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Does the pension system's income statement really matter? A proposal for an NDC scheme with disability and minimum pension benefits

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ABSTRACT

This paper develops an accounting model for monitoring the solvency of a notional defined contribution (NDC) pension scheme with disability and minimum pension benefits. Using the annual report of the Swedish pension system as a benchmark, the "Swedish" actuarial balance is extended by adding an income statement fully explaining the reasons behind the changes in the system's solvency by type of benefit. In line with the reference model, assets and liabilities are measured at present value at each reporting date, and in each period, included as income or expenses on the Income statement. This accounting framework integrates both contributory and social aspects of public pensions and discloses the real cost of the disability contingency and the redistribution through minimum pensions. Apart from Sweden, this proposal could be especially interesting for improving the reporting of public pensions in countries such as Poland, Italy, Latvia and Norway.

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1. Introduction

The delivery or payment of social benefits to beneficiaries is one of the primary objectives of most governments and accounts for a large proportion of their expenditure. It is important that the financial statements accurately report pension disbursements and any associated liabilities (Mason, 2018). The financial reporting method used for most social security systems (SS systems) around the world is based exclusively on cash accounting, which is not a suitable accounting framework for the assets and liabilities allocated to pay for scheduled benefits. Cost estimates of deferred payment programmes are especially susceptible to misstatement in cash-basis budgetary

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accounting systems (Phaup, 2019). Reporting should be based mainly on the accrual accounting principle, the cornerstone of good financial management.

Statistical, accounting and actuarial guidelines for valuing the liabilities of social security programmes are published by several international organizations and national standard setters (Wiener & Stokoe, 2018). These standard setters have different approaches to the accounting, actuarial, funding and disclosure requirements of different types of pension programmes, and standards may be ambiguous, inconsistent and not fully enforced. Even when standard setters reach the same conclusion, the rationale is different.

In line with the ongoing debate on how to recognize and measure the assets and liabilities of SS systems, the paper develops an accounting model for monitoring the solvency of a notional defined contribution (NDC) pension scheme with permanent disability and minimum pension benefits.

The paper builds on previous work carried out on the so-called "Swedish" open group (SOG) approach. The starting points are the papers by Ventura-Marco and Vidal-Meliá (2014, 2016), Pérez-Salamero González et al. (2017), Settergren and The Swedish Pension System (TSPS) (2019) and Vidal-Meliá et al. (2018). Inspired by the Swedish model, Ventura-Marco and Vidal-Meliá (2014) developed a theoretical basis for compiling a Swedish actuarial balance sheet (ABS) for a defined benefit (DB) pay-as-you-go (PAYG) scheme with retirement and disability benefits. The paper by Ventura-Marco and Vidal-Meliá (2016) presented the principles for integrating retirement and permanent disability using a generic NDC framework. Pérez-Salamero González et al. (2017) developed a Swedish-type ABS for an NDC scheme with disability and minimum pension benefits. TSPS (2019) is the most recent annual report of the Swedish pension system and presents its financial status and income statement along with a description of the accounting principles used for valuing the system's assets and liabilities. Finally, the paper by Vidal-Meliá et al. (2018) develops a social insurance accounting model for an NDC scheme combining retirement and long-term care contingencies.

This research uses the Swedish pension system's most recent annual report as a benchmark (TSPS, 2019) and extends the model developed by Pérez-Salamero González et al. (2017) by adding an income statement that fully explains the reasons behind the changes in the system's solvency by type of benefit.

The paper contributes to filling a gap in the literature because little attention has been paid to, the link between the "Swedish" open group (SOG) approach and other classical approaches, and also because our proposed income statement could serve as a guide to improve the true and fair view of the Swedish ABS by more clearly determining the changes in the system's net worth. Apart from Sweden, the proposal could be especially interesting for improving the reporting of public pensions in countries such as Poland, Italy, Latvia and Norway.

The structure of the paper is as follows. After this introduction, Section 2 looks into the methodology known as "Swedish" open group and its link with other approaches. Section 3 presents the main characteristics of a social insurance accounting model for an NDC scheme including retirement, disability and minimum pension benefits (MPB) for both contingencies. Special attention is paid to the income

statement and the rationale behind why presenting the income statement of a fictional already-functioning NDC (PAYG) scheme is important. Section 4 provides a numerical example, which illustrates annual changes in the system's financial position by means of an income statement for an already-functioning system. The paper ends with concluding comments and three online appendices. The first of these is a glossary. The second gives a brief picture of how disability benefits are treated within the NDC framework and their relationship with minimum pension benefits, while the third provides the technical details of the model that enable it to integrate disability and minimum pension benefits within the NDC framework.

2. Measuring assets and liabilities in social security schemes: main approaches and literature review

Social security pension schemes (SSSs) are considered to be contributory schemes because they are mainly financed by employer and employee contributions and/or tax allocations.

