Title: "*Distribution of Surpluses, and the Role of Bookkeeping in the Swedish Public Pay-As-You-Go Pension Scheme*"

Authors: Kristoffer Lundberg, Swedish Social Insurance Agency
Danne Mikula, Swedish Social Insurance Agency
Ole Settergren, Swedish Social Insurance Agency

Address: Adolf Fredriks Kyrkogata 8
SE-103 51 Stockholm
Sweden

E-mail: kristoffer.lundberg@forsakringskassan.se
danne.mikula@forsakringskassan.se
ole.settergren@forsakringskassan.se

Phone: Kristoffer Lundberg +46-8-786 92 52
Boguslaw D. Mikula +46-8-786 92 75
Ole Settergren +46-8-786 93 37

Fax: +46-8-786 93 76

Abstract

This paper discusses the role of bookkeeping and the balance sheet in the Swedish public Pay-As-You-Go (PAYG) pension scheme. The scheme's income statement and balance sheet, its balance mechanism, and the proposed legislation for the distribution of system surplus are presented.

A stochastic simulation model for projections of the Swedish pension system is presented as a tool to analyse alternative settings for different rules to identify and distribute surpluses. These model runs are then used to discuss the effects from alternative rules in respect to balancing risks and inter-generation fairness.

Keywords:
Actuarial bookkeeping, financial stability, balance mechanism, balance sheet, Pay-As-You-Go financing

Introduction

The new Swedish pay-as-you-go pension system, the *inkomstpension*[1], has been designed to be financially stable. That is regardless of economic or demographic development it will be able to finance its obligations with a fixed contribution rate and fixed rules for calculating benefits. This aim has been reached – at least this is what the designers claim[2] – by;

i. tying the pension entitlement (credit) almost completely to the contribution (tax) paid,
ii. indexing contributions and pensions with the change in average income,
iii. converting the accumulated notional capital with the current remaining life expectancy at retirement,
iv. including a buffer fund in the system to which all contributions are paid, and from which all benefits are paid,
v. dealing with any (negative) financial imbalances that remain in spite of, or are caused by, i-iv, with provisions for what is called automatic balancing.

"Rules" i.-iii. can perhaps be considered to summarize the essential aspects of so-called notional defined contribution systems.

If ex ante financial stability is a sought characteristic of a public pension system it can be achieved by a variety of means. The reasons for the design of this aspect of the Swedish system have been explained in the legislative history of the automatic balance mechanism, and in English in Settergren 2001, 2003a and 2003b. The practical application of the balance method can be studied in The Annual Reports of the Swedish Pension System 2001-2006. Settergren and Mikula (2005) attempt to give the balance method a formal explanation and generalise it to include also defined benefit PAYG pension plans.

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[1] In Swedish the word inkomst means income. The name inkomstpension was chosen to point out that the indexation of this benefit (normally) follows the income development. Here we follow the somewhat conflicting conventions used in the Swedish Pension System Annual Report not to translate the name inkomstpension but to do so when we write about the premium pension and the guaranteed pension. in Swedish; *premiepension* and *garantipension*.

[2] The first test of the financial stability that the inkomstpension done by persons not involved in its design is a recent working paper by Alan J. Auerbach and Ronald Lee (NBER Working Paper No. 12805). Their judgement, according to our interpretation of their paper, is that the design does secure financial stability in the sense that it excludes permanent buffer fund deficits.

The design of the inkomstpension plan implies that there is a risk that the system may accumulate a surplus. This was of course known by government and parliament when the design was proposed and decided in 1998.[3] However the research on the design of the automatic balance mechanism had had the objective to secure financial stability understood chiefly to avoid the risks of deficits. That is the objective was to legislate a pension plan that, irrespective of economic and demographic development, was able to finance all commitments made with a fixed contribution rate and resources in the buffer fund, while striving for a minimum volatility in average benefit level relative to average wage.[4] How to deal with the positive risk of accumulating surpluses had not been investigated. For this reason "*Genomförandegruppen*", the group of politicians to implement the pension reform, demanded that this issue should be investigated at the same time as they guided the bill on automatic balancing to parliament in 2001.

That investigation took the form of an inquiry with Inger Rydén Bergendahl as special inquirer. The Commission of Inquiry's recommendation took the name *Utredningen om fördelning av överskott i inkomstpensionssystemet* (UTÖ). One aim of this paper is to present in English some of the results from the inquiry which presented its findings in 2005 (SOU 2004:105).[5]

Brief on the Swedish public pension system

The public pension in Sweden consist of the *inkomstpension*[6], the *premium pension* and the *guaranteed pension,* a minimum subsistence pension that is added to the *inkomstpension* if a

[3] The automatic balance mechanism was only presented to parliament as a concept in the 1998 bill, when the financially unstable average wage indexation was chosen as the default indexation. One reason government chose to adopt this financially instable form of indexation was that the concept of automatic balancing had been presented and promised to be able to eliminate the financial instability that the preferred indexation was the main contributor to. In the 1998 bill government asked parliament to accept the concept of automatic balancing to be introduced if it was proven technically possible to legislate this concept after further investigation. Parliament accepted this proposal. In 2001 government presented legislation according to the principles adopted in 1998. Parliament passed the proposed legislation.

[4] To be more precise and technical, the aim was to minimize the volatility in the ratio of discounted benefits over discounted contributions for each cohort, using the growth in average wage as discount factor. In an ideal, for most nations unrealistic scenario, a NDC-system indexed with average income growth will produce zero volatility in this ratio and, even more unrealistically, produce a stable replacement rate over time.

[5] Gudrun Ehnsson, Ossian Ekdahl, Sarah McPhee, Hans Olsson, Boguslaw D. Mikula, Ole Settergren and Magnus Sjöström served as experts to the commission and Annika Sundén as its secretary.

[6] Until 2018 pension rights will earned also according to the "old" rules. In this paper this fact is largely disregarded.

person receives an inkomstpension below a certain limit.[7] This paper deals only with the inkomstpension.

Both the inkomstpension and premium pension works very much like ordinary "bank savings". The total contributions every year amount to 18.5 percent of all pensionable income below a ceiling which in Sweden is low in international comparison, only some 120 percent of an average full time salary. 16 percent points of the total 18.5 are contributions to the inkomstpension and the rest 2.5 goes to the premium pension. The contributions are recorded in a "bankbook" an individual account, where the "savings" accumulate over the years together with the applied indexation, the default indexation of the inkomstpension is the percent change in average pensionable income. This indexation will be interrupted if the balance mechanism is triggered.

Both the inkomstpension and premium pension can be drawn earliest at age 61 and both are paid until the death of the insured.[8] Both benefits are calculated by dividing the accumulated notional and funded capital, respectively with estimates of the payment periods length and interest rates. Both the mortality estimates and the interest rates used differ somewhat for the inkomstpension and premium pension. For details se the Annual Report 2006. Appendix A. page 71.

2 The Swedish Context

The method used to prepare the balance sheet and income statement of the new Swedish public pension scheme the *inkomstpension* is based on insights gained from the work undertaken to ensure its financial stability.[9] The founders of this social insurance scheme sought to legislate a pension plan that would guarantee the financing of its obligations with a fixed contribution rate – 16% – and the resources available in the buffer fund of the system. One reason for this financial firmness was based on social policy. Financial stability is a matter of social policy since any imbalance will have to be paid by someone at some time. This fact is also a source of distrust and reduced credibility of any "promise" that under some conditions will be (very) expensive to comply with.

