Financial investment returns as a hedge for pension obligations linked to cumulative salary increases: An applied approach.

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Abstract.

Occupational pension plans are often characterized by two "risk extremes":

1. Defined Benefit/DB: The benefit promise is stipulated as a certain annual benefit amount in relation to the employee's salary at retirement. The employer assumes the full obligation of fulfilling this benefit promise, irrespective of how the employee's salary evolves over time and irrespective of the outcome of market returns from investments made by the pension plan.
2. Defined Contribution/DC: The benefit promise is to make annual contributions to a DC account held by each employee while in active service. Market returns obtained by the investment account underlying investments are fully at the employee's risk.

In this paper we consider a "hybrid" occupational pension concept which was recently introduced in the Norwegian market. Main features of the benefit design are that:

1. Adjustment of the accumulated hybrid account is linked to a certain salary increase index (which in principle and also in practice will deviate from the actual salary increase for each individual employee).
2. Investment returns are restricted to finance the cost of providing the salary indexation
3. Certain mechanisms are introduced to allow for the smoothing over time of deviations between investment returns and salary indexation cost

Intentionally this design will combine two desirable possibilities: Firstly that the benefit provided bears a reasonable relationship to the pensioner's past salary while in active service and secondly that they employer's cost shall be predictable and not be exposed to risk beyond providing for the fixed annual contributions.

The purpose of the paper is to investigate some risk properties of the plan design for the employer and for the employees, with a view to whether one has succeeded in combining the two above-mentioned benefit objectives.

Acknowledgement.

I am indebted to my colleagues at Lillevold & Partners for interesting and encouraging discussions about the subject and in particular to Hans Gunnar Vøien for valuable comments to an earlier version of this paper.

1. Introduction.

This is an applied paper, which considers financial risk characteristics for an occupational retirement concept which was recently introduced in Norway[1]. The risks are considered both for the employer in the capacity of plan sponsor and for the employee(s) in the capacity of future retirement benefit recipient(s).

The new occupational retirement concept in question has as its overriding objective to achieve a better risk balance between the employer on the one hand and the employees on the other hand than the two "risk extremes" pure defined benefit (DB) and pure defined contribution (DC). More specifically, the plan design starts with a definition of annual accrual according to an ordinary DC definition. As opposed to an ordinary straight DC plan, however, the adjustment of the individual's pension account is linked not to the return achieved on an underlying investment portfolio but on a specific salary increase index. This index may be related to average salary increase for the plan sponsor's employees or average salary increase for society as a whole, and it should be noted that it differs from the actual salary increase for each individual member.

For a period where the investment portfolio's achieved return has been higher than required to adjust the account in line with the salary increase index, the excess return is allocated to an adjustment fund. Conversely, for a period where the investment portfolio's achieved return has been insufficient to adjust the account in line with the salary increase index, the lacking amount is charged to the adjustment fund. It follows that the adjustment fund plays a time diversification role for the investments return's ability to provide for the cost of accumulative salary index increases.

Moreover, there is a specific pension enhancement provision associated with the adjustment fund: When an employee goes into retirement, a proportionate share of the adjustment fund (in the aggregate for all employees) is allocated as an addition to his or hers pension account and accordingly used to provide for a higher pension payment.

The financial position of investment return, salary increase and the adjustment fund may on occasions be such that the adjustment fund is insufficient to provide for a required charge. The employer is then required to provide the amount to make up the balance. At the other extreme, in order to prevent the adjustment fund to grow to an unreasonably high level, the legislation introduces an upper limit for the adjustment fund. A balance in excess of this ceiling is reverted to the employer[2].

The main purpose of the paper is to study financial risk aspects of this concept of applying investment returns as a financing source for increasing the obligations in line with a salary increase index, where the adjustment fund with its lower limit (0) and upper limit (ceiling) play an important role. We will demonstrate that, under reasonable assumptions, the employer's risk to have to provide for additional "adjustment fund shortfall" payments is substantial, while at the same time the employee's "risk" to receive a benefit higher than expected according to the straight salary increase provision is also substantial. The properties of these risks under varying assumption will be demonstrated and commented.