As far as measuring the liabilities and assets of SSSs is concerned, there are five approaches, four of which are reasonably well-known (Closed group without future accruals (CG), Closed group with future accruals (CGFA), Hybrid open group (HOG), Open group (OG)) while another is relatively unknown even to most pension experts, the "Swedish" open group (SOG). Table 1 summarizes the main features of these approaches.

SOG is the methodology used by the Swedish authorities since 2001 when measuring the assets and liabilities of an SSS. In Sweden there is a notional defined contribution (NDC) pension scheme in force, a special type of PAYG pension system. The theoretical foundation of this approach can be mainly found in the papers by Settergren and Mikula (2005), Boado-Penas et al. (2008), Vidal-Meliá and Boado-Penas (2013), Ventura-Marco and Vidal-Meliá (2014), Pérez-Salamero González et al. (2017) and Vidal-Meliá et al. (2018).

From an applied perspective, the annual reports of the Swedish pension system are the main references. Likewise, some researchers have used the (actuarial) balance sheet (ABS) approach and applied it to various countries including Japan (Takayama, 2005), Spain (Boado-Penas et al., 2008; Vidal-Meliá et al., 2009; Vidal-Meliá, 2014), Canada (Billig & Ménard, 2013), Switzerland (Metzger, 2018), Germany (Metzger, 2019) and Belgium (Alonso-García & Devolder, 2019).

SOG is based on the CG method but modified to make it equivalent to OG. It can be considered "open group" in any particular year t because, in order to value the system's assets and liabilities, it takes new entrants into account and assumes that there will be contributions to meet liabilities, although valuation formulas consider only pensioners and contributors at the valuation date.

A central accounting principle of this approach is that the system's assets and liabilities are valued on the basis of events and transactions that are verifiable at the time of valuation, with no need for explicit projections. It is assumed that the system's rules and the economic and demographic conditions prevailing at the time of the valuation remain constant.

Table 1. Measuring liabilities (and assets) in (contributory) social security schemes: summary.

Approach	Time horizon (valuation period)		Number of new cohorts of contributors included	Projections (explicit)	Suitable for … Applied to …
	System	Actuarial perspective			
Closed group without future accruals (CG)	Zero. The system is assumed to be closed.	Pensions in payment are estimated in present value terms. Years elapsed between the highest age to which it is possible to survive and the youngest cohort of pensioners.	Zero.	No	Fully-funded DC schemes or PAYG schemes when the decision is made for immediate closure. (Eurostat, 2011).
Closed group with future accruals (CGFA)	Years elapsed between the retirement age and the youngest cohort of contributors.	Future and current pensions in payment are estimated in present value terms. Years elapsed between the highest age to which it is possible to survive and the youngest cohort of contributors.	Zero. The system is considered as if it were operating until the last contributor dies.	Yes. Explicit projections of economic, financial or demographic variables must be made.	Fully-funded DB schemes or PAYG schemes when no new entrants are allowed.
Hybrid open group (HOG)	An arbitrary time period corresponding to the number of new cohorts of contributors allowed (from 50 to 75 years).	Years elapsed between the highest age to which it is possible to survive and the youngest cohort of contributors plus the arbitrary time period.	An arbitrary number (from 50 to 75). The system is considered as if it were functioning until the last contributor of the last cohort of entrants accepted as contributors dies.	Yes. Explicit projections must be made.	PAYG schemes when only a limited number of new cohorts of entrants are allowed.
Open group (OG)	An arbitrary time period from 75-95 years to infinite.	Under a cash flow approach, matches the system's time horizon.	An arbitrary number from 75-95 years to infinite. An ongoing basis for the scheme is assumed.	Yes. Explicit projections of economic, financial or demographic variables must be made.	PAYG and partially funded schemes. (EC, 2018); (BOT, 2019); (AAD, 2017); (OSFIC, 2018)
"Swedish" open group (SOG)	Valuation formulas consider only pensioners and contributors at the valuation date, but …	… the use of the expected time between payment of contributions and receipt of pensions (turnover duration, TD) and other assumptions makes this approach equivalent to a perpetual time horizon.	Equivalent to an infinite number of cohorts.	There is no need for explicit projections. It is assumed that the system's rules and the economic and demographic conditions prevailing at the time of the valuation remain constant.	PAYG schemes, especially for NDCs. (TSPS, 2019)

Source: Own.

As we will see later, the value of the contribution flow (the contribution asset) is estimated by multiplying the system's current contribution revenue by the time expected to elapse between payment of contributions and receipt of pensions (turnover duration, *TD*), and this could be interpreted as being equivalent to discounting an assumed perpetual constant flow of contributions by the inverse of the *TD*. This involves an OG approach with a perpetual time horizon.

This way of measuring the system's assets and liabilities has a high degree of transparency and needs no complicated projections of economic, financial or demographic variables that could easily have a bias effect on the sustainability and solvency indicators. This approach is suitable for the introduction of automatic balance mechanisms (ABMs), given that the possibly endless debates as to the accuracy of long-term projections are avoided.