[7] The guarantee is actually calculated on the size that the inkomstpension would be if also the premium pension contribution would have been credited the inkomstpension.
[8] The premium pension can be paid to either of two spouses or cohabitants as long as one of them survives. If this option is chosen by the insured the monthly benefit will be actuarially reduced.
[9] See the legislative history of the automatic balance mechanism.

In addition, financial sustainability was considered necessary to provide credible protection for the scheme against the daily governmental and parliamentary battle over resources. The founders were convinced that citizens would benefit if the new Swedish pension plan clearly determined who would pay for any financial imbalance, and when this burden would be borne. They considered it desirable to insulate the old-age pension system from the national budget to the maximum extent possible. To have this insulation it was considered necessary that the pension plan would never need financial support from the national budget to finance its obligations. That financial stability was considered necessary to insulate the scheme from the shorter term battle over resources does not imply that it was also sufficient to achieve this goal.

Though possessing unusual personal qualities the members of the pension reform group were not immune to the common temptation of wanting to have their cake and eat it, too. Specifically, they sought to establish a pension system that was not just financially stable, but also designed to ensure that pensions would develop in line with average earnings, i.e. provide a stable replacement rate for different generations. Swedish economists, well versed in Samuelson's (1958) basic text, strongly urged reformers to index pensions and the pension liability to the growth of the contribution base, mistakenly believing that such indexation would secure financial stability. As for the reformers, they were concerned not only with financial stability, but also with the "content of the product", i.e. the specific effects on pensions from different types of indexation; thus, they advocated indexation of pensions and the pension liability according to the development of the average wage, rather than total wages.

The method of managing the conflicting goals of financial stability and a good insurance product – here, essentially indexation to the average wage – is perhaps of some general interest. The dilemma in this case was "managed" not by a compromise, but through a design intended to maximize the likelihood of indexation at a rate equal to the growth in average income, with automatic exceptions to this indexation if the system would otherwise risk becoming financially insolvent. Weather the system can afford to index notional pension accounts and pensions with the growth in average income or not is determined by estimating the pay-as-you-go schemes assets and liabilities in a double entry bookkeeping system. Prior to the description of this

bookkeeping a short section follow below on measures of actuarial balance in pay-as-you-go pension plans.

3 Measures of actuarial balance in pay-as-you-go pension plans

For us, the most familiar measures of the financial status of public pension schemes are the one that was used in Sweden by Riksförsäkringsverket (RFV) prior to 2001[10] and the central measure since long used by the US Social Security Agency (SSA).

In Sweden RFV was obliged to present an analysis every five years of the financial status of the public pension scheme and, in relation to this analysis, to propose a suitable contribution rate, i.e. payroll tax. The analysis was presented mainly as a projection of buffer-fund development, in terms of fund ratio,[11] assuming a fixed contribution rate and unchanged benefit provisions. Normally financial balance, i.e. a buffer fund that never dropped below a certain level in a specific scenario, would be secured by proposing an upward adjustment of the contribution rate. The range of these projections varied, but prior to 1990 they were never for longer than 50 years.

In several respects the financial analysis of the US Social Security system has been more advanced and systematic than was the case in Sweden. One reason has perhaps been the longer tradition of the large US public pension plan. The US Social Security system was introduced in the 1930's; in Sweden the earnings-related pension plan (ATP) was started in 1960. The US Social Security Administration (SSA) reports annually on the financial status of the Social Security system. In this report, it uses a similar but more sophisticated, dense, measure of financial balance than the RFV previously used: a single figure called actuarial balance. Briefly, the actuarial balance -- deficit or surplus -- reflects how much the contribution rate must be increased (decreased), to ensure that the Social Security buffer fund, the trust fund, never drops below a stipulated level in the standard 75-year projection of the SSA.

[10] In English the National Social Insurance Board. RFV and the local social insurance offices were merged 1 January 2005 under the name of those local insurance offices, Försäkringskassan, in English Swedish Social Insurance Agency.

[11] The market value of the fund divided by one year of pension disbursements. In Sweden this measure is usually referred to as "fund strength".

The main drawback of these measures, aside from all the very difficult issues related to the preparation of these projections, is one of presenting the right information. To provide a clear picture of the interactions that exists, we would like to know the reasons for the change in financial position from last measurement to the present, and for each such reason we want to know the magnitude of its effect on the change. For example, not even the public pension scheme probably best analysed by conventional methods – the US Social Security system – has provided regular information on such an interesting and elementary figure to show the cost of the annual change in life expectancy.

The double-entry algorithm is the standard, and so far the most efficient, way of simultaneously and consistently conveying financial position and changes in it. For this reason, double-entry bookkeeping ought to be a prime candidate as a way to improve financial reporting on pay-as-you-pension systems. However to produce double-entry bookkeeping you need to account both for liabilities and assets.

4 Pay-as-you-go assets?

The idea that the financial position of a pay-as-you-go pension plan can be presented in the terms of assets and liabilities does not come naturally, and indeed it may need some getting used to. However, to most people it seems clear that a pay-as-you-go system has liabilities, both to retired persons and to those who at the time of measurement are working and have accrued some pension claim. Opinions differ on the choice of method to estimate the value of this liability, but not its existence.[12]

It is understandably more controversial to claim that the liabilities of a pay-as-you-go pension plan are fully or partially backed by something that we may call “assets”. A defining feature of pay-as-you-go financing is that it finances its payments not from pre-funded assets, but from current contributions. As a pay-as-you-go system has little or no tangible assets, it may be considered, by definition, to be in permanent deficit. While this view seems plausible, it may be impractical and perhaps even questionable on theoretical grounds.

[12] The preferred method depends partly on the objective of the liability estimation.

For example, in the extremely unlikely event that a pay-as-you-go system with fixed contribution rate and benefit rules, contributions continuously and perpetually perfectly match pension payments, does this system have a deficit, or is it in financial balance? Reasonably, it can be considered to be in financial balance, i.e. have a net present value of zero. If a system with a liability of a defined and measurable size has a net present value of zero, it must also have assets equal to that liability.

As opposed to a premium reserve plan, a pay-as-you-go pension plan is free to use contributions to pay off the pension liability, even when the contribution directly or indirectly is a source of a new pension liability. Thus, in a pay-as-you-go pension system, the contribution flow can and should be considered as the principal asset. The double-entry bookkeeping of the new Swedish pay-as-you-go pension plan is based on this reasoning. The Swedish concept of the value of the contribution flow is expressed in English as the *contribution asset.*[13]

In many accounting contexts it is accepted – or even recommended – to use prices recorded during the accounting period, or last day of the accounting period to estimate the assets and liabilities of the accounting entity. The method used in the inkomstpension to estimate the value of the contribution flow follows a similar philosophy. The contribution asset is equal to the pension liability that would have existed the last day of the accounting period if the age-related income distribution, age-related mortally, the size of the contribution (tax) base and pension system rules would have existed unchanged since ever. As the age-related income distribution, age-related mortally, the size of the contribution (tax) base and possibly also the pension system rules changes every year so does the value of the contribution asset. Not so different to market prices.