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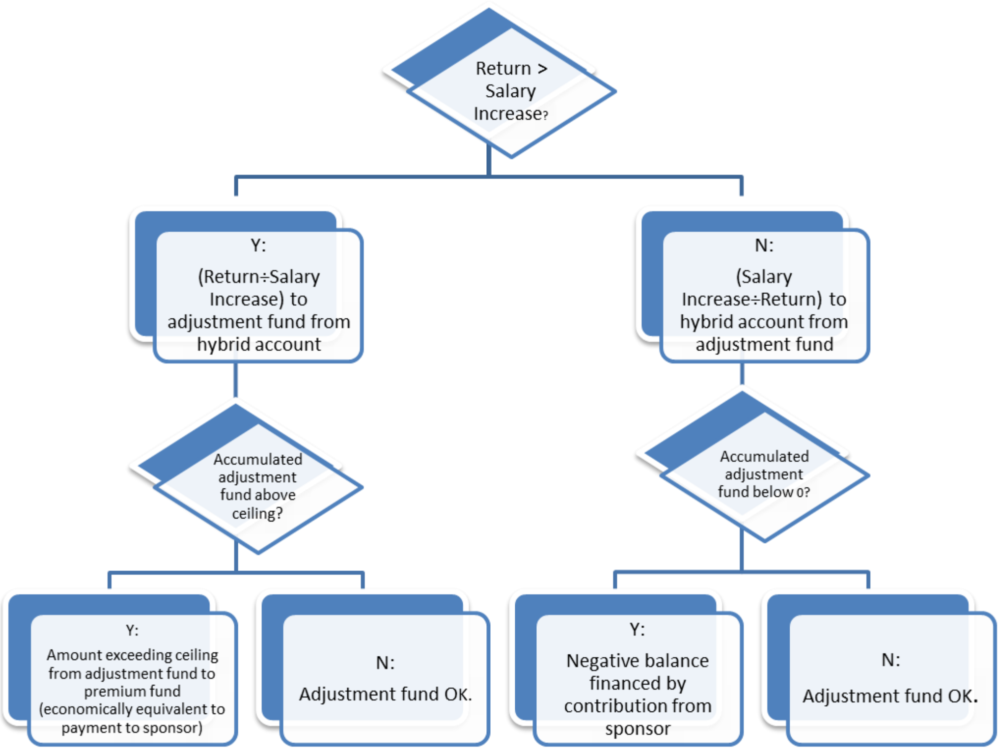
[1] Lov om tjenestepensjon 13 Dec 2013

[2] In reality the amount is allocated to a separate premium fund account associated with the hybrid plan. The employer may choose to charge future contributions against the premium fund account. For pension funding purposes the premium fund account has the same economic value as the employer's ordinary assets, and we therefore disregard it as a separate item for our analysis.

2. Description of the pension plan.

We restrict our presentation to cover the pension plan dynamics during the accumulation phase. The working of the salary indexation clause and the financing mechanism associated with it, can be described schematically as in the hierarchical decision tree below:



Based on four main plan properties the dynamics of the plan's flows and balances is described in the following. The description is done for one single member with his or hers separate hybrid account. As in an ordinary DC plan, the hybrid account is credited with contributions according to some plan formula, and its balance is invested in the financial market where it achieves some return.

Properties which distinguish the hybrid plan from an ordinary DC plan can be worded and expressed mathematically as follows:

Property 1: The hybrid account is adjusted in line with the salary increase index:

$$HA_t = (HA_{t-1} + contr_{t-1}) \cdot (1 + sal\_inc_t) \qquad (1)$$

where:

HA_t = value of hybrid account at time t, with the initial value $HA_0 = 0$.

$contr_t$ = contribution to the hybrid account at time t.

sal_inc_t = salary increase index for the period $< t-1, t]$

Property 2: The difference between the cost of providing salary increase indexation of the hybrid account and the investment portfolio's achieved investment return is transacted as a net amount from the adjustment fund to the hybrid account:

$$AF\_to\_HA_t = (HA_{t-1} + contr_{t-1}) \cdot (sal\_inc_t - return_t) \quad (2)$$

where:

$AF\_to\_HA_t$ = net amount transacted from the adjustment fund to the hybrid account at time t.

$return_t$ = rate of return for the period $< t-1, t]$

Property 3: The basic dynamics of the adjustment fund is that it is credited with its own return and charged with the net amount transacted to the hybrid account. Additionally, the lower bound 0 and the ceiling as an upper bound must be taken into consideration:

$$AF_t = Min\{Max[AF_{t-1} \cdot (1 + return_t) - AF\_to\_HA_t, 0], AF\_Max_t\} \quad (3)$$

where:

AF_Max_t = Ceiling for the adjustment fund at time t.

Property 4: The difference between the actual value for the adjustment fund and the value that would have been achieved in absence of its lower limit (0) and upper limit (ceiling) is transacted as a net amount from the employer to the adjustment fund (a negative amount if the upper limit (ceiling) is applicable and a positive amount if the lower limit (0) is applicable):

$$Employer\_to\_AF_t = AF_t - [AF_{t-1} \cdot (1 + return_t) - AF\_to\_HA_t] \quad (4)$$

where:

$Employer\_to\_AF_t$ = net amount transacted from the employer to the adjustment fund at time t.

It should be noted that we have adopted the terms hybrid *account* and adjustment *fund*. The latter terms indicates that the adjustment fund is common to all plan members, while the hybrid account is specific for each individual member. However, since the preceding exposition and the numerical illustrations that we will presented in paragraph 5 is done for one single member, we don't elaborate further on this distinction.