The ABS can be defined as a financial statement listing the pension system's obligations to contributors and pensioners at a particular date, with the amounts of the various assets (financial and mainly through contributions) that underwrite those commitments. As Boado-Penas et al. (2008) have pointed out, the main aim of the ABS is to give a true and fair view (TFV) of the pension system's assets and liabilities at the beginning and end of the fiscal year and, by comparing these figures, to determine the change in net worth. It can be said that the pension system is solvent at the valuation date when the ratio between the system's assets and liabilities is equal to or greater than 1.

3. The accounting model

This section (briefly) presents the main characteristics of an accounting model for an NDC scheme including retirement, disability and minimum pension benefits (MPB) for both contingencies. Special attention is paid to the income statement and the specificities of a (fictional) already-functioning NDC scheme. Reasons are also given to explain why presenting the income statement of an already-functioning NDC (PAYG) scheme is important.

It seems difficult to hide the real importance of including disability benefit in an NDC scheme. This benefit protects affiliates should they no longer be able to support themselves due to a severe long-term disability.

The study of how disability benefits are treated within the NDC framework and their relation to minimum pension benefits shows there are several issues that could be improved (Online Appendix 2) These include discontinuities in benefit levels that have occurred when disability benefits are converted into retirement benefits at the ordinary retirement age (Sweden), and disability pensions that are converted into old-age pensions according to NDC rules when the old-age pension cannot be lower than the disability benefit granted (Latvia). In Norway, disability pensioners are partially exempt from life-age adjustments, so the "system" gives incentives for them to register as disabled before obtaining their retirement pension. In Italy the formula used to calculate the disability pension does not provide a clear link between benefits and contributions and also includes the possibility of paying survivor benefits. Generally speaking, in the countries analysed a lack of transparency can be observed in the

redistribution embedded in the defined benefit formula used to calculate disability benefits. The specific life expectancy of disabled people by age is not used to compute the disability benefit, which is surprising from an actuarial point of view. Given that the NDC pension operates on a PAYG basis but mimics an FDC scheme, the idea of using the specific mortality of disabled people comes naturally to actuarial thinking as a way of improving the link between benefits and contributions.

The income statement would give a full explanation of the reasons for changes in the system's solvency, and in our model the reasons are also detailed by type of benefit.

3.1. The "Swedish" actuarial balance sheet for a (fictional) already-functioning NDC scheme combining retirement and disability contingencies with an MPB

The main features of the proposed scheme and the full technical details can be found in the online Appendix 3.

An ABS for a fictional already-functioning NDC scheme combining retirement and disability contingencies with an MPB can be compiled as shown in Table 2.

In this table, the two contingencies are disclosed and the commitments deriving from non-contributory rights (NCRs) are accounted for. This ABS splits the system into two parts: the actuarial part (pure NDC) and the redistributive part, which includes the assets and liabilities originating from NCRs, but for the sake of brevity the ABS is shown as a whole.

The right-hand side of Table 2 shows the liabilities and sponsor support (capital). The interest rate for discounting liabilities to pensioners is taken to be the growth rate of the covered wage bill (G).

The left-hand side (or assets side) of Table 2 lists the main entries that can appear in the ABS. The Swedish concept of the value of the (future) contribution flow is expressed as the contribution asset, i.e. the maximum level of liabilities that would have existed on the last day of the accounting period if the age-related income distribution, age-related mortality and disability, the size of the contribution (tax) base, the

Table 2. The ABS for an already-functioning NDC scheme combining retirement and disability contingencies with an MPB.

ASSETS	LIABILITIES AND SPONSOR SUPPORT (CAPITAL)
Financial (and real) assets: **FA**	Financial liabilities: **FD**
	Sponsor support: **Ss**
Contribution asset for retirement: **CA_(R)**	Liability to contributors for retirement: **Con_(R)**
	Liability to pensioners for retirement: **Pen_(R)**
Buffer fund for retirement: **BF_(R)**	Liability to contributors for retirement: **Con_(R)_NCR**
	Liability to pensioners for retirement: **Pen_(R) _NCR**
Contribution asset for disability: **CA_(D)**	Liability to contributors for disability: **Con_(D)**
	Liability to pensioners for disability: **Pen_(D)**
Buffer fund for disability: **BF_(R)**	Liability to contributors for disability: **Con_(D)_NCR**
	Liability to pensioners for disability: **Pen_(D)_NCR**:
Accumulated deficit: **Ad_(R + D)**	Accumulated surplus: **As_(R + D)**
Actuarial losses for the period: **L_(R + D)**	Actuarial profit (gains) for the period: **P_(R + D)**
TOTAL ASSETS	**TOTAL LIABILITIES**

Source: Own.

structure of the pensions and the pension system rules were never changed (Boado-Penas & Vidal-Meliá, 2013).

The net worth is a balancing item that stems from valuing assets and liabilities (including sponsor support) according to the accounting principles used on the date of the balance sheet. Net worth can be positive, negative or zero, and is equal to the accumulated surplus plus the profit for the period or, where appropriate, minus the loss for the period. By the same token, net worth could be equal to the accumulated shortfall plus the actuarial losses for the period or, where applicable, minus the profit for the period.

