per person in 2001 prices is used as currency unit.[6] Table 4 also shows the percentage change of the three different reforms relative to the current system.

Table 4 contains six main panels. Each panel shows the results from a combination of model specification, either the peak or option value accrual measure, and the three different simulation strategies explained in Section 4. Each main panel contains results on six different simulated outcomes for the current system and the three hypothetical reforms respectively.

The first row shows the expected present value of all future benefits from the public pension system. The pension benefits from the occupational pension schemes, which are considered in the incentive calculations since they contribute to net income after retirement, are deducted in

[6] We have used the exchange rate between SEK and Euro on January 1, 2001 (9.3175 SEK/Euro).

order to focus on financial implications for the public sector. To also show the total financial implications for the average worker, the second row shows total benefits including occupational pension benefits.

The third through the fifth row shows the average present value on different taxes paid directly or indirectly by the worker. The third row shows the payroll tax, the fourth the income tax and the fifth the VAT and indirect taxes.[7] Finally, the sixth row shows the sum of all these taxes.

Table 5 shows the decomposition, explained in Section 4.5, of the total financial implication of the reforms in a mechanical and a behavioral effect. As in Table 4, the results in Table 5 are divided into six main panels depending on combination of model specification and simulation strategy. Instead of the outcomes for the three different tax categories, each panel in Table 5 contains two additional items. The first one, "Net Change", measures the change in the benefits from the public income security system minus the changes in tax payment for each reform relative to the current system. The second item measures this as a percentage share of the benefits from the public income security system under the current regime.

In analyzing the results we will first look at the background to the results in Table 4 and 5 for each of the three reforms separately. We then look at the decomposition of the total financial effects in a "mechanical" and a "behavioral" effect as we described in Section 4. Finally, we analyze the income distribution implications by showing separately how the different quintiles in the in the distribution of lifetime income are affected by the reforms.

### *5.1 The Plus-3-years Reform*

Obtaining the predictions and the decomposition analysis presented in Tables 4 and 5 involves several steps. To explain these steps, and thereby giving an assessment of the reliability of the predictions, we will first explain the mechanical effects of the age shift reform - mechanical in the sense that the outcomes are measured assuming no change of labor force exit at different ages, i.e., the behavior responses are not taken into account. We then

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[7] To be able to estimate the effect of income changes on VAT and other indirect tax payments we need a tax rate for the combined effect from these taxes. This is set to 22 percent and is obtained from the ratio between aggregate sum of all indirect tax payments and household disposable income. We use data from the 2001 National Accounts for Sweden.

present the predictions of the behavioral changes implied by the reform; and, finally, the predictions of the financial outcome, i.e., combining the predictions of the mechanical and behavioral changes.

Figure 2 panel a shows the gross income security wealth, excluding occupational pensions, at age 55 by different ages of labor force exit for the current income security system and the policy implied by the Plus-3-year reform, respectively. It can be seen that the average social security wealth is somewhat higher under the Plus-3-years reform regime for most ages up to age 62. This is due to the fact that the probability of using the labor market insurance programs conditional on age of labor force exit is higher for younger age groups. Since these probabilities are shifted by three years in the Plus-3-years reform the ISW at a given age of exit will be higher under the post-reform regime. Between age 62 and 71, when most workers exit the labor market, the ISW is substantially higher under the current regime due to the higher actuarial adjustment under the post-reform rules.

For measuring the budget implications for the public sector of the reform, it is necessary to also consider all possible tax payments to the public sector. Figure 2 panel b shows the changes in the present value of the total taxes by age of labor force exit. It can be seen that the taxes paid are markedly lower under the post-reform regime between age 62 and 71. This reflects the lower replacement and consumption levels under this regime.