It is simple to calculate the contribution asset: it is the product of the size of the flow per time unit, which in practice is a year, and the expected time between payment of contributions and receipt of pensions. The averages are weighted by the age-dependent amounts of expected

[13] R. Lee has published considerable work relating to the value of the contribution flow in pay-as-you-go financing; in another context, Lee (1994 and later) uses the term *transfer wealth* for a corresponding concept.

contributions and pensions. In Sweden the expected contribution-weighted average age of contributors is about 42, and the expected pension-weighted age of retirees is about 74. Thus, the relevant time span is about 32 (74-42) years, and the contribution asset is 32 times one year's contributions. In the Swedish legislation on the automatic balance mechanism, this time span is called *omsättningstid* – expected turnover duration – as it is a measure of the time required for a cycle of accumulation and depletion of the pension liability. Information on the expected turnover duration can be, and is in Sweden, annually retrieved from the records of the pension plan. These calculations are performed by using every insured's earnings and/or pension. Since a few years those calculations are made "automatically" by running a routine in the IT-system.

The contribution asset, that is, contributions times' turnover duration, tells us the size of the pension liability that would result in a steady state determined by demography, i.e. nativity, age-related net migration and mortality, and the economy of the country, i.e. the size of the contribution base and the age-related average incomes, at the time of measurement.[14] The turnover duration measures informs, in a single figure, the effect that changes in fertility[15] and age-related income patterns and mortality have on the capacity of the contribution flow to finance pension liability.

5 New use of an old Italian device

The income statement and balance sheet of the *inkomstpension* plan for the five years 2002 - 2006 are "reproduced" below. However, to facilitate international comparison, the amounts here are expressed in percent of GDP for each year; the appendix gives the original amounts in Swedish currency. The income statement consists of 13 entries and 4 sums. Of these only the four cash-flow entries and sum were disclosed prior to 2001. The balance sheet consists of five entries and three sums. Of these only one entry – the market value of the buffer fund -- was disclosed

[14] For details on turnover duration and the contribution asset, see the legislative history of the automatic balance mechanism, Settergren (2001) and Settergren and Mikula (2005).
[15] In the legislation on the Swedish scheme, the effects of fertility changes on turnover duration are disregarded. The effects on the size of the contribution (tax) base from changes in fertility will affect the contribution asset when the changes in fertility makes the labour force grow or decline.

prior to 2001. For each of the entries, there is a note with detailed information; here the notes will not be considered.[16]

The income statement is divided into three sections. Section (a) *Change in funded assets* deals with the cash flows of the scheme, i.e. those flows that have changed the value of the buffer fund. As mentioned this section contains no new information relative to what always has been reported. Noticeable is the – for a European context – low level of contributions and pension disbursements, around 7 percent of GDP. This is explained largely by the fact that the *inkomstpension* deals exclusively with earnings related old-age pensions. Thus disability pensions, the guarantee-pension and survivors benefits, which is slowly being phased-out of Swedish social security, are not included in the income statement nor in the balance sheet. Would those benefits be included expenditure would be around 10 percent of GDP. Presently contributions are larger than pension disbursements, a situation that is projected to continue up until around year 2010. From that time on pension disbursements are projected to surpass contributions, the deficit will be financed with the return on the assets in the buffer fund and also, according to projections, part of its capital. The buffer fund is valued at market prices the last trading day of the accounting period.

As the buffer funds on average has close to 60 percent of its assets in equities the sharp decline in prices on that market fed into significant buffer fund losses in 2001 and 2002, losses that were partly regained by a positive development in 2003, and completely by 2005. By the end of 2006 the funds have developed better than the long-term assumption in the projections made by the Swedish Social Insurance Agency of a real annual return of 3.25 percent.

Section (b) *Change in contribution assets* deals with how much the contribution asset has changed due to change in contribution flow (revenue) and due to change in turnover duration respectively. As the contribution asset is calculated as the contribution flow (C) times the turnover duration (TD) the separation of the effects from changes in two components imply that

[16] The full reports 2001-2006 can be downloaded free of charge from www.forsakringskassan.se.

the *Value from change in contribution revenue* is:[17] $(C_t - C_{t-1}) \times \frac{TD_t + TD_{t-1}}{2}$. The *Value from change in turn over duration* is similarly calculated as $(TD_t - TD_{t-1}) \times \frac{C_t + C_{t-1}}{2}$. Since 2002 there is a negative trend in turnover duration. The persistent increase in life expectancy which makes the turnover duration increase has been more than offset by an increase in the expected average age of contributors. The reasons for the higher expected age of contributors have not been firmly established. One explanation could be a tendency to delay entry into the labour force, but this hypothesis has not been firmly tested, other or contribution explanations are possible.[18] In a steady state the *Value of change in turnover duration* is zero and *Total change in contribution asset* assets will grow only as a function of the growth in the contribution flow. The contribution flow grows with increases in average incomes times the number contributors, essentially the number of gainfully employed.[19]

Table 1. **Income statement of the Inkomstpension as a percent of GDP**[20]

	GDP, millions of SEK, current prices	2 288 351	2 371 606	2 459 413	2 565 056	2 670 547
	Year	2006	2005	2004	2003	2002
	Change in funded assets					
	Pension contributions	8,0	7,6	7,0	6,4	6,0
	Pension disbursements	-7,7	-7,1	-6,7	-6,1	-5,7
	Return on funded capital	3,6	4,8	2,6	3,2	-3,2
	Costs of administration	-0,1	-0,1	-0,1	-0,1	-0,1
	Total change in funded capital (a)	3,9	5,2	2,8	3,5	-2,9
	Change in contribution assets					
New	Value of change in contribution revenue	10,3	6,9	5,8	6,2	8,4
New	Value of change in turnover duration	-0,6	-2,1	0,0	0,5	-0,6
New	Total change in contribution asset (b)	9,8	4,8	5,8	6,7	7,8

[17] Trough out this paper the different kinds of smoothing that is done according to the legislation is disregarded, for details see the technical appendix of *The Swedish Pension System Annual Report 2002*.
[18] See the special feature article in The Swedish Pension System Annual Report 2002.
[19] In the Swedish scheme the government finances with general tax revenue the contributions for unemployed persons, sick persons etc., thus the contribution flow depends on more factors than the number of gainfully employed.
[20] Source for the numerators are *The Swedish Pension System Annual Report 2001, 2002* and *2003*. The GDP denominator used are from Konjunkturinstitutets konjunkturrapport, in March 2004.

	Change in pension liability*					
New	New Pension credits and ATP points	-8,4	-8,0	-10,0	-6,7	-6,3
	Pension disbursements	7,7	7,1	6,6	6,1	5,7
New	Indexation	-8,5	-6,8	-6,6	-8,9	-10,3
New	Value of change in life-expectancy	-1,4	-1,5	-0,7	-0,4	-0,2
New	Inheritance gains arising	0,4	0,4	0,3	0,3	0,2
New	Inheritance gains distributed	-0,4	-0,4	-0,3	-0,3	-0,2
New	Deduction for costs of administration	0,0	0,1	0,1	0,1	0,1
	Total change in pension liability (c)	-10,6	-9,2	-10,6	-10,0	-11,1
New	**Net income/ -loss** (a)+(b)+(c)	**3,1**	**0,8**	**-2,0**	**0,2**	**-6,2**

*A negative value (-) means that the pension liability increases, and a positive value ( ) that the pension liability decreases, by the amount shown.