The balance sheet records changes in the value of the assets and liabilities in the course of the accounting period and the aggregated amounts recorded in the various accumulation accounts. Indeed, this is the definition of the income statement (Eurostat, 2011), which quantifies changes in solvency by means of differences in the system's net worth.

3.2. The income statement for a fictional already-functioning NDC scheme combining retirement and disability contingencies with an MPB

In this sub-section, the profit and loss account follows the model published by the Swedish authorities, but some modifications need to be introduced in order to adapt it to the specific NDC model proposed in this paper.

As can easily be seen, the ABS and the income statement are closely linked. In fact, the "net profit" for a period can be computed without an income statement. The simplest way of determining the change in the system's net worth is by comparing the opening and closing ABS, but there is a significant lack of detail.

The proposed income statement structure is shown in Table 3, in which for simplicity's sake it is assumed that NCRs are totally guaranteed by the sponsor, that the system's administration costs are financed by general taxation and that inheritance gains arising and distributed are perfectly matched within the year.

On the left-hand side, Table 3 shows changes in assets, and on the right-hand side we find the changes in pension liabilities.

Beginning with the left-hand side, the annual change in the fund's assets or buffer fund is the result of adding the income from all types of contributions to the return on funded capital and deducting the payments for retirement and disability pensions. In this scheme there could be two types of contribution: firstly, ordinary

Table 3. The income statement for an NDC scheme combining retirement and disability contingencies, with an MPB for the period.

FUND ASSETS (Changes)	**LIABILITIES (Changes)**
Pension contributions: **C**	New pension credit: **C**
Sponsor contributions for NCRs: **SC**	Recognition of NCRs: **R**
Pension disbursements: - **PT**	Pension disbursements: - **PT**
Net return on funded capital: **D**	Indexation: **I**
CONTRIBUTION ASSET (Changes)	Value of change in life expectancy: δ**e**
Value of change in contribution revenue: δ**C**	Value of change in discount rate: δ**G**
Value of change in turnover duration: δ**TD**	**NET GAIN/LOSS**
TOTAL DEBIT SIDE	**TOTAL CREDIT SIDE**

Source: Own.

contributions, which are made by affiliates, and secondly, extraordinary contributions, which are made by the sponsor to cover NCRs.

The extraordinary contribution (if necessary) for each new beneficiary is determined in the following way: If the amount accredited in the notional account is less than the amount calculated (required to award the MPB), the sponsor has to top up the difference.

Pension contributions are used to pay beneficiaries (the disabled and retirees) in the same year. In practice, all pension contributions are paid and distributed monthly to the reserve fund. The surpluses or deficits that arise when pension contributions are greater or less than pension disbursements are absorbed by the buffer fund. Finally, the net return on funded capital includes dividends on assets held by public pension funds, with financial assets being valued at their market price on the last trading day of the year.

On the left-hand side we can also see the changes to the contribution asset broken down into contribution revenue and turnover duration. The value of the change in contribution revenue is the monetary value in terms of how much more (or less) liability can be financed by a higher (or lower) level of contributions compared to the preceding year.

The value of the change in *TD* (volume of assets) is a combined effect from a variety of causes. This amount synthesizes into a single number a great deal of information about the system's rules, the age distribution of the population, the age patterns of the labour supply and earnings, mortality (changes in life expectancy) and disability rates (changes in biometric assumptions) (Pérez-Salamero González et al., 2017).

The first item that we see on the right-hand side is the new pension credits. This accounting item should be identical to income from contributions, since the equality between contributions paid and new pension credits is a key feature of a pure NDC scheme. In practice, both items could be slightly different for operational reasons.

The second item on this side is the so-called "recognition of NCRs". Apart from under certain demographic and economic circumstances, its annual amount will depend on the criteria chosen to quantify the NCRs. Its balancing entry on the debit side is sponsor contributions for NCRs. Both amounts should match perfectly and correspond to the redistributive part of the scheme. This entry would include the effect of legislative reforms affecting minimum pension benefit levels. Such an entry is not found in the benchmark model.

The liability is reduced by the amount of pension expenses, given that pension payments are an amortization of the pension liability. On both sides of the income statement, the amount of the pension disbursements should match.

Changes in pension liabilities due to indexation of notional accounts and benefits in payment, are also accounted for. It is assumed that the indexation rules are the same for the actuarial part and for the benefits originating from NCRs. In our model the notional rate of return is wage bill growth. If the system had an ABM and it were triggered because the balance ratio fell below 1.0000, then the real indexation would be lower than wage bill growth.

The "Value of change in life expectancy" entry, $\delta\mathbf{e}$, is the annual update of life expectancy. The increase in life expectancy over the past several decades has been striking and represents a key challenge for SSSs. This item is in coherence with the accounting principle of updating main data on an annual basis. It is important to accurately estimate life expectancy for the two collectives: the disabled and the retired. Mortality (life expectancy) for disabled people depends on the cause (e.g. accident versus sickness) and severity (partial versus total, temporary versus permanent) of the disability (Pitacco, 2019).