3. Basic risk considerations.

In an ordinary DC plan, the employer's cost of financing future pension obligations is determined by the $contr_t$-process. Contributions $contr_t; t = 0,1,,,,T$ until time T determines the ultimate cost for pension accruals until time T, irrespective of how risk factors such as salary development and investment return evolve. How the value of the DC account evolves and what the benefit amount will turn into, is fully at the individual member's risk.

The hybrid concept moderates that complete absence of risk for the employer with a liability to adjust the value of the hybrid account in line with a salary increase index. The hybrid account's investment return is the intended financing source for this adjustment provision; not necessarily on a year by year basis but intentionally over time. The underlying thought seems to be that "in the long run the level of salary increases and investment returns should balance out" and accordingly that the salary increase adjustment should in the long run be more or less self-financing.

The adjustment fund, and its cushion mechanics to absorb year by year deviations between investment return and salary increase, is introduced as a time diversification tool intended to transform short term fluctuating contribution cash flows into long term smooth contribution cash flows.

Irrespective of the intention to produce a smooth contribution pattern with small risk of additional cost for the salary increase indexation, the fact remains that this latter risk on the part of the employer does exist. Other than intuitive anticipation there is no foundation to assume that "in the long run the level of salary increases and investment returns should balance out".

While the basic cost for the hybrid plan is included in the risk-free $contr_t$-process, the additional cost of the salary increase indexation is represented by the not-risk-free $Employer\_to\_AF_t$-process.

An important additional feature that has so far been disregarded, is the application of the adjustment fund's balance at the end of the accumulation phase/inception of the decumulation phase (alternatively in more ordinary wording; when an employee goes into retirement and starts drawing the retirement benefit): The balance is then not reverted to the employer but instead applied to provide for an enhancement of the retirement benefit.

While the hybrid account at retirement, say at time n, amounts to HA_n, the member will in addition also receive AF_n immediately prior to retirement[3]. In the aggregate, the member has accumulated $(HA_n + AF_n)$ as a basis to draw a future benefit. $\frac{AF_n}{HA_n}$ can be considered as a relative benefit enhancement, which follows indirectly from the plan's funding and smoothing mechanism.

The main objective of this paper is to consider the risk properties of firstly the $Employer\_to\_AF_t$-process-process and secondly $\frac{AF_n}{HA_n}$ under different assumptions of market risk and pension plan parameters. This is intended to illuminate how the hybrid plan properties may give rise to additional cost and risk for the employer and correspondingly "risk" for the member that the benefit received will ultimately be higher than determined straightly by the accumulation of contributions and salary indexation of the account.

4. Modelling the financial market return and salary inflation.

4.1 The model.

There are to underlying risk driving processes for the employer's cost and the member's benefit level; firstly the financial market return and secondly the salary increase index, hereinafter referred to as the salary inflation.

As a compromise, for a model to capture main features of actual market behavior on the hand and to be understandable, transparent and operational on the other hand and, we assume that

[3] More generally, a member who goes into retirement will receive his or hers proportionate share of the aggregate adjustment fund for all members, where the proportion is based on the hybrid account's balance. Since our consideration is for one single member only, this distinction does not have a bearing in our case. Moreover, a similar provision of receipt of a share of the adjustment fund applies also for a member who leaves active service and terminates his or hers plan membership prior to retirement. Also this provision will have no bearing in our case, since we disregard turnover prior to retirement.

the two processes are governed by a two-dimensional, dependent, GBM-process. Then the two processes have the following mathematical properties:

$sal\_inc_t; t = 1, \dots n$ are *i.i.d*

$return_t; t = 1, \dots n$ are *i.i.d*

sal_inc_s and $return_t$ are independent for $s \neq t; s, t = 1, \dots, n$.

$$sal\_inc_t = e^{\mu_S - \frac{\sigma_S^2}{2} + \sigma_S \cdot V_t} - 1 \tag{5}$$

$$return_t = e^{\mu_R - \frac{\sigma_R^2}{2} + \sigma_R \cdot W_t} - 1 \tag{6}$$

$$(V_t, W_t) \sim \mathcal{N}\left(\begin{pmatrix} 0 \\ 0 \end{pmatrix}, \begin{pmatrix} 1 & \rho \\ \rho & 1 \end{pmatrix}\right) \tag{7}$$

4.2 Parameter discussion

Given the underlying intention and assumption to finance salary increase indexation by investment return, both in the long run, the connectivity between the two processes is of particular interest. In our model there are two different levels of such connectivity:

- Firstly by how the expectance compare between the processes, which in the model jargon can be expressed as μ_S compared to μ_R
- Secondly the extent of covariation for the randomness of the two processes, which in the model jargon can be expressed by the magnitude of $Corr[sal\_inc_t, return_t] = \frac{e^{\rho \cdot \sigma_S \cdot \sigma_R - 1}}{\sqrt{\left(e^{\sigma_S{}^2} - 1\right) \cdot \left(e^{\sigma_R{}^2} - 1\right)}} \approx \rho$[4]

For the case $\mu_R < \mu_S$, the realized return will on average be insufficient to finance the increase of the hybrid account in line with the salary increase index. We can predict systematically additional cost for the funding of salary increase, with the probability distribution for the aggregate $Employer\_to\_EF_t$-cost well to the right of the origin. This risk position is similar to the funding of an ordinary DB pension obligation where salary increase exceed investment return, with the distinction that the salary increase for the hybrid plan follows an index applied equally to all members as opposed to each individual's actual salary increase.

For the case $\mu_R > \mu_S$, the realized return will on average be more than sufficient to finance the increase of the hybrid account in line with the salary increase index. Where the upper limit AF_Max_t is "real"/"restrictive", the probability distribution for the aggregate of $Employer\_to\_AF_t$-cost will then be well to the left of the origon. At the same time it is a close to certain probability that AF_n will be equal to AF_Max_n. These are risk characteristics similar to a DB plan with a DB formula inclusive of the value of AF_Max_n. On the other hand, where there is no or an "excessive" upper limit, "$AF\_Max_n \approx \infty$", the risk characteristics is similar to a DC plan with the plan sponsor's ultimate cost equal to basic contribution and the employee/retiree harvesting the economic benefit of financial return systematically at a higher level than salary increases.

The case case $\mu_R = \mu_S$ is where, as a starting point, intuition calls for investment return income and salary indexation cost to balance in the long run. At the same time the picture is

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[4] For the quantification in the examples in the following we refer to the values of the model parameters μ_S, μ_R and ρ respectively, with the understanding that they are representative approximates for their corresponding annual values

made less obvious by the variability of actual return and actual salary indexation, the funding mechanism including the EF_t-cushion and the allocation of AF_n as a supplement to HA_n upon retirement,.

We will concentrate our study on this latter case with $\mu_R = \mu_S$, which provide for the least obvious and also most interesting circumstances to illuminate.

As a starting point, it appears obvious that the upper limit(ceiling) for the adjustment fund will be key to the properties of the cash flows to/from the plan in addition to the basic contribution, the $Employer\_to\_AF_t$-process, and to the property of the ultimate adjustment fund, AF_n, allocated to the retiring member's hybrid account upon retirement. The legislative provisions for how the ceiling, AF_Max_t, still remain to be settled[5]. As a technical construct we will assume that the ceiling is stipulated in proportion to the hybrid account, i.e. $AF\_Max_t = max\_AF \cdot HA_t$, where max_AF is a parameter value for the ceiling. In our calculations, we will evaluate results for the four values $0, 0.05, 0.10$ and 0.20 for max_AF.

As described above, for our calculations the connectivity between market return and salary indexation in terms of their expectance has been limited to to $\mu_R = \mu_S$. The variability connectivity, as expressed by ρ, are still not subject to any specific restrictions. It seems reasonable so assume that both the extent and the variability of the salary indexation financing cash flows will be smaller, the closer the variability connection is between the return and the salary indexation. We will investigate this aspect by doing calculations for different values for ρ, with $0, 0.25, 0.50$ and 0.75 for the four chosen parameter values.

Other specific values that we have chosen for our calculations are:

$$\mu_R = \mu_S = Log(1.03)$$

$$\sigma_S = 0.0075$$

$$\sigma_R = 0.06$$

We do not go deep into the substantiation of the choice of these parameter values. However, we observe that $2/3$ percentile intervals for sal_inc_t and $return_t$ respectively are approximately $(0.0225, 0.0375)$ and $(-0.03, 0.09)$. That realized values for the two processes will "largely" be captured within these limits, does not seem unreasonable for the economic phenomena that they represent.

For the duration of the accumulation period, n, we use $n = 35$.

4.3 Computational comments.

We use pseudo-stochastic Monte Carlo simulations to perform our calculations, where the simulation scheme is as follows:

1. A draw of sample of pseudo-random realisations of $sal\_inc_t; t = 1, \dots, n$ and $return_t; t = 1, \dots, n$ according to formulae $(5) - (7)$.
2. For the given sample drawn in 1., generate values for HA_t, $AF\_to\_HA_t$, AF_t and $Employer\_to\_AF_t; t = 1, \dots, n$. according to formulae $(2) - (4)$.
3. Repeat the steps 1. and 2. for a "large" number of times.
4. Use the "large" set of generated values for the processes under considerations as representative outcomes for their actual probability distributions.

Since we focus on capturing some main characteristics of the probability distributions, we have limited the "large" number of pseudo-stochastic draws in our simulation scheme to100

[5] As of 31 May 2015

thousands (while a higher number would have been appropriate if we were to consider properties more to the extreme, such as very low or very high quantiles).