Section (c) *Change in pension liability* informs of the reasons and magnitudes of changes in the size of the pension liability. The pension liability:

- Increases as *new pension credits* have been earned during the accounting period. When the new pension system has been fully phased in year 2018, i.e. when no ATP points any longer can be earned; *new pension credits* will equal *Pension contributions*. That pension credits earned are equal to contributions paid is one criterion for a pension scheme to be defined-contribution.
- Decreases as part of the liability has been paid off as *pension disbursements* have been made.
- Increases with the interest paid on the liability, i.e. the *indexation*. When the new system has been fully phased in this interest in percent will normally be equal to the percent change in average income in Sweden. Only if the automatic balance mechanism is activated will the indexation deviate from the change in average income.
- Increases (decreases) with the *Value of changes in life-expectancy*. Even in the Swedish NDC pension plan, perhaps the world's best financially insulated pension scheme relative to changes in life expectancy[21], the economic impact from such demographic changes are important. The annual increase in pension liability due to changes in life-expectancy varies from 0.2 in 2002 to 1.5 percent of GDP in 2005. A normal DB plan with out provisions for adjusting benefits or normal pension age relative to changes in life expectancy would have had at least twice as high impact, i.e. ranging from an annual 0.4 to 3 percent of GDP increase in pension liability due to the annual increase in life expectancy.

[21] Viewed from another angle this efficient insulation can be view as efficiency in passing on the economic effects from increases in life expectancy to the insured. When the old pension scheme is fully phased-out the inkomstpension liability will be less affected by increases in life expectancy than the scheme is at present.

- Decreases with the *Inheritance gains arising* that is the value of the pension claims of persons that have died before beginning to draw a pension,
- Increases with *Inheritance gains distributed* that is the survivor bonus distributed to those non retired, note that the distribution of such survivor bonuses are explicit in the Swedish scheme. Every year each insured is receives the survivor bonus as an explicit increase of his/her notional account.
- Decreases with the reduction for administrative costs made of the insured's notional account value. (When the transition rules have faded out this reduction will equal the systems administrative costs, item four in the income statement.)

Table 2. Balance sheet of the *Inkomstpension* as a percent of GDP

	Dec. 31	2006	2005	2004	2003	2002
	Assets					
	National Pension Funds	37,5	32,4	26,3	22,5	18,3
New	Contribution asset	259,8	241,2	228,0	213,1	198,2
	Total assets	297,3	273,6	254,2	235,6	216,4
	Liabilities and Surplus					
New	Opening surplus*	1,2	0,4	2,4	2,0	8,2
New	Net income/-loss	3,1	0,8	-2,0	0,2	-6,2
New	Closing surplus*	4,4	1,2	0,4	2,3	1,9
New	Pension liability	292,9	272,5	253,9	233,3	214,5
New	Total liability and surplus	297,3	273,6	254,2	235,6	216,4

The assets of the balance sheet are the market value of the buffer fund and the contribution asset, calculated as $C_t \times TD_t$. With a buffer fund ratio (fund size in SEK over total annual benefit payments in SEK) of about 500 percent the Swedish national pension plan is large in international comparison, but it still represents only some 12 percent of the pension liability.

The opening surplus is, naturally, the closing surplus of the preceding accounting period, as the GDP denominator changes between the years this important relationship is obscured. The opening surplus/-deficit plus the net income/-loss for the year gives the closing surplus for the accounting period. The fundamental accounting equality states that:

Opening balance + net income/loss + (Pension) liability = Total assets. Appendix B. presents the income statement and balance sheet in Swedish currency; there the accounting identity can be followed.

If one single financial indicator of financial position is sought the natural, most information dense is total assets divided by pension liability. In the English translation of the Swedish legislation this figure is called *balance ratio*. If this ratio is less than one (1) the system has a deficit, a negative net present value, if it is above one the system has a surplus, a margin. In the Swedish system legislation stipulates that if the balance ratio is below 1.0000 the so-called balance mechanism is triggered.

Table 3. The balance ratio – Summarising the accounting in one figure

Dec. 31	2006	2005	2004	2003	2002[22]
Total assets	297,3	273,6	254,2	235,6	216,4
Liability	292,9	272,5	253,9	233,3	214,5
./. Balance ratio	**1,0149**	**1,0044**	**1,0014**	**1,0097**	**1,0090**

When the balance mechanism is triggered the indexation of pensions and notional accounts will be effectuated by the change in average income adjusted by multiplying the index with the balance ratio, starting of a new index series. The balancing of the system means that an amount equal to the closing deficit in the balance sheet will be eliminated. If the balance ratio after being triggered grows bigger than one the closing balance surplus is automatically distributed by increasing the indexation. This continues until the balance index reaches the level of the income index.

In some respects the balance ratio resembles the actuarial balance measure that SSA uses, but the income statement and balance sheet that comes with the balance ratio, and the notes tied to their entries, incorporates details on what *cause* provokes what *effect*, by what *means*, at what *rate*. Thus it should be better at supplying the essentials of knowledge.

[22] Due to (minor) errors in the accounting for 2001 and 2002 the balance ratio confirmed by government those years differed from the balance ratio in the annual report. Those errors affected the net income reported each subsequent accounting year.

It is clear that if other administrators of national pension plans were to present their financial position the individual entries of their income statements and balance sheets, and the associated notes, needed to be modified relative to those that accompany the inkomstpension. This to comply with the specific demands of each plan, but the general outline should be possible to follow. However the work required in each case to be able to present a complete income statement and balance sheet should not be underestimated, neither should the rewards from a successful effort.

A much less ambitious endeavour, but a still worth while financial indicator, would be to start to annually publish the change, most likely increase, of the pension liability caused by changes (increases) in life expectancy.[23]

4.1 A note on the particular simplicity of the inkomstpension

The double entry bookkeeping of the new Swedish essentially pay-as-you-go financed pension plan has been much facilitated by the design of the *inkomstpension*. These design features implies that the present value of pension liabilities in the pension scheme can be approximated to equal the nominal (face) value of the pension liability. Further the nominal value of the pension liability to persons that have not yet started to draw a pension is much simpler to calculate in a (notional) defined-contribution pension plan, such as the Swedish is, than it is for a traditional defined-benefit plan. The *inkomstpension* liability to persons who have not yet begun to persons still economically active is valued as the aggregate of the amounts on each individual's so-called "notional" account. This calculation entails a simple aggregation of account balances in the registers of The Swedish Social Insurance Agency. The pension liability to retirees is also presented at its nominal value. This is done by multiplying pensions granted by the expected number of times that the amount will be disbursed. The number of expected disbursements is calculated from annual measurements of the length of the time that pension amounts in the records of The Swedish Social Insurance Agency records are paid out.

[23] If this is done the positive effect on the expected turnover duration from increases in life expectancy should be deducted.

The nominal valuation of assets and liabilities of the Swedish pension plan imply that all valuations are made solely according to what is observable at the time of valuation. For example, the normal assumption that contribution revenue increases at the rate of economic growth is not explicitly considered in the calculation of the contribution asset. Nor is the assumption that pension disbursements, because of factors like indexation, will increase in the future considered in the valuation of the pension liability. The main reason why it has been deemed reasonable to value assets and liabilities solely according to what can be observed is that the financial position of the system is not dependent on the amount of assets and liabilities *taken separately.* The financial position of the system is determined exclusively by the *relationship* between assets and liabilities, in other words, by the so-called *balance ratio.*

The *inkomstpension* is designed so that there is a strong link between the development of the assets and liabilities of the system. In cases where the balance ration exceeds on (1), however, liabilities and assets will develop at somewhat different rates. In cases where the balance ration is less than one, the provisions for automatic balancing establish an absolute link between the rates of growth in liabilities and assets. Taken as a whole, this means that valuing the assets and liabilities of the system solely on the basis of conditions observable at the time of valuation entails no risk of overestimating assets in relation to liabilities in the long run.[24] Together with other design features the provisions for automatic balancing have eliminated the need for making explicit assumptions about future economic and demographic developments in order to ensure the financial stability of the system.