To give a couple of examples, in Canada the mortality rate for disability beneficiaries is much higher than that for the general population. Mortality rates for disability beneficiaries aged 50 to 64 in 2011 were on average six times higher than those for the general population. (OSFIC, 2015). In the US, for a 50-year-old female (male) disability beneficiary, the mortality rate is almost equal to that for an individual aged 69 (72) in the population of healthy pensioners (Society of Actuaries (SOA), 2014). Similar results can be found in other countries.

In short, disabled people have a lower life expectancy than active people, but the difference in longevity tends to decrease notably as individuals get older.

In contrast to the Swedish model, on the right-hand side we have included an item known as the "Value of change in the discount rate (G)", $\delta\mathbf{G}$. The discount rate assumption is the most influential actuarial input affecting both funding ratios and contribution requirements (Chen & Matkin, 2017). In our model it does not affect the level of contributions, but is very important for valuing pensions in payment and to compute the balance ratio.

The main practical implication of introducing this item is that it would increase the volatility of the system's results and could trigger the ABM more often.

Finally, a net income or loss for the year is accounted for on the right-hand side.

From an analytical point of view, the change in net worth can be detailed as follows:

$$\underbrace{\delta NW_t^S = NW_t^S - NW_{t-1}^S}_{Changes\ \ in\ \ net\ \ worth} = \overbrace{\left(\underbrace{A_t^S - A_{t-1}^S}_{Assets}\right) - \left(\underbrace{V_t^S - V_{t-1}^S}_{Liabilities}\right)}^{=Changes} = \overbrace{\underbrace{\delta BF_t^S}_{Fund\ \ asset} + \underbrace{\delta CA_t^S}_{Contribution\ \ asset} - \underbrace{\delta V_t^S}_{Liabilities}}^{=Changes} \quad (1)$$

As depicted in formula (1), the change in net worth can be determined in the simplest way by comparing the system's assets and liabilities on two consecutive valuation dates.

If $\delta NW_t^S > 0 \Rightarrow P_t^S$, the change in net worth is positive, i.e. the sum of the items on the left-hand side exceeds in value the sum of the items on the right, which means the system has actuarial profits for the period.

If $\delta NW_t^S < 0 \Rightarrow L_t^S$, the sum of the items on the right-hand side exceeds in value the sum of the items on the left, which means that the net wealth has decreased and the system has actuarial losses for the period.

If $\delta NW_t^S = 0$, the system's net worth is unchanged.

The changes in net worth can be broken down into three main items:

1. Change in the fund/financial asset:

$$\delta BF_t^S = C_t^S + {}^{NCR}SC_t^S - PT_t^S + D_t^S \tag{2}$$

where C_t^S is the income from ordinary contributions, ${}^{NCR}SC_t^S$ is the income from sponsor contributions for NCRs, PT_t^S is total pension disbursements, and D_t^S is the net return on funded capital.

2. Change in the contribution asset:

$$\delta^{NDC}CA_t^S = {}^{NDC}CA_t^S - {}^{NDC}CA_{t-1}^S = \overbrace{\delta C_t^S}^{Revenue\ effect} + \underbrace{\delta TD_t^S}_{Turnover\ duration\ effect}$$

$$= \overbrace{\left(\left(C_t^S - C_{t-1}^S\right) \cdot \frac{\left(TD_{t-1}^S + TD_t^S\right)}{2}\right)}^{\delta C_t^S} + \left(\underbrace{\frac{\left(C_t^S + C_{t-1}^S\right)}{2} \cdot \left(TD_t^S - TD_{t-1}^S\right)}_{\delta TD_t^S}\right) \tag{3}$$

3. Change in pension liability:

$$\delta V_t^S = C_t^S + {}^{NCR}R_t^S - PT_t^S + I_t^S + \overbrace{\delta e_t^S}^{Life\ expectancy\ effect} + \underbrace{\delta G_t^S}_{Discount\ rate\ effect} \tag{4}$$

where ${}^{NCR}R_t^S$ is the value of newly awarded NCRs, I_t^S is the indexation effect, δe_t^S is the value of the change in the liability to pensioners due to changes in life expectancy, and δG_t^S is the value of the change in the liability to pensioners due to changes in the discount rate.

