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The concept of Target Retirement Income: supervisory challenges

Dariusz Stańko
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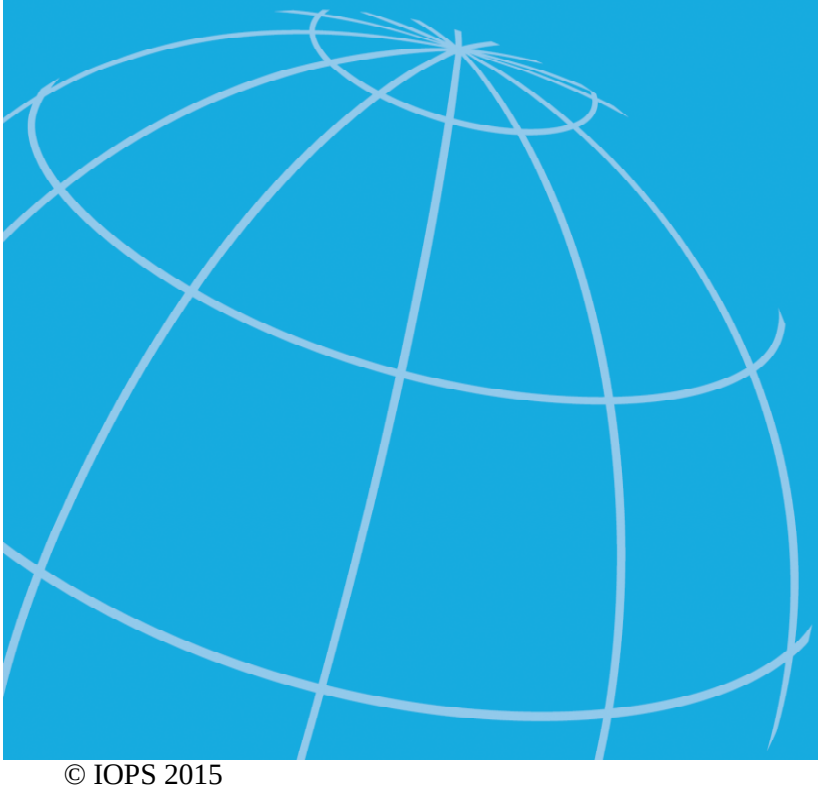

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THE CONCEPT OF TARGET RETIREMENT INCOME: SUPERVISORY CHALLENGES

Dariusz Stańko*

ABSTRACT

This paper discusses supervisory challenges in relation to the concept of the target retirement income (TRI). The TRI framework attempts to shift the short-term focus of pension providers and investment managers towards the long-term income perspective of retirement savers. It seeks to address the needs of pension fund members by providing them with understandable and substantial information about their expected income needs in retirement and the risks to which they are exposed.

Supervisors will need to think ahead about requirements and challenges they will have to face if systems with retirement targets for private pensions are introduced by their governments. Pension supervisors should make sure that the TRI framework contains the following five key features. (1) The retirement target is defined and presented to the members as a lifetime income or range of income levels expected in return for assuming a pre-defined level of risk, (2) both expected risk and return are measured and presented in a meaningful way, (3) projections as well as the probability of meeting stated retirement goal are reasonable, (4) pension fund members understand the fundamental link between the level of target and contribution rates and are offered a range of choices when the ongoing investment results suggest that the target is not likely to be reached, and (5) members understand the consequences of the above choices.

Keywords: target retirement income, supervision, pension policy, private pensions

JEL codes: D-14, G-23, G-28, D-02

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Introduction

Target retirement income (TRI) is a concept that attempts to shift the short-term focus of pension funds and their investment managers towards the long-term income perspective of retirement savers. It seeks to address the needs of pension fund members by providing them with more understandable and substantial information about their expected income needs in retirement and the risks to which they are exposed.

In a few jurisdictions supervisors, besides assessing the performance of DC pension funds, also apply other indicators relevant to DC funds (e.g. value-at-risk, probability of benefits being reduced), whereas the level of solvency is a more frequently used tool used for monitoring the situation of DB and hybrid funds. While examining these indicators is important and serves a range of purposes, they are of the short-term, and therefore have a volatile character that does not help respond to the most fundamental question asked by pension fund members: "What income will I get when I retire?"

Various authors (Blake et al., 2008; Antolin et al., 2010; Hinz et al., 2010; Castañeda and Rudolph, 2011; Stewart, 2014) have called for creating a more coherent and long-term investment-oriented pension system that would align the typically short-term interests of asset managers with the long-term interests of the pension fund members. Blake et al. (2008: 3) suggested that a key role of the regulator or other responsible parties should be to design the system with target annuitisation funds as default options during the accumulation stage.

It is argued (cf. OECD, 2012) that funded pension systems should offer default options to those who are unable to make informed decisions. Members could then be allocated to those funds by age (or any other attributes deemed appropriate). The investment of these default funds should follow closely a benchmark portfolio that should be constructed in such a way as to maximise the expected long-term returns of individuals (Castañeda and Rudolph, 2011: 5). Supervisors might be involved in the task of overseeing these default options. Randle and Rudolph (2014: 10) postulate supervision of pension funds on the pension risk defined as "the risk that on retirement, the actual pensions are different than a specific target, which could be related to a specific replacement rate, annuity or volume of assets". Consequently, some new benchmarks with the objective of optimising the contributors' pensions at retirement should be constructed (Randle and Rudolph, 2014: 19). As the actual investment portfolio will deviate from the reference portfolios based upon the changing situation in the market and manager's expectations about the future development of economic variables, supervisors might be involved in monitoring the ongoing performance of pension funds against the benchmark(s).