It is apparent from the above that the method for valuing the assets and liabilities of the *inkomstpension* system is implicitly based on the assumption that assets and liabilities grow at the same rate after each valuation. To put it another way, it is assumed in the method of valuation that the indexation of the system will always be the same as the internal rate of return of the pension liability, even though this outcome is certain only if balancing has been activated. When

[24] The way the turnover duration is specified in the Swedish legislation involves an implicit assumption that the population growth is zero. Thus, turnover duration will be (slightly) over estimated in cases where the working-age population is decreasing. This entails a risk that the calculations will (slightly) overestimate the system's assets in relation to its liabilities. However, it is reasonable to assume that the population decline will cease at some point. If so, the deficit will be temporary.

balancing has not been activated, the indexation can be either greater of less than the internal rate of return of the pension liability.

6. The UTÖ-proposal of how to define and distribute an excess surplus

The Government assigned the inquiry to establish rules that could be legislated, to define;
How large surpluses must be to be considered an “excess” surplus that could be distributed
How excess surplus should be distributed to the insured.

The expression “excess surplus” was used to differentiate such surplus from the “normal” surpluses were the sum of the contribution asset and buffer fund assets exceeded the pension liability, i.e. any situation were the balance ratio is more than unity. A simple way to rule out surpluses would be to index the pension liability in such a way that the balance ratio always was at unity. However the legislator had, when it preferred to base the indexation of pensions and notional accounts with the growth in average wage and only make exceptions from this when it was considered financially necessary, indicated that its main concern was that the indexation should follow the average wage growth.

In essence the job of the inquiry was to estimate when the system was so well financed that a distribution of recourses accumulated above this level would not unduly increase the risks of, in a later stage, triggering the balance mechanism.

In its instructions government – in practice *Genomförandegruppen* – had ruled out the perhaps quite natural option to use an excess surplus to have a rebate on the contribution. Such a rebate would have implied that the contribution paid would have been less than the pension credit registered for each individual. The inquiry was instructed to distribute any excess surplus among the insured. That ruled out a transfer of excess surpluses to the government. Considering that the perhaps most probable cause of a surpluses in the inkomstpension plan is population growth one can question why a surplus in this program of the government must be “reinvested”, increase the replacement ratio of public pension system. At least one reason for this was to create symmetry;

if the insured are exposed to the negative risks that the balance mechanism imply, the insured should also have the possibility to be beneficiaries of the up-side of those same risks.

The inquiry proposed that:

1) The balance ratio shall be used to define if there is an excess surplus

This was a natural decision, however there were some discussion if not also the size of the buffer fund should have a more direct implication, than its effect on the balance ratio, for deciding if a excess surplus existed or not. By tying these regulations for the distribution of excess means to the balancing ratio the system behaves uniformly with regards to balancing due to deficits and when distributing excess means.

2) A distribution of excess surpluses shall be made if the balance ratio exceeds 1.1000

The legislation for the distribution of an eventual excess surplus shall not in any way reduce this possibility. The choice of the balancing ratio that delimits the excess surplus, i.e. the balancing ratio lower limit when distribution occurs, decides how large this safety buffer can be. The lower it is set, the smaller this buffer will be.

The UTÖ-inquiry proposed that this higher limit for the balance ratio should be set to 1.1000. This means that the total assets should outweigh the total system liabilities by 10 percent, before the system should be considered to have an excess surplus. When distributing any excess surpluses in the pay-as-you-go scheme this always means that the risk for the activating of the automatic balancing in the future increases a little, relative to a situation were the surplus is allowed to increase further.

The proposed legislation is based upon forward looking calculations of a model of the pay-as-you-go scheme. A large number of simulations have been made with the duration of 75 years, in order to estimate the effects of the proposed legislation. During these runs different elaborations with balance ratios where made. The simulations show that the proposed legislation for the

distribution of an eventual excess surplus gives higher pension on average than otherwise. Although the actual pension payments from one year to another may me lower due to the fact of drainage of the total assets from the pay-as-you-go scheme and this might actually cause the automatic balancing to occur. If the balancing ratio is set to low, i.e. close to 1.0000 it would in effect change the rules for indexation. Recalculations of pension liabilities would then be done on an ongoing basis due to short-run fluctuations in the contribution assets and the rate of return on the buffer fund instead of following the average income index. With this in mind, there is a strong case for caution. Therefore the guiding principle for when to distribute and excess surplus should be that the balancing ration should be at least 1.1000 in order for the system to have reasonable possibilities to avoid the activation of the automatic balancing after the distribution of any excess surplus.

The demand on the system to have a reasonable buffer is some what contradictory with the aim to be fair between generations. With a high lower limit on the balancing ratio on when to distribute an eventual excess surplus, individuals in certain cohorts can gain pension credits in times when the pay-as-you-go scheme gradually becomes more and more solvent, with out the later on getting a share of the distributed surplus.

A high lower limit on the balancing ratio also convey that the system overtime does not pay out as much pension as it would if the lower limit would have been set on a lower level. Therefore with regards to all these considerations the lower limit of when to distribute an excess surplus with regards to the overall driving principle of caution has set to 1.1000.

3) A surplus shall be distributed through a recalculation of all pension liabilities

An excess surplus should be distributed among all pension liabilities. The dividend should be distributed so that the indexation given though the income indexation and the adjusted income indexation is increased above what follows from the increase in the income index. An increase through the indexation is an administratively efficient method of providing the insured the full value of the excess surplus in the form of higher pensions and pension entitlements.

The recalculation of the *inkomstpension* entitlements shall for a year with excess surplus distributions be done by the quotient of the income index from the current year and the income index from the previous year multiplied by a quotient where the numerator is the current balance ratio and the denominator is the lowest limit for when an excess surplus is distributed, i.e. 1.1000.

The adjusted indexation shall for each year with an excess surplus take place through the indexation. The quotient of the current income index and the income index from the previous year shall be divided by 1.016. Thereafter shall the result of this calculation be multiplied by the quotient where the numerator is the current balance ratio and the denominator is 1.1000. The consequence of the method for distributing an excess surplus is that the balance ratio sinks to 1.1000 *ceteris paribus*.

6. Model properties and simulations

The UTÖ-model is a cohort model, which means that all calculations are done on the basic of birth year (birth cohort). Each cohort earns pension rights in the ages 16 to 64 and pensions are withdrawn from the age of 65.[25]

The annuity devisors are in conformity with the demographic assumptions exogenously given in the model. The demographic tendency follows the 2003 population forecast of Statistics Sweden. Within the projections short-run deviations in the contribution base are done with the help of the stochastic model connections made for the labour force.

Table 1: Annuity divisors at the age of 65
Cohorts born in 1940-2020

Birth cohort	Annuity divisor at 65
1940	15.82
1950	16.48
1960	17.01
1970	17.51
1980	17.90
1990	18.21

[25] The *inkomstpensionsystem* has a flexible pension age, where pensions can begin to be draw, partially or full, from the age of 61. At the same time if there is an increase in average lifetime, the active age has to be prolonged if the *inkomstpension* is to remain the same over time. When doing the simulation, for reasons of simplicity, it has been assumed that all individuals in all cohorts start to draw pensions at the age of 65.

2000	18.50
2010	18.79
2020	19.07

6.1 The model projections

The starting point (the base year) of the UTÖ-model corresponds to the state of the *inkomstpension* in the end of 2003. All accumulated cohort pension liabilities have been extracted from the registers of the late National Insurance Board (*Riksförsärkingsverket*) the predecessor of the Swedish Social Insurance Agency (*Försäkringkassan*). Through this procedure the total pension liabilities are created at the base year. The model also contains the system commitments to the insured according to older rules, now being phased out. The system assets reflect the contribution base and the buffer fund that existed at the turn of 2003.