5. Numerical results.

5.1 Measures to illuminate the risk properties.

For the calculation of numerical results we introduce the following stochastic variables/processes:

Discounting factors:

$$v_t = \prod_{j=0}^{t} \frac{1}{1 + return_j}; t = 0, \dots, n$$

Present value of contributions:

$$\sum_{t=0}^{n-1} contr_t \cdot v_t$$

Present value of cash flows arising from salary index financing:

$$\sum_{t=1}^{n} Employer\_to\_AF_t \cdot v_t$$

For the assessment of the extent to which salary indexation gives rise to additional cost, and the variability of the cash flows towards such cost, we introduce the following two measures:

Aggregate measure of expected additional cost arising from salary index financing:

$$Sal\_ind\_cost = \frac{E(\sum_{t=1}^{n} Employer\_to\_AF_t \cdot v_t)}{E(\sum_{t=0}^{n-1} contr_t \cdot v_t)}$$

Volatility of cash flows arising from salary index financing:

$$Sal\_ind\_fin\_vol = E\left(\sqrt{\sum_{t=1}^{n} \left(\frac{Employer\_to\_AF_t}{contr_{t-1}}\right)^2 \cdot v_t}\right)$$

where we have adopted the standard notation $E(\cdot)$ to denote the mathematical expectation.

It should be noted that all discounting of (the stochastic) cash flows is done on the actual realized (stochastic) market returns. The discounted cash flows can then be interpreted as their actual values, measured up front, as they can be determined ex post.

Finally, for the assessment of the *enhancement stemming from the attribution to the hybrid account of the adjustment fund at the member's retirement*, we consider:

$$Enhance\_from\_AF = E\left(\frac{AF_n}{HA_n}\right)$$

The expected values in the preceding are estimated from our Monte Carlo simulation from the mean value of the realized values of the corresponding stochastic variables.

The contributions are stipulated as a certain percentage of the member's salary at any point of time. The three variables we will use in our illustrations, Sal_ind_cost, $Sal\_ind\_fin\_vol$ and

$Enhance\_from\_AF$, are all expressed as relative measures, and they are therefore independent of the member's salary level and the contribution rate

5.2 Results.

5.2.1 Additional contributions.

Figure 1 and Figure 2 summarizes numerical results for the level and volatility for the employer's additional contributions required to finance the increase of the hybrid accounts in line with the salary increase index. The four alternative values for max_AF and their corresponding computation results are represented by separate curves, while we distinguish between the four ρ parameter values by showing their alternative computation results for each max_AF-curve, as indicated by the ρ parameter values along the horizontal axis.

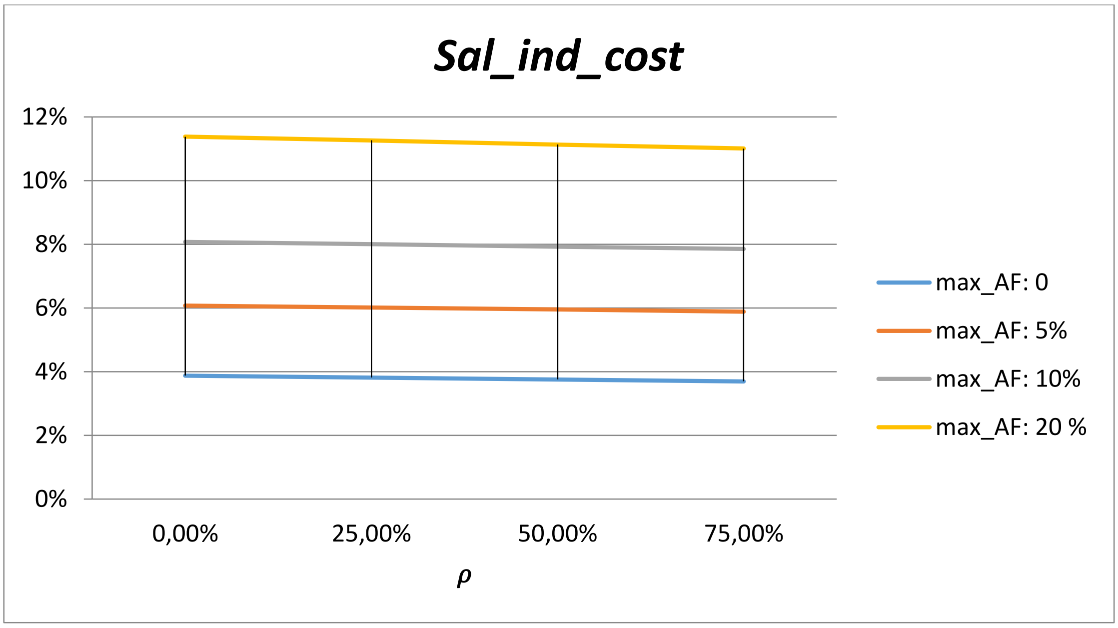

Figure 1 - Expected additional cost of financing salary increase indexation, relative to expected cost of contributions.