The differences in pre- and post-reform regimes conditional on age of labor force exit, shown in Figure 2 panel a and b, weighted by the pre-reform state probabilities sum up to the mechanical effect shown in Table 5. It can be seen that the reform implies that both benefit payments and taxes decrease, which was also evident from the figures.[8] The net change is, however, positive, which implies that the tax decrease dominates and the total mechanical effect of the reform represents a deficit for the public sector. This deficit is comparatively small – it corresponds to only 2.3 percent of the total benefits from the pre-reform public income security system.

[8] It can be seen in the second column of Table 5 that this mechanical effect varies between the simulation where the linear specification in age is used and the two specifications with age dummies. This is due to the different weighting of the different states. Since the dummy variable specification provides weighting that is more close to the actual behavior under the pre-reform regime, this is probably a better prediction of the mechanical effect.

The predictions of the behavioral response of the reform are shown in Figure 2 panel c, e and g for the option value specification and the three different simulation strategies. Each figure shows retirement probabilities for the pre- and post-reform regimes respectively for each age between 55 and 75. It is evident from these figures that all simulation strategies predicts delayed retirement as a result of the reform. The peak value predictions are not shown in the figure but the results are also quantitatively fairly robust with respect to choice of incentive measure (peak or option value). However, the predicted size of the behavioral effect is very different between S2 and S3.

In Section 4.4.1 we discussed the methodological background to the three simulation strategies. One interpretation of the large difference between the S2 and S3 results is that there are important aspects of the economic incentives that are not measured by the incentive measures in the model, which, in turn, are caught by the over-parameterized dummy-variable specification. It is, however, also possible that the dummy variables reflects institutions on the labor market, like rules on mandatory retirement ages and social norms, which are likely to affect the retirement behavior but are omitted in the econometric model. For this particular reform, which includes increasing the ERA from 60 to 63 and reducing access to labor market insurance programs at each age, the large behavioral response predicted by the S3 strategy might be more plausible than for other conceivable reforms.

Table 5 shows that all models and simulation strategies predict a financial surplus for both the income security system and the entire public sector from the reform. However, as expected from the simulation of the retirement behavior, the magnitude of the surplus differs substantially between the S2 and S3 simulations. This difference is largest when the peak value measure is used for measuring economic incentives, where the difference in “Net Change” is almost five times as large in the S3 simulation compared to about three times as large when the “option value” measure is employed. This difference follows from both a higher prediction of the S2 “lower bound”, about 14.2 thousand Euros compared the 11.7, for the option value measure and a higher prediction of the S3 “upper bound”, 43.0 thousand Euros compared to 51.8. The prediction from the S1 simulation is, as expected from the simulation methodology explained in Section 4.4.1, between the S2 and S3 lower and upper bounds, being very close, both in the peak and option value models, to the lower bounds.

The simulations of the behavioral effects also show that the greatest source of the surplus from the reform for the entire public sector (the “Net Change”) comes from greater tax payments. The share of the surplus that comes from more tax payments varies between 62 and 65 percent depending on model and simulation strategy.

The last step in obtaining the financial implications of the reform is to combine the mechanical, financial predictions with the behavioral ones. Figure 2 panel d, f and h show the total effect by age of retirement. The shaded bars show the total change in present value for all benefits (except occupational pensions) by age of labor force exit. The non-shaded ones give the corresponding information for the size of the total net effect. A negative outcome gives a surplus for the public sector from the reform corresponding to a particular age of labor force exit.

The total financial effect for the public income security system (“Benefits”) and the total public sector (“Net Change”) respectively shown in Table 5 can be obtained by summing the two sets of bars over all ages of labor force exit. The “Net Change” row is also shown in Figure 5. It is evident from the results in Table 5 that the financial surplus from the behavioral effect of the reform is substantially larger than the mechanical. This result comes out in all combinations of specifications and simulation strategy.

To sum up, the results on the first reform show that there is large degree of uncertainty depending on the choice of simulation strategy. Using the peak value measure, the net effect on the finance of the entire public sector compared to the current system is about five times as large when the second simulation strategy is used compared to the first one. The difference comes from both smaller benefit payments and larger tax contributions. All predictions, however, give substantial financial implications of the first reform. For the lowest estimate, the difference compared to the current system is about 5 billions SEK, which corresponds to about 0.2 percent of GDP in 2001.