Table 2: Key financial numbers for the inkomstpension at the end of 2003, Billions of SEK

Buffer fund	577
Contribution base	5 465
Total assets	6 042
Pension liabilities	5 984
Surplus	58
Balance ratio	1,01

From this starting point the model then every year calculated the system assets and liabilities within a calculation module that contains the rules of the automatic balancing mechanism and where it is possible to alternate between different rules for distributing the excess surplus. The surplus is thus distributed at times when the balance ratio exceeds a predefined limit within the model. The excess surplus is then distributed through the indexation. The buffer fund has a portfolio that contains 60 percent stock and 40 percent bonds. The yearly yield on these assets deviates stochastically according to the predefined trends. Each year the initial relation of stocks and bonds are reinstated within the buffer fund. The buffer fund assets are also affected of the pension payments and contribution base. The process that is initiated within the model usually last for 75 years, and thus gives the development in the pay-as-you-go system from 2003 to 2077.

6.2 Comparison of parallel processes

A simulated process contains a unique production of deviations in the stochastically dependent variables. In order to value the model result for a certain rule of how to distribute and eventual excess surpluses, one has to compare the outcome with an identical course of events but without any distribution. The outcome in a system with distribution is in effect compared with a parallel process where there is no distribution. The analysis is based upon comparisons of 20 different lower limits on when to distribute an excess surplus, the range of the analyzed interval on the balancing ratio has been 1.00 to 1.20.

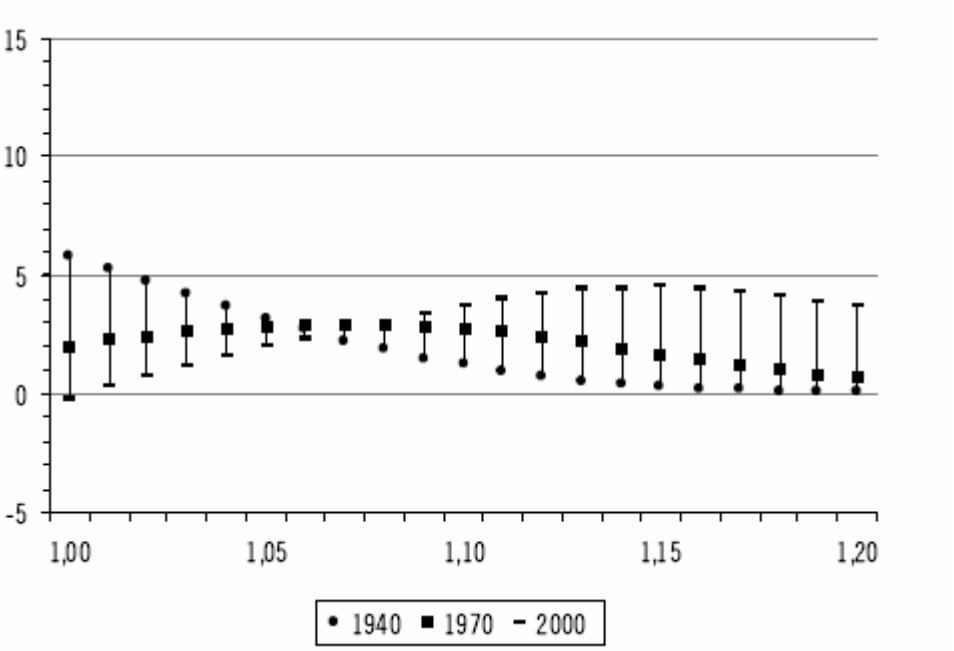
Table 3: The risk of activating the automatic balancing with different ceilings

Ceiling of BR	Share of years with BR<§.00	Increased share of years with BT<1 in comparison without rule	Share of year s with distribution
Nothing	2 %	-	-
1.00	37 %	35 %	41 %
1.01	29 %	27 %	32 %
1.02	24 %	22 %	27 %
1.03	19 %	17 %	23 %
1.04	16 %	14 %	20 %
1.05	13 %	12 %	18 %
1.06	12 %	10 %	16 %
1.07	9 %	7 %	14 %
1.08	7 %	6 %	12 %
1.09	6 %	5 %	11 %
1.10	5 %	4 %	10 %
1.11	4 %	3 %	9 %
1.12	4 %	2 %	8 %
1.13	3 %	1 %	7 %
1.14	3 %	1 %	7 %
1.15	3 %	1 %	6 %
1.16	2 %	0 %	6 %
1.17	2 %	0 %	5 %
1.18	2 %	0 %	4 %
1.19	2 %	0 %	4 %
>1,20	2 %	0 %	4 %

The increased risk of activating the automatic balancing is below the level of 5 percent when choosing a distribution level of 1.1000 or higher.

Diagram 1. Changes in lifetime pensions for three cohorts as a result the distribution limit 1.00-1.20

Change in percent. On an average 500 simulations, the Baseline scenario



The above shows the different gains from for different cohort from the distribution mechanism for the pension scheme, revealing the conflict of interest for different generations. The figure above shows different limits of distribution on the horizontal axis compared to the change in lifetime pension benefits on the vertical axis. From this we can observe that for a low level on the ceiling the surpluses are distributed earlier to older cohorts, while for the higher levels the distribution is postponed and is not activated until much later in most cases.

6.3 Simulation scenarios [26]

The UTÖ-model is a stochastic model where an unlimited number of combinations of events can occur, during a simulated timeframe. For the stochastic variables; employment, bond yield, and the rate of stocks, both the expected trend and the strength of deviations from the trend can be varied. The UTÖ-inquiry has worked with a baseline scenario and two alternative methods. The motives behind the assumptions are presented in chapter 4 of the inquiry. With a stochastic model a large number of timeframes can be simulated a large number of times. This makes it possible to state probabilities for many types of events. Normally 500 simulations have been done. This number has been estimated to be large enough to illustrate the characteristics of the pay-as-you scheme.

[26] Hans Olsson estimated these equations for UTÖ.

The Baseline scenario

The long-run expected number of employed has been decided on the basic of the number of persons of active ages within the total population, with an assumption of a constant labour force participation rate in different ages over time. The model allows short run deviations from this expected labour force participation. The short-run deviations have an auto-regressive pattern, where the deviations affect the events after the original deviation has occurred; according to the following pattern:

$$q_t = 1.51 \cdot q_{t-1} - 0.66 \cdot q_{t-2} + e_t \qquad (1)$$

Where q_t equals the percentage deviation in the labour force participation rate from the expected number for year *t* and where e_t is the stochastic deviation during the same year. The stochastic deviation term is normally distributed with an expected value of nil and with a standard deviation of 1.13 percentage points (UTÖ-inquiry chapter 4). The real bond yield has in the baseline scenario been assumed to be 2.3 percent each year. With the deviations assumed to be short-run deviations from the expected inflation: In the model the inflation has an autoregressive pattern, given by:

$$I_t = 2.0 + 0.7360 \cdot (I_{t-1} - 2.0) + e_t \qquad (2)$$

Where I_t is the inflation in per cent year *t* and where e_t is the normally distributed stochastic deviation term with an expected value of nil and a standard deviation of 0.871 percentage points. The short-run inflation model decides the bond yield in the model. The expected inflation in the model is the mean value of the last ten years prior to the base year. In the baseline scenario stocks are assumed to earn a real rate of return of 4.5 percent per year. The real rate of return varies a lot in the model. The accumulated deviation of the real rate of return from the expected trend is in logarithmic terms a given year a function of the earlier deviations and a stochastic deviation term according to:

$$\log w_t = 1.0580 \cdot \log w_{t-1} - 0.2176 \cdot \log w_{t-2} + e_t \qquad (3)$$

where w_t is the accumulated real return in relation to the trend year *t* and where e_t is the normally distributed stochastic term with an expected value of nil and a standard deviation of 19.3 percentage points.