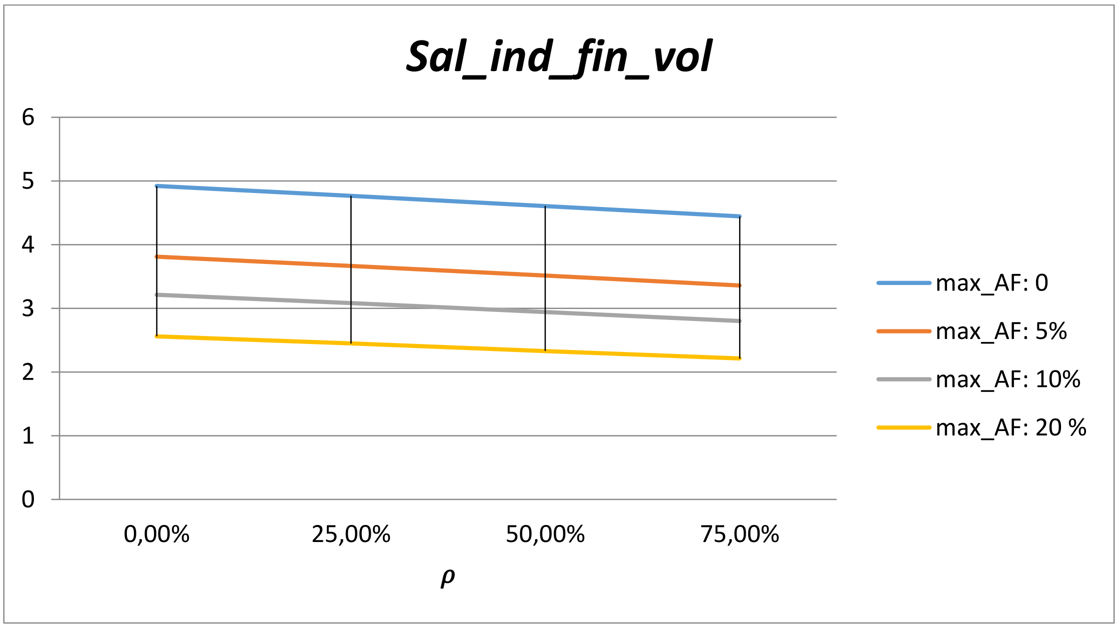

Figure 2 - Volatility of additional cash flows towards financing salary increase indexation.

Some basic properties we can deduct from these results are:

1. Since $\mu_R = \mu_S$, one might expect that the only systematic force to generate an additional cost would be the allocation of the adjustment fund to the hybrid account at retirement. Accordingly there should be no expected additional cost in the case of $max\_AF = 0$. However, our results do indeed show an additional cost also in this case. The explanation is that the discounting is done on the actual realized market returns, as opposed to a pre-determined interest rate (curve). Discounted on the latter interest rate (curve), the expected additional cost is indeed 0. Given the interpretation of our discounting measure, we argue that although an ex post discounting with a fixed interest rate (curve) results in no expected additional cost, the probability distribution of the additional cost ex ante, taking into account the volatility of market returns, has a positive expected value.
2. The expected additional cost increases with increasing max_AF. This is in accordance with what we would expect, since it is the allocation of the adjustment fund to the hybrid account at retirement that is the primary driver of the additional cost. The results shown in Figure 1 indicates that the expected cost increases with a pace which is in the order of 35-45% of the incremental value of max_AF.
3. The volatility of financing the extra cost decreases with increasing max_AF. This property seems intuitively evident, and it demonstrates that the desired cushion effect of the adjustment fund can be expected to be achieved.
4. ρ has little impact on both the expected level and the volatility of the additional cost. Since ρ measures the connectivity of variability between $return_t$ and sal_inc_t, one might expect that a higher ρ should also have a stronger reduction effect than the numbers demonstrate. However, recalling that the $(return_t - sal\_inc_t)$-process is the main driver of the additional cost and that:
$$E(return_t - sal\_inc_t) = 0$$
we can seek to justify these relatively modest ρ-sensitivities by considering:
$$Std(return_t - sal\_inc_t) \approx \sqrt{\sigma_R^2 + \sigma_S^2 - 2\rho \cdot \sigma_R \cdot \sigma_R} = \sqrt{0.00365625 - \rho \cdot 0.0009}$$
Here, the minimum and maximum values for $Std(return_t - sal\_inc_t)$ in our numerical exercise are attained at $\rho = 0.75$ and $\rho = 0$, the minimum and maximum values being approximated to 0.0605 and 0.0546 respectively. The relatively limited impact that variations in ρ have on $Std(return_t - sal\_inc_t)$ is probably a lead to understand why the same applies also to the volatility of the cash flow towards additional cost.