### *5.2 The Actuarial Adjustment Reform*

The corresponding results to those shown in the previous section for the Plus-3-year reform are obtained for the Actuarial adjustment reform. As in the previous section, we start the analysis of the simulation results by looking at the mechanical effects. We then turn to the behavioral effects and, finally, to the total financial implications of the reform.

Figure 3 panel a shows the mechanical reform effect on benefit payments from the public income security system by age of exit from the labor market. The results here are very different compared to those obtained for the Plus-3-year reform. As expected, the present value of the payments conditional on labor force exit in young ages, the ages where the actuarial adjustment of the labor market insurance programs in the reform have a large effect, are substantially reduced compared to the current system. Also, after age 64 as the last year in the labor force there are still slightly higher payments under the current system. This is due to the fact that the 0.7 percent per month (8.4 percent per year) actuarial increase for delaying retirement after age 65 under the current system is actually *higher* than the 6 percent actuarial adjustment implied by the reform.

Figure 3 panel b shows the corresponding results for tax payments. As expected, tax payments decrease for all ages of labor force exit. The effect is largest conditional on early ages of labor market exit, where the largest effects on payments from the public income security system were located.

The mechanical effect is summarized in Table 5. Comparing the results to those of the Plus-3-year reform it can be seen that the effects are much larger for this reform - both for income security payments and taxes. Unlike the previous reform, the reductions in income security payments dominate the reduction in tax payments resulting in a surplus for the entire public sector ("Net Change") from the mechanical effect.

Turning to the behavioral effects Figure 3 panel c and e shows that the effect towards delayed labor market exit is much smaller compared to the Plus-3-year reform. Since neither the ERA nor NRA are changed from the current income security system, S2 and S3 are identical, which means that we only need to consider four combinations of simulation strategy and model specification. Comparing the results in Figure panel c and e shows that the predicted effects on behavior are in general smaller when the dummy-variable specification is used.

Again, Table 5 summarizes the behavioral effects. It is evident from these results that the financial implications from the behavioral effect can be ignored. The main explanation for this result is, of course, the small, predicted changes in retirement behavior. Also, in the age-interval where any differences were predicted, the current system is very similar to that under the reform.

The total effect shown in Table 5 and Figure 5 summarizes the results for the Actuarial adjustment reform. These results show that the effect is somewhat larger than the predicted lower bound of the Plus-3-year reform: around 7 compared to around 5 percent of the expected payments from public income security under the current system. However, compared to the upper bound of the Plus-3-year reform the effect of this reform is substantially smaller.

*5.3 The Common Reform*

The mechanical effects of the Common reform have, as can be seen in Figure 4 panel a and b, a similar pattern compared to those of the Actuarial adjustment reform discussed in the previous sub-section, the results from the Common reform are, however, somewhat stronger for young ages of labor market exit. This is due to the fact that the labor market insurance programs are abolished for these ages, while only actuarially reduced under the actuarial adjustment reform policy.

Again, the mechanical effects are summarized in Table 5. These results confirm that the mechanical effects on payments from the public income security system are stronger in the Common compared to the Actuarial adjustment reform. However, the largest difference between the mechanical effects of these reforms is on taxes: the reduction in tax payments is more that twice as large in the common reform compared to the Actuarial adjustment reform. The background to this result is that the occupational pension is abolished in the Common reform. Also, the payments from the income security system are capped at the $90^{th}$ percentile of the income distribution. As a result total benefit levels are substantially lower than under the Actuarial adjustment and current policy regime, which can be seen from the second row of Table 4. Benefits including occupational pension benefits are reduced by 29 percent, compared to 15 percent for the Actuarial adjustment reform and 9 percent for the Plus-3-year reform. Tax payments, especially from high-income retirees, are therefore reduced. The mechanical effect on the entire public sector is much smaller than for the Actuarial adjustment reform and actually zero in the simulation with the peak value incentive measure and the dummy-variable specification.