Diagram 2. Net contributions 2003-20077, in percent of total contributions in ten randomly drawn runs

Baseline scenario without distribution of excess surplus

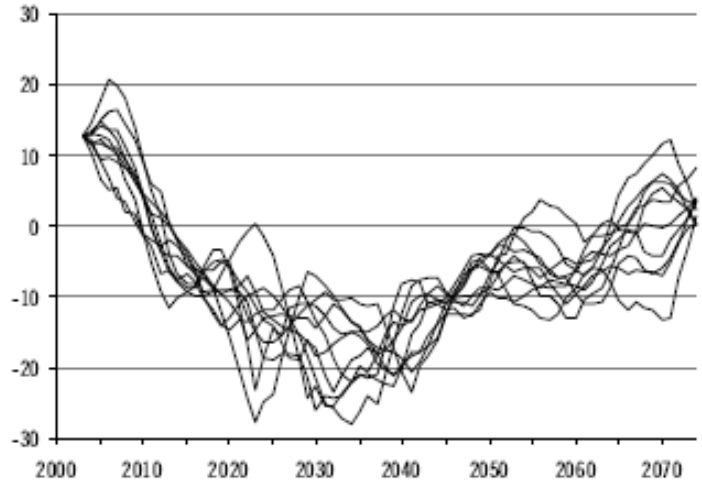


Diagram 3. Size of buffer fund in percent of pension liability 2003–2077, in ten randomly drawn without distribution of excess surplus

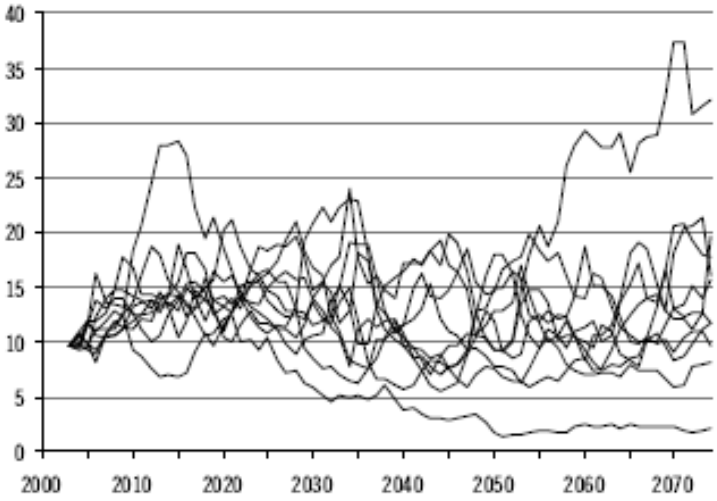
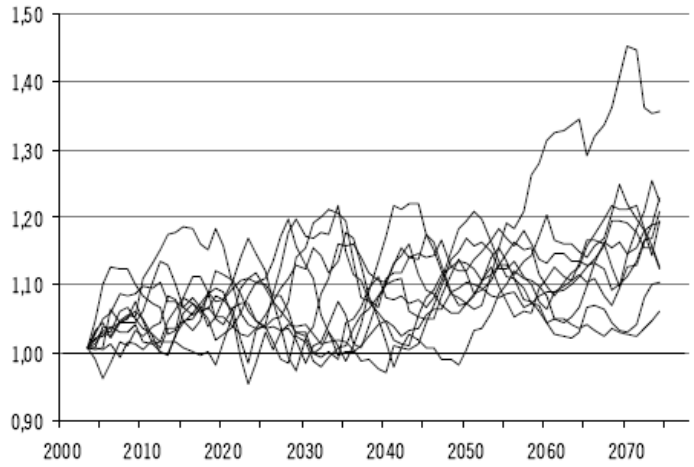


Diagram 4. Balance ratio 2003–2077 in ten randomly drawn Baseline scenarios without distribution of excess surplus



An alternative scenario with a lower real rate of return on stocks

In the first alternate scenario the expected real return of stocks have been set to 3.0 percent that is 1.5 percentage points lower than in the baseline scenario. I this scenario the volatility remain the same as in the baseline case as well as all other assumptions. The direct consequence of this is that the expected real rate of return on the buffer fund in any simulated timeframe will be lower.

An alternative scenario with a lower volatility in the labour force participation rate

In the second alternative scenario the volatility of the stochastic deviations in the labour force participation have been halved. The standard deviation of the stochastic term has been set to 0.565 percentage points. Everything else remains the same. The consequence of this change is that the contribution base will fluctuate less than in the baseline scenario. The system finances will therefore be more stable. This alternate scenario can be motivated if one takes into consideration that contributions to the pay-as-you-go pension scheme is not only paid upon incomes from employment but on unemployment benefits, disability benefits, sickness benefits, childcare- and maternity benefits etc. which all are accredited pension contributions.

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Appendix A.

Mathematical Description of the Balance Ratio

Excerpts from Regulation 2002:780 on the Calculation of the Balance Ratio

For each year the Swedish Social Insurance Agency is to calculate the balance ratio according to Chapter 1, §§ 5 a and 5 b of the National Income Replacement Pension Act (1998:647) in accordance with the following formula:

1. Balance ratio, BR

$$BR(t+2) = \frac{CA(t) + F(t)}{D(t)} \tag{1.0}$$

$$CA(t) = \overline{C}(t) \times \overline{T}(t) \tag{1.1}$$

$$\overline{C}(t) = \frac{C(t) + C(t-1) + C(t-2)}{3} \times \left(\frac{C(t)}{C(t-3)} \times \frac{CPI(t-3)}{CPI(t)} \right)^{1/3} \times \left(\frac{CPI(t)}{CPI(t-1)} \right) \tag{1.2}$$

$$\overline{T}(t) = median\left[T(t), T(t-1), T(t-2)\right] \tag{1.3}$$

where

t	= calendar year if the variable refers to flows, end of calendar year if the variable refers to stocks
CA(t)	= contribution asset, year *t*
F(t)	= buffer fund, the aggregate market value of the assets of the First to Fourth and Sixth National Pension Funds year *t*. By market value is meant the value which in accordance with Ch. 6, § 3 of the National Pension Funds Act (200:193) is to be shown in the annual reports of these funds.
D(t)	= pension liability, year *t*
$\overline{C}(t)$	= smoothed value for the contribution to the pay-as-you-go system, year *t*
$\overline{T}(t)$	= smoothed value for turnover duration, year *t*
C(t)	= contributions to the pay-as-you-go-system, year *t*
T(t)	= turnover duration, year *t*
CPI(t)	= consumer-price index for June, year *t*

2. The average retirement age, $\overline{R}$, us calculated as

$$\overline{R}(t) = \frac{\sum_{i=61}^{R^*(t)} P_i^*(t) \times G_i(t) \times i}{\sum_{i=61}^{R^*(t)} P_i^*(t) \times G_i(t)}, \ \overline{R} \text{ round off to nearest whole number} \tag{2.0}$$

where

i	= age at end of year *t*

$R^*(t)$ = the oldest age group for which pensions have been granted in year *t*

$P_i^*(t)$ = total of pensions granted monthly in year *t* to persons in age group *i*