5.2.2 Enhancement of hybrid account at retirement.

Figure 3 summarizes numerical results for the expected enhancement that attribution to the hybrid account of the adjustment fund at the member's retirement will give rise to. The technical construct of the graphics to illustrate variations with different parameter values for max_AF and ρ is as explained for Figure 1 and Figure 2 in paragraph 5.2.1.

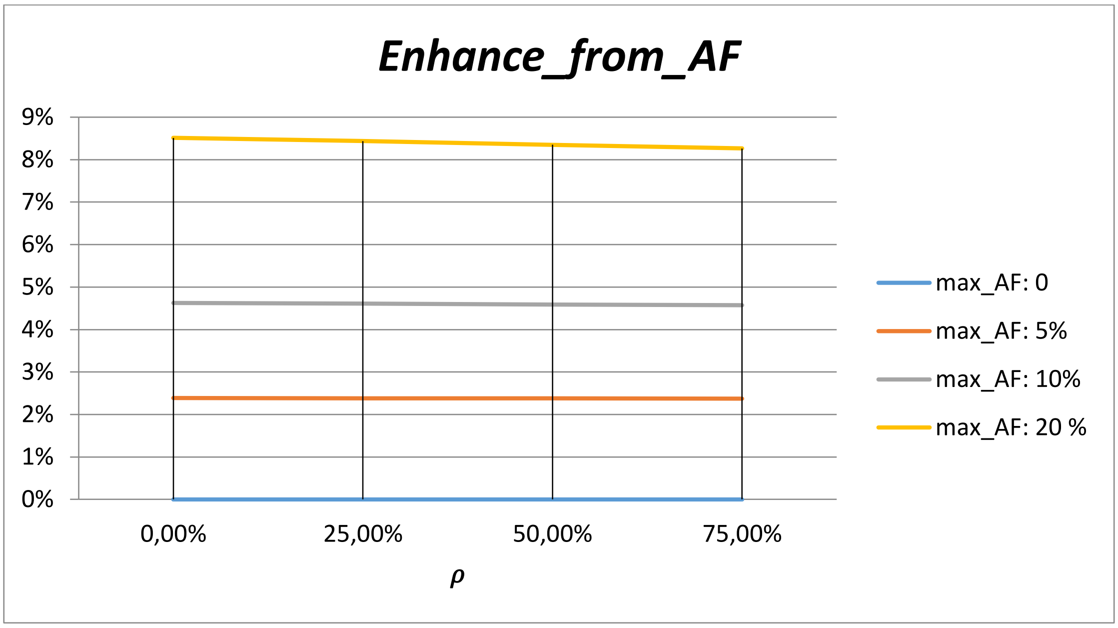

Figure 3 - Expected enhancement stemming from the attribution to the hybrid account of the adjustment fund at the member's retirement

Properties that are evident from Figure 3 are that:

1. Obviously, for the case $max\_AF = 0$, enhancements are out of scope.
2. Also obviously, the expected level of enhancement increases with increasing $\max\_AF$. Very roughly stated, the expected enhancement level is in the order of ½ of $\max\_AF$.
3. Variations with ρ has very little impact on the expected level of enhancement. The underlying reason and interpretation is probably as discussed for the similar phenomena in paragraph 5.2.1.

One might expect that max enhancement or no enhancement are the two outcomes that will occur with highest probability, and that there is a relatively even spread for the probability distribution covering the possible outcomes between. This is indeed confirmed in the graphical illustration for the probability distribution in Figure 4 in the following, which is derived for the parameter values $max\_AF = 0.10$ and $\rho = 0.50$. In this case, the probability that there will be no enhancement is approximately 28 %, the probability that the enhancement will be at the max attainable 0.10 is approximately 20 %, while the remaining slightly more than 50 % probability covers the possibilities of outcomes of enhancements higher than 0. and lower than 0.10.