Turning to the behavioral effects, Figure 4 panel c and e show much stronger behavioral effects of the Common reform compared to the Actuarial adjustment reform. This is expected since the Common reform implies a more radical reduction of the income security benefits. This implies that the age distribution of exit from the labor market shifts to ages where the present value of the payments from the income security system is larger, which, in turn, implies that the behavioral effect on benefits from the income security system is positive. This result can be seen for all four combinations of incentive measure and simulation strategies in Table 5. However, this shift also implies that tax payments will increase, which induces a financial surplus for the entire public sector. As can be seen in Table 5, this effect dominates and the "Net Change" is very close to those obtained for the Actuarial adjustment reform.

For the common reform, the mechanical and behavioral effects work in the same direction. This implies that there will be a financial surplus from the reform. For the Actuarial adjustment reform almost the entire effect can be attributed to the mechanical effect, while the behavioral effect dominates for the Common reform.

### *5.4 The Total Effect of the Reforms as Shares of GDP and the Relative Importance of Mechanical and Behavioral Effects*

Figure 5 panel a-c show the decomposition of the total financial implications of the three hypothetical reforms as shares of Sweden's GDP for 2001. Relating the effects to GDP shows the economic importance of implementing the reforms for *the group of individuals that form the population of our sample*. As we described in Section 4, we use a random sample of individuals who were born in 1940 and employees[9] in 1995 at age 55. This group corresponds to 66 percent of all born in 1940 and living in Sweden in 1995. The size of this group is about 64,000 individuals.

Figure 5 panel a reveals that the net effect for the public sector finances corresponds to between 0.2 and 0.4 percent of GDP for the lower bound prediction of the Plus-3-year reform and all predictions for the Actuarial adjustment and Common reforms. Considering that the population under study corresponds to only about 1.5 percent of the total labor force, the effect must be considered to be of economic significance. Figure 5 panel a also shows that the upper bound prediction of the effect of the Plus-3-year reform gives a net effect between 1 and 1.3 percent of GDP. This is, however, likely to be an overestimate of the true effect.

Figure 5 also highlights the very different allocation between mechanical and behavioral effects between the reforms. An interesting result is that the behavioral effect is largest, even for the lower bound simulations, for the Plus-3-years reform. The only reform for which the mechanical effects seem to be important is the Actuarial adjustment reform.

### *5.5 Income Distribution Effects of the Hypothetical Reforms*

The simulations of the three hypothetical reforms also allow us to look at distributional implications. To do that we use family lifetime income from labor[10] to split the cohort sample into five quintile groups. The first quintile constitutes the 20 percent richest households; the second one includes households with lifetime income between the 60$^{th}$ and the 80$^{th}$ percentiles, and so on until the poorest 20 percent, which forms the fifth group.

The results are shown in Table 6 and Table 7. The S1 simulation strategy is used for obtaining the results in Table 6 and S3 for the results in Table 7. The option value (OV) accrual measure was used for both sets of results. The key result in these tables is the average change in net public sector payments in the quintile, measured as a share of the average present value of benefit payments in the current system. This amount measures how the burden of the decrease in public sector net payments is divided between different parts of the income distribution relative to their original share of expected payments from the public income security system. Note that the percentage change of expected discounted net income will be different since they include also occupational pension payments.

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[9] In the labor force and not self-employed.

[10] We use the sum of labor earning for the 40 best years (highest earnings) since age 20. For married couples we sum earnings from both spouses. Information on family composition is obtained from 1995 and we assume that each individual has been married (or in consensual union) to the same individual their entire life. The sample is divided into quintiles separately for married and singled and then merged together. This means that we get the same shares of married and single individuals in each quintile.