The value of the change in the liability to pensioners due to updated information regarding the discount rate and life expectancy can be expressed as follows:

$$\overbrace{Pen\_(s)_t^{ui}}^{\substack{Liability\ to\ pensioners\\ with\ updated\ information}} - \underbrace{Pen\_(s)_t^{nui}}_{\substack{Liability\ to\ pensioners\\ with\ non-updated\ information}} = \delta e_t^S + \delta G_t^S$$

$$= \overbrace{\underbrace{Pen\_(s)_t^{ui(e)}}_{\substack{Liability\ with\\ updated\ information\\ about\ life\ expectancy}} - \bar{Pen}\_(s)_t^{nui}}^{\delta e_t^S} + \underbrace{Pen\_(s)_t^{ui} - Pen\_(s)_t^{ui(e)}}_{\delta G_t^S} \quad (5)$$

Finally, the income statement could easily be broken down by contingency in formulas (1) to (5). We would only need to change the superscript "S" for "R" or "D" where necessary.

$$\delta NW_t^S = \delta NW_t^D + \delta NW_t^R \quad (6)$$

3.3. Why the income statement of a fictional already-functioning NDC is important from a public accounting perspective

The main objective of a public sector financial reporting mechanism is different to that the private sector. In the case of the public sector pension system, the main objective is not that of a profit-making entity and pension and disability policies have multiple implications for society that go beyond the scope of this paper.

However, here we are dealing with the pension contributions of individuals and there needs to be responsibility for the correct management of these sums and the sustainability of the system, and the financial information reported must be useful according to the needs of the users and for future decision making.

The reporting of an income statement also coincides with the objectives of IPSAS 1 as regards the presentation of financial statements (International Public Sector Accounting Standards Board (IPSASB), 2017) using accrual-based accounting methods. This standard outlines that the aim of general-purpose financial reporting in the public sector should be to provide useful information for decision-making purposes and to demonstrate the accountability of the entity for the resources entrusted to it.

In order to fulfil this aim, among other things the standard mentions the provision of aggregate information that could be used to assess the entity's performance in terms of service costs, efficiency and accomplishments. This would justify the preparation of an income statement.

IPSAS 1 (International Public Sector Accounting Standards Board (IPSASB), 2017) considers that a complete set of financial statements would include the following items: a statement of financial position, i.e. a balance sheet; a statement of financial performance, referred to in our paper as an income statement; a statement of changes

in net assets/equity; a cash flow statement; budgeted and actual amounts when the entity presents its approved budget; and notes to the accounts and comparative information for the preceding period.

The inclusion of an income statement as part of the information published about a country's public pension system could make this information easier to understand and also improve the system's transparency.

An income statement shows a breakdown of change in net worth during the period. All changes can be interpreted and explained, which will help to identify possible problem areas for the future, areas that need to be monitored more closely, and to examine whether significant variances are one-offs or whether they need to be incorporated into future budgets.

Traditionally the public sector has relied on pure cash accounting. However, public pension systems prepared using the accruals accounting method have an advantage insofar as a complete picture is shown by including the assets and liabilities of all the system's components at a particular moment in time, thereby improving decision making for the future.

This could be beneficial for pension system affiliates in that they can assess the extent to which pension promises are reliable and make decisions about the future when exercising their right to vote.

Accrual-based accounting per se is considered more suitable than cash-based accounting to ensure intergenerational fairness and sustainability. Intergenerational equity expresses the position that no generation should profit from governmental services at the expense of another generation, and sustainability should seek to meet the needs of the present without compromising the ability of future generations to meet their own needs.

The inclusion of an income statement is a big step leading to improved public pension reporting. We also believe that the main reason for including an income statement is to provide a TFV/FP of the changes that take place in the pension system over a particular period, breaking them down into sub-classifications that are more understandable and useful than a simple figure showing the difference in the system's net worth from the balance sheet.

4. Numerical illustration

This section provides a numerical example representative of the proposal developed above, the example, which should be viewed simply as an illustration, shows the annual changes in the system's financial position via the income statement for a fictional already-functioning NDC pension system. The proposed scheme is not yet in operation anywhere.

The starting point is the scheme's ABS at the end of years $t-1$ and t (Table 4). The system incorporates an MPB equivalent to 25 per cent of the system's average wage ($NDC_{dr}^{25\%}$).

Figures shown in the ABS at the end of year t are based on the paper by Pérez-Salamero González et al. (2017), Table 2.

Table 4. The ABS of an $NDC_{dr}^{25\%}$ scheme at the end of years t-1 and t with changes in net worth (monetary units).

Items/year	$t-1$	t	Variation
ASSETS			
BF	11.500	11.730	0.230
BF_(R + D)_NCR	5.500	5.588	0.088
CA_(R)	80.120	81.963	1.843
CA_(D)	19.880	20.079	0.199
Ad_(R + D)	0.000	0.000	0.000
L_(R + D)	0.000	0.000	0.000
Total	**117.000**	**119.360**	**2.360**
LIABILITIES AND SPONSOR SUPPORT (CAPITAL)			
Ss_(R + D)	10.000	10.000	0.000
Con_(R)	55.510	56.620	1.110
Con_(D)	12.260	12.505	0.245
Pen_(R)	24.610	24.856	0.246
Pen_(D)	7.620	7.772	0.152
Pen_(R)_NCR	2.200	2.222	0.022
Pen_(D)_NCR	3.300	3.366	0.066
As_(R + D)	1.500	1.500	0.000
P_(R + D)	0.000	0.518	0.518
Total	**117.000**	**119.360**	**2.360**
SOLVENCY, FUNDING AND LIABILITY STRUCTURE INDICATORS			
$TD_t^S \quad (TD_t^R; TD_t^D)$	31.92 (34.03; 25.55)	31.60 (34.37; 23.78)	−0.3192
BR_t^S	1.014	1.019	0.0046
DF_t%	16.11	16.13	0.0002
LS_t%	64.24	64.40	0.0016

Source: Own.