$G_i(t)$ = annuitization divisor in year *t* for age group *i*

3. Turnover duration, T,

$$T(t)=ID(t)+OD(t) \tag{3.0}$$

3.1 Pay-in duration, ID

$$ID(t)=\frac{\sum_{i=17}^{\bar{R}(t)}\bar{E}_i(t)\times L_i(t)\times\left(\bar{R}(t)-i-0.5\right)}{\sum_{i=17}^{\bar{R}(t)}\bar{E}_i(t)\times L_i(t)} \tag{3.1.1}$$

$$\bar{E}_i(t)=\frac{\frac{E_i(t)}{N_i(t)}+\frac{E_{i+1}(t)}{N_{i+1}(t)}}{2} \text{ for } i=17, 18, \ldots, \bar{R}(t)-1 \tag{3.1.2}$$

$$\bar{E}_{\bar{R}(t)}(t)=\frac{E_{\bar{R}(t)}(t)}{N_{\bar{R}(t)}(t)} \tag{3.1.3}$$

$$L_i(t)=L_{i-1}(t)\times h_i(t) \qquad \text{for } i=18, 19, \ldots, \bar{R}(t) \text{ where } L_{17}(t)=1 \tag{3.1.4}$$

$$h_i(t)=\frac{N_i(t)}{N_{i-1}(t-1)} \text{ for } i=18, 19, \ldots, \bar{R}(t) \tag{3.1.5}$$

where

$E_i(t)$ = the sum 16 % of pension-qualifying income calculated in accordance with Ch. 2 of the National Income Replacement Pension Act (1998:674) and 16 % of imputed pension-qualifying income calculated in accordance with Ch. 3 of said act in pay-in year *t-1*, i.e. year of determination t, for age group I for individuals who have not been registered as deceased *t-1*.

$N_i(t)$ = number of individuals in age group *i* who at any time up until pay-in year *t-1*, i.e. year of determination *t*, have been credited with pension-qualifying income or imputed pension-qualifying income and who have not been registered as deceased *t-1*

$L_i(t)$ = proportion of persons in age group *i* surviving in year *t*

$h_i(t)$ = change in proportion of persons in age group *i* surviving in year *t*

3.2 Pay-out duration, *OD*

$$OD(t)=\frac{\sum_{i=\bar{R}(t)}^{R(t)}1.016^{-(i-\bar{R}(t)+0.5)}\times L_i^*(t)\times\left(i-\bar{R}(t)+0.5\right)}{\sum_{i=\bar{R}(t)}^{R(t)}1.016^{-(i-\bar{R}(t)+0.5)}\times L_i^*(t)} \quad (3.2.1)$$

$$L_i^*(t)=L_{i-1}^*(t)\times he_i(t),\ L_{60}^*(t)=1 \quad (3.2.2)$$

$$he_i(t)=\frac{P_i(t)}{P_i(t)+Pd_i(t)+2\times Pd_i^*(t)} \text{ for } i=61, 62, \ldots,R(t) \quad (3.2.3)$$

where

$R(t)$ = the oldest age group receiving a pension in year t

$P_i(t)$ = total pension disbursements in December of year t to age group i

$Pd_i(t)$ = total of the last monthly pension disbursement to pensions in age group i who received a pension disbursement in December of year $t-1$ but not in December of year t

$Pd_i^*(t)$ = total of the last monthly pension disbursements to pensions in age group i with pensions granted in year t and not receiving a pension in December of year t

$L_t^*(t)$ = proportion of remaining disbursements to age group i in year t

$he_i(t)$ = change in pension disbursements due to deaths in year t, age group i

4. The pension liability, *D*,

$$D(t)=AD(t)+DD(t) \quad (4.0)$$

$$AD(t)=K(t)+E(t)+APT(t) \quad (4.1)$$

$$DD(t)=\sum_{i=61}^{R(t)}P_i(t)\times 12\times\left(\frac{Ge_i(t)+Ge_i(t-1)+Ge_i(t-2)}{3}\right) \quad (4.2)$$

$$Ge_i(t)=\frac{\sum_{j=i}^{R(t)}\frac{1}{2}\times\left(L_j^*(t)+L_{j-1}^*(t)\right)\times 1.016^{i-j-1}}{L_i^*(t)} \text{ for } i=61, 62, \ldots,R(t) \quad (4.3)$$

where

$AD(t)$ = pension liability in year t in regard to pension commitment for which disbursement has not commenced (pension liability to the "economically active")

$DD(t)$ = pension liability in year t in regard to pensions currently being disbursed to retired persons in the pay-as-you-go system

$K(t)$ = total of pension balances in year t according to Ch. 5, § 2 of the National Income Replacement Pension Act (1998:674)

E(t)	= estimated pension credit in year *t* for the inkomstpension according to Ch. 4 §§ 2-6 of said act
ATP(t)	= estimated value in year *t* of the ATP pension for persons who not yet begun to receive this pension.
$Ge_i(t)$	= economic annuitization divisor for age group *i* in year *t*.

Appendix B. Five years of inkomstpension accounting

Millions of SEK

Income statement

Year	2006	2005	2004	2003	2002
Change in funded assets					
Pension contributions	183 624	179 552	171 600	165 107	160 745
Pension disbursements	-176 156	-169 127	-164 762	-155 410	-151 757
Return on funded capital	83 355	114 598	65 162	82 060	-84 529
Costs of administration	-2 077	-2 032	-2 736	-2 359	-2 081
Total change in funded capital (a)	88 746	122 991	69 264	89 398	-77 622
Change in contribution assets					
Value of change in contribution revenue	236 612	163 453	141 518	159 964	224 275
Value of change in turnover duration	-12 652	-49 367	0	12 346	-16 763
Total change in contribution asset (b)	223 960	114 086	141 518	172 310	207 512
Change in pension liability*					
New Pension credits and ATP points	-191 168	-189 556	-244 879	-172 567	-167 585
Pension disbursements	176 132	169 071	162 783	155 410	151 562
Indexation	-194 172	-161 809	-161 616	-228 288	-275 946
Value of change in life-expectancy	-32 764	-36 519	-17 614	-11 045	-5 923
Inheritance gains arising	9 490	8 854	7 789	7 090	6 389
Inheritance gains distributed	-10 182	-9 246	-8 222	-7 616	-6 617
Deduction for costs of administration	1 130	1 738	1 949	1 475	1 478
Total change in pension liability (c)	-241 534	-217 467	-259 810	-255 541	-296 642
Net income/ -loss (a)+(b)+(c)	71 172	19 610	-49 028	6 167	-166 752

Balance sheet

Dec. 31	2006	2005	2004	2003	2002
Assets					
National Pension Funds	857 937	769 190	646 200	576 937	487 539
Contribution asset	5 944 638	5 720 678	5 606 592	5 465 074	5 292 764
Total assets	6 802 575	6 489 868	6 252 792	6 042 011	5 780 303
Liabilities and Surplus					
Opening surplus*	28 392	8 783	57 812	51 645	218 397
Net income/-loss	71 172	19 610	-49 028	6 167	-166 752
Closing surplus*	99 564	28 392	8 783	57 812	51 645
Pension liability	6 703 010	6 461 476	6 244 009	5 984 199	5 728 658
Total liability and surplus	6 802 574	6 489 868	6 252 792	6 042 011	5 780 303

Balance ratio

Balance ratio	1,0149	1,0044	1,0014	1,0097	1,0090