Although the results in Table 6 and 7 in some cases are on somewhat different levels, they show a very similar pattern of how the burdens of the reforms are distributed. The Plus-3-years reform is progressive in the sense that the upper quintiles in the income distribution experience a larger burden of the reform, as a proportion of the average present value of the expected payments from the income security system, than the quintiles with less average life time income. The results for the Common reform, and to a less extent also for the Actuarial adjustment reform show the opposite pattern: the low-income quintile groups suffer from a larger average burden of the reform than proportional to the average present value of their expected payments from the current income security system.

There are two main reasons for the simulation results for the Plus-3-year reform. The first reason is differences in changes in benefit payments due to the reform. Individuals in the low-income group have higher retirement probabilities at relatively young ages. One part of the Plus-3-year reform is that the probability of access to the labor market insurance benefits at each age and the probabilities of receiving benefits from a labor market insurance program conditional on retirement at a particular age are also shifted by three years (see Figure 1). The net effect is that individuals in the low-income group will experience an increased probability of receiving benefits from a labor market insurance program and the benefits from these programs are not affected by the reform. This is not true for the high-income group, which on average retire at much older age and have a lower probability of being eligible for labor market insurance benefits and, therefore, will suffer more from the shift in the actuarial adjustment implied by the reform.

The second reason is that tax payments increase more in the high-income group. Tax payments have three main components in this analysis: VAT, income and payroll taxes. Payments from income taxes and VAT will decrease with the S1 simulation strategy since the benefit levels decrease as a result of the reform. For the S3 case the behavioral effect is so large that it outweighs the negative mechanical effects on income taxes and VAT. However, payments through payroll taxes will always increase as a result of the delayed exit from the labor market since payroll taxes are only paid by workers in the labor force. The payroll tax increase as a percent of public benefit payments will be large in the high income group due to lower replacement rate and possibly also due to a larger behavioral response to the reform.

The result that the Common reform is regressive does also stems from differences in retirement behavior between different segments of the income distribution. Since the low-income group on average retire earlier and have a higher probability of being eligible for benefits from a labor market insurance program they will on average suffer more when these programs are replaced by an old-age pension scheme under the Common reform policy regime. This also applies to the Actuarial adjustment reform, but to a much less extent, since the labor market insurance programs are only subject to an actuarial adjustment under this policy regime

**6. Conclusions**

In this paper we use a labor supply model for the retirement decision and a sample of workers born in 1940 to simulate the effect on net public sector payments of three hypothetical reforms of Sweden's income security system. The estimates of the magnitude of the effects, disregarding the upper bound of the Plus-3-years reform, ranges between about on average 8,000-11.000 Euros in present value of all future transactions for the Plus-3-Years reform, to about 13.000 Euros for the Actuarial adjustment reform, and to about 15,000 Euros for the Common reforms. These average effects corresponds between about 0.2 and 0.4 percent of Sweden's GDP in 2001 for 66 percent of the cohort born in 1940.

These total effects are achieved very differently between the reforms. For the Plus-3-years reform the entire effect comes from the behavioral effect. The mechanical one actually works in the different direction. For the actuarial adjustment reform the entire difference comes from the mechanical effect, while for the Common reform the mechanical effect is close to zero and, again, the behavioral effect is the most important one.

Also the simulated effects on the income distribution is very different between the reforms. The Plus-3-years reform is progressive in the sense that a larger burden of the reform, measured as a share of the present value of expected payments from the income security system, is attributed to households with relatively high life time earnings. The opposite is true for both the other reforms, although to a larger extent for the Common reform. The background to the results were mainly found in the fact that low income workers on average exit earlier from the labor market and are more likely to be eligible for benefits from a labor market insurance program.

A general conclusion from the study is that both differences in retirement behavior between different groups of workers, in particular for the distribution analysis, and behavioral responses to the reforms, in particular for the total effect of both the Plus-3-year and the Common reforms, are very important for analyzing economic implications of reforms in the income security system.

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