Changes in net worth are determined by comparing the system's assets and liabilities in these consecutive accounting periods. Table 4 also shows the TD for the system, $\boldsymbol{TD_t^S}$, and by contingency, $(\boldsymbol{TD_t^R}; \boldsymbol{TD_t^D})$, along with the balance ratio, $\boldsymbol{BR_t^S}$ (calculated without taking into account the part of the buffer fund corresponding to sponsor support), the degree of funding, $\boldsymbol{DF_t}$ (the buffer fund divided by the system's pension liability), and the liability structure ratio, $\boldsymbol{LS_t}$ (the ratio between liabilities to contributors and total liabilities).

At the end of year $t-1$ the system's financial position is sound, since the balance ratio is greater than one (1.014), i.e. the accumulated surplus is positive. In general terms it can be said that this particular system is reasonably solvent, and therefore at the date of the report the participants (contributors and pensioners) should have a realistic expectation of receiving the benefits that have accrued without the system's sponsor (the state) having to make any extraordinary contributions (except for future NCRs).

It can be seen in Table 4 that the degree of funding for this system is clearly positive (16.11%), mainly due to sponsor support and because the approach adopted to cover the increase in liabilities due to the introduction of an MPB is the buffer fund method. The higher the level of the NCRs, the higher the degree of funding.

At the end of year t the system's ABS reports a better financial position (1.019) than at the end of the previous accounting period, given that the system registers actuarial profits (0.518). In this situation the accumulated surplus becomes larger, i.e. the change in net worth is positive. We can see that the system has recorded profits in this accounting period because the difference between the variation in assets (2.360) and liabilities (1.842) is positive (0.518). Details of the changes in the system's

Table 5. The income statement for the period t-1, t (monetary units).

ITEMS	System	R	D
FUND ASSET (Changes)	**0.318**	**0.197**	**0.121**
Pension contributions	3.229	2.385	0.844
Sponsor support for NCRs	0.088	0.022	0.066
Pension disbursements	−3.164	−2.337	−0.827
Net return on funded capital	0.165	0.127	0.038
CONTRIBUTION ASSET (Changes)	**2.042**	**1.843**	**0.199**
Value of change in contribution revenue	3.057	1.036	2.021
Value of change in turnover duration	−1.015	0.806	−1.822
Total LEFT-HAND SIDE	**2.360**	**2.040**	**0.320**
LIABILITIES (Changes)	**1.842**	**1.397**	**0.445**
New pension credit	3.229	2.385	0.844
Recognition of NCRs	0.088	0.022	0.066
Pension disbursements	−3.164	−2.337	−0.827
Indexation	0.900	0.720	0.180
Value of change in life expectancy	0.030	0.010	0.020
Value of change in discount rate	0.759	0.597	0.162
NET WORTH (Change)	**0.518**	**0.643**	**−0.125**
Total RIGHT-HAND SIDE	**2.360**	**2.040**	**0.320**

Source: Own.

financial position by contingency are shown on the income statement (Table 5). The chance to study the statement is the real novelty of this paper and enables us to more thoroughly analyse the reasons behind the changes in the system's solvency by type of benefit.

Looking at the income statement, what first draws our attention is that for this period the disability contingency shows a loss (0.125), whereas the retirement contingency records a profit (0.643). Expenditure on disability pensions accounts for around 26.15 per cent of the pension disbursement. In this proposal, we do not reclassify pensions once they are in payment, since this would prevent us from accurately determining the actuarial result by contingency. This makes sense from an actuarial point of view and enhances transparency.

The system has a cash flow surplus because income from contributions plus sponsor support for NCRs exceeds the outlay on pensions. This surplus accumulates in the buffer fund, and the positive return on funded capital increases the fund asset at the end of the accounting period. This is also true if we examine the change in fund assets by contingency.

The ratio between (total) pension contributions and (total) pension disbursements is approximately 104.82 per cent, so the system has a treasury surplus that amounts to 4.82 per cent of the aggregate income from contributions.

Changes in the contribution asset add net worth to the system (2.042), but the value of the change in the system's turnover duration decreases the asset by the amount shown in the left-hand column (-1.015). Nevertheless, as seen in Table 4, the value for the retirement contingency is positive, given that its associated TD is slightly higher in t (34.37) than in $t-1$ (34.03).

An analysis of the changes in liabilities shows that the pension liability increases mainly due to the annual indexation of pensions in payment and pension account balances (0.90) and the value of the change in the discount rate (0.759). The annual changes for both items are determined by the change in growth of the notional rate, "G". However, the effect on the pension liability works in the opposite direction.