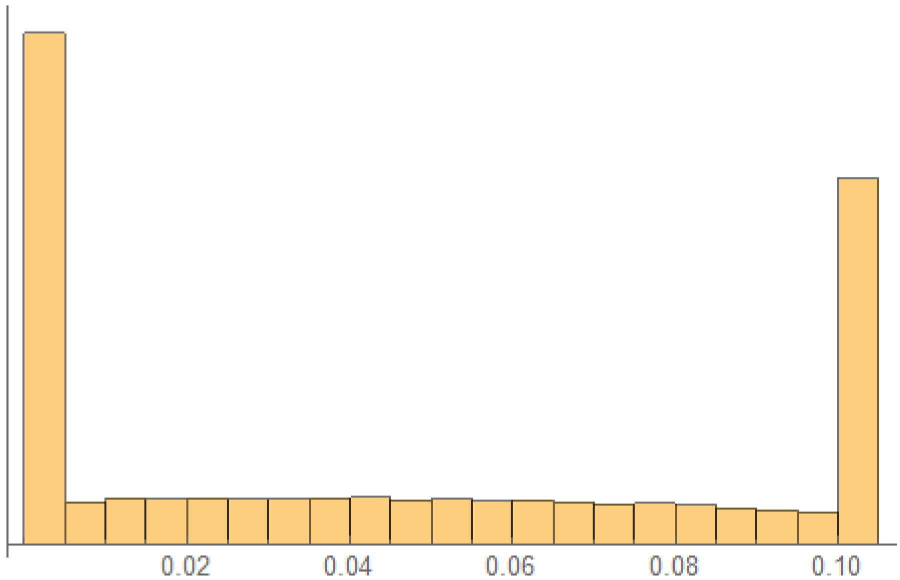

Figure 4 - Probability distribution of enhancement of the hybrid account stemming from attribution of the adjustment fund at retirement, based on parameter values $max\_AF = 0.10$ and $\rho = 0.50$.

6. A note on IAS19 and local accounting standards of a similar nature.

The analysis in the preceding makes an attempt to address the “true” underlying cost of providing pensions that reflects firstly the stochastic nature of the underlying forces giving rise to cost risk for the employer and benefit risk for the employee and secondly which reflects the actual nature of the risk exchange between the employer, plan provider and employee. In this author’s view the measurement of cost of providing occupational pensions should be based on these two criteria.

Furthermore, it is this author’s view that IAS 19 and local accounting standards of a similar nature fall short of complying with the said two criteria. Accordingly they may give rise to measurements of an employer’s accrued obligation and ongoing cost to provide future benefit obligations which are not economically representative and may be substantially misleading.

To elaborate on the last point first, IAS19’s “problem” is that it adopts a black and white view in classifying the nature of the risk exchange between the employer and the plan provider. On the one hand are the straight DC plans, where payment of the contribution is a full risk exchange and means that the employer has been revealed of any obligation in relation to past pension accruals. On the other hand are all other plans that are not straight DC plans. They are all classified and treated as if no risk has been transferred to the plan provider and that the full risk is retained by the employer.

This latter risk description of “non DC plans” may be representative for an ordinary DB plan, but is certainly not representative for all occupational plans not being DC plans. The opposite of not transferring all risk is different from not having transferred any risk.

IAS19’s classification leads to a gross consideration as a basis for the accounting of pension cost: Economically the employer assumes the gross liability to provide pensions directly to current and future pensioners. Funds that have been accumulated with the plan provider are “plan assets” which the employer may choose to draw upon to finance future pension payments. The net pension liability is the balance between the value of the gross liability and the plan assets.

Unarguably the cash flows an employer is confronted with in respect of future and past accruals is a payment stream to the plan which the plan provider subsequently draws on the plan asset.; not a payment stream to the benefit recipients as the benefit payments fall due. IAS19's gross approach for all non DC plans does not address this in an appropriate manner.

For the hybrid plan that we have considered the IAS19 approach would be to consider the accumulated hybrid account as a plan asset, probably with the addition of the adjustment fund. On the other hand are the future benefit payments as a gross liability for which the employer is fully responsible. How do the cash flows in respect of financing salary indexation between employer and plan provider, which is a main feature of the hybrid plan, come into this equation? Under the gross consideration, the impact of future economic scenarios is measured through the magnitude of future pension amounts and their expected present value. The economic reality is that the true impact is represented by cash flows from the employer to the plan provider, and the economic value of the two may not necessarily be the same.

The "problem" in relation to the first point, i.e. to reflect the stochastic nature of economic phenomena in a representative manner, is how IAS19 considers risk. As an example, if an economic scenario foresees future investment return at a deterministic level of 2 % p.a. and future salary increases at a deterministic level of 3 % p.a., IAS19 considers the financing shortfall of 1 % p.a. of the accrued liability as a "risk" for the employer, and it does not go beyond that in its risk considerations. Within a stochastic framework this is not a "risk" but a fully foreseeable economic liability. "Risk" is exposure to random fluctuations of certain economic phenomena, and this risk may in its own right give rise to costs beyond, or possible below, a realization of the economic phenomena in the absence of random fluctuations. This was demonstrated for the hybrid plan in the preceding, where the presence of randomness for the return and the salary increase resulted in a higher pension cost than was intuitively expected in the deterministic scenario.

In conclusion, the appropriate basis for measuring accrued pension liability and future pension cost is the probability distribution of the cash flows that the plan requires from the employer to make up for these obligations.

This issue in its own right deserves a more thorough elaboration than allowed for within the context of the specific hybrid plan that has been the subject of this paper.