The higher the growth of the annual notional rate, the higher the pension liability due to the indexation mechanism. And obviously, as far as the "Value of change in discount rate" item is concerned, the higher the growth of the annual notional rate used for valuing pensions in payment, the lower the pension liability. In this numerical example, this item increases the pension liability because the discount factor used is slightly lower than in the previous accounting period.

In order to calculate the liability to pensioners in the Swedish system, the initial pension of each cohort is multiplied by the economic annuity divisor (ED), which corresponds to an actuarial discount factor weighted by the number of pensioners and their respective pensions and with a technical interest rate of 1.6 per cent, i.e. the assumed annual real growth rate of the income index (TSPS, 2019). This discount rate has remained unchanged since the system's inception. Here a clear policy implication emerges, given that the procedure for fixing the discount rate over time seeks to maximize the stability of the solvency ratio. In practice, the introduction of a change in this item would increase the volatility of the system's results and could trigger the ABM more frequently.

Nevertheless, from the point of view of the fair presentation of the financial statements, it cannot be considered appropriate that the Swedish authorities should ignore any change in this item. According to Palmer and Könberg (2019), during 2002–2017 real income per capita grew at an average rate of 2.1 per cent, i.e. 0.5 per cent per year higher than the 1.6 per cent applied in the actuarial factor used for computing the liability to pensioners. If the annual growth rate of real income had been used to calculate liabilities to pensioners, the changes in net worth originally estimated would have been (very) different from those reported by the Swedish authorities. More importantly, the ABM would not necessarily have been triggered and/or the timing would have been different.

We should bear in mind that a retrospective accounting exercise would be needed in order to respond properly to the above issues regarding the Swedish NDC pension scheme.

To conclude this brief analysis, it can be seen that the value of the change in life expectancy also increases the pension liabilities for retirees. The pension liability for active workers is unaffected by changes in mortality. This accounting model requires periodic updates of life expectancy data on both collectives, i.e. periodic (static) mortality tables need to be frequently published. For the disability contingency, the value of the change in life expectancy assumptions shows a positive amount of 0.02 monetary units, which leads to an increase in disability pension liabilities.

Finally, as in any double-entry accounting system, the net income or loss (change in net worth, which is 0.518 units in this example) equals the difference between the change in assets and the change in liabilities.

5. Concluding comments

This paper looks into what is known as the "Swedish" open group methodology developed for measuring liabilities and assets in contributory SS systems. Little

attention has been paid to the SOG approach in the literature, so the first contribution of this paper is to fill the gap.

SOG methodology has two important positive features. Firstly, its way of measuring the system's assets and liabilities has a high degree of transparency and needs no complicated projections of economic, financial or demographic variables, which could easily have a bias effect on the sustainability and solvency indicators. And secondly, the approach is suited to the introduction of ABMs given that possibly endless debates as to the accuracy of long-term projections are avoided.

The paper's second contribution is to develop an accounting model for monitoring the solvency of an NDC scheme with disability and minimum pension benefits. In line with the principle of separating the distributional aspects of social policy from the contributory aspect of the NDC scheme, the proposed model splits the system into two parts: the pure NDC part and the redistributive part, which includes the assets and liabilities originating from NCRs.

Using the annual report of the Swedish pension system as a benchmark, we have extended the "Swedish" actuarial balance sheet developed by Pérez-Salamero González et al. (2017) by adding an income statement to fully explain the reasons behind the changes in the system's solvency by type of benefit. The paper has developed a highly realistic case for an already-functioning NDC scheme and presented the technical details of the model (online appendix 3), which makes it possible to integrate disability and minimum pension benefits within the NDC framework.

Another valuable contribution is that the paper highlights the importance of disability in contributory SS systems and the fact that its costs need to be closely monitored. The link between disability and NDC schemes is not a minor issue. The paper analyses how disability benefits are treated within the NDC framework and their relation to minimum pension benefits. We have found that several aspects need to be improved (online appendix 2).

The example we develop adds value to the paper because it sheds light on the main differences between our proposal and the benchmark model, which only includes the retirement contingency and does not account for NCRs. Furthermore, the example clearly shows that this accounting framework integrates both contributory and social aspects of public pensions and discloses the real cost of the disability contingency and the redistribution through minimum pensions.

With regard to the question posed in the paper's title, solid reasons have been given to highlight the importance of the pension system's income statement and the need for PAYG pension systems in general – and NDC schemes in particular – to present one every year. The income statement provides more detailed information on changes that occur in the system and helps stakeholders and management to make informed decisions. It is also useful for assessing the entity's performance in terms of service costs, efficiency and accomplishments, and can be used to predict the level of resources required for continued operations, the resources that may be generated by continued operations, and the associated risks and uncertainties.

Last but not least, our proposed income statement could serve as a guide to improving the true and fair view of the Swedish actuarial balance sheet by better determining changes in the system's net worth.

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