Increasing longevity, the aging of the population, the negative equity returns of the recent financial crisis and prolonged low interest rates have put negative pressure also on DB schemes and undermine the viability of the guarantees offered by employer sponsors (Kortleve, 2013:6). Moreover, regulatory costs for running the DB pension arrangements are increasing. That is why new practical approaches to pension systems to combine the best elements of DC and DB systems are being debated. If introduced, new pension paradigms with income-related targets, whether soft or hard, are likely to bring about significant regulatory changes in various jurisdictions. One such example is the concept of defined ambition (DA) schemes being analysed in the Netherlands and – until very recently – deliberated in the UK[1]. The Dutch DA schemes, as well as Icelandic schemes, can be defined as a type of plan that targets a stated income-related benefit but which retains the flexibility to lower that target after financial or longevity shocks. Consequently, the target benefits are no longer guaranteed (Kortleve, 2013: 6). Notwithstanding, such pensions may be more stable

[1] The UK government announced in October 2015 that it would halt work on defined ambitions to focus on current new pensions freedoms and recent regulatory changes (http://www.ipe.com/countries/uk/uk-government-halts-work-on-collective-dc-defined-ambition/10010272.article).

as shocks could be absorbed in small steps. Also, the investment strategy in the DA framework enables to switch from the currently applied inflation protection and short-term nominal asset-liability matching to the long-term indexation of benefits (Kortleve, 2013: 8).

This paper analyses a stylised target retirement income (TRI) framework, where the investment process is driven by the ultimate outcome such as a stream of expected retirement income expressed in absolute or relative terms. Pension assets managers would have to find long-term portfolios that would maximise the probability of achieving this goal given a particular fixed size of pension contributions and a fixed level of risk the members/designers are willing to take. The retirement-outcome oriented system could use life-cycle (or target-date) funds and incentivise asset managers to define their asset allocations and 'glide paths' (describing how risky assets are reduced) to reflect the objectives of the pension system. As a result, both phases of the retirement process, accumulation and decumulation, would be combined into a single framework. Life cycle funds with their asset allocations and "glide paths" during the accumulation phase, would serve as indicators of different (more or less risky) routes to achieving replacement rate/income targeted for the decumulation. In their IOPS Working Paper, Ashcroft and Stewart (2010) state that "pension fund managers would offer funds in the same category as these benchmark funds, with their returns being measured accordingly".

The main purpose of this paper is to identify what challenges may be faced by pension supervisory authorities under the TRI framework. Supervisors will need to think ahead about requirements and challenges they will face if systems with retirement target(s) for private pensions are introduced whether voluntarily by pension providers or in a regulated manner by governments. The paper uses the experience of existing or proposed solutions in various jurisdictions. Also, the findings of this paper can offer some feedback for policy makers on the types of adjustments or changes that should be taken into account from the pension supervisory point of view when designing and implementing such frameworks. In this vein, the paper can be of interest not only to supervisors but also to policy makers and other relevant pension stakeholders such as trustees, beneficiaries and pension managers[2].

The paper identified the following key challenges that supervisors may encounter when overseeing the TRI framework:

- supervision of asset managers' investment governance;
- monitoring of solvency of DB-hybrid schemes (e.g. target-benefit plans);
- measurement of risks transferred to various stakeholders, along with assessment and supervision of risk-sharing mechanisms;
- supervision of communication between pension funds and their members with regard to key concepts such as: the target, long-term projections, current investment results and reasons for deviation from the target/projections; meaningful options available to the members to improve the likelihood of realising the target.

Pension supervisors should make sure that the TRI framework contains the following five key features. (1) The retirement target is defined and presented to the members as a lifetime income or range of income levels expected in return for assuming a pre-defined level of risk, (2) both expected risk and return

[2] The paper benefited from comments of IOPS Delegates and in particular detailed suggestions by Björn Ásgrimsson, Dirk Broeders, Olga Fuentes, Ambrogio Rinaldi, Darren McShane, Fiona Stewart, Andrius Škarnulis and André Tapernoux. Comments of Pablo Antolín and Ole Beier from OECD, Michiel van Leuvensteijn from APG, and Brendan Maton, the editor, are also kindly acknowledged.

are measured and presented in a meaningful way, (3) projections as well as the probability of meeting stated retirement goal are reasonable, (4) pension fund members understand the fundamental link between the level of target and contribution rates and are offered a range of choices when the ongoing investment results suggest that the target is not likely to be reached, and (5) members understand the consequences of the above choices.

The study focuses on DC and DB-hybrid private pension funds. The paper neither seeks nor proposes an optimal level of retirement target as such a target is the ultimate result of various socio-economic features that are different in each jurisdiction. Nor does it attempt to investigate the design of target retirement income frameworks with quantitative settings. As targeted income resulting from all pension pillars is likely to be out of the scope of supervisors, only the second pillar will be considered[3]. The paper concentrates on the technical aspects of introducing and supervising the target income framework and related potential supervisory problems.

The structure of the paper is as follows. Section one proposes main elements of the Target Retirement Income (TRI) concept that can be useful when analysing supervisory challenges in systems with retirement targets. Section two provides examples of pension schemes in several jurisdictions that reveal certain features of the TRI concept. Section three lists supervisory challenges which are already present or may result from creation and supervision of the schemes focused on retirement goals. The paper ends with general conclusions and possible policy-making recommendations from the supervisory perspective.

[3] Projecting all sources of retirement income is difficult (unless all pillars are integrated, as it is for instance in Chile and in Iceland where pillar I is complementing the pillar II). The relative weight of each element (state pensions, occupational pensions, personal pensions, imputed income from house ownership or reverse mortgage etc.) varies in each jurisdiction and within socio-economic groups. Moreover, when setting up the investment policy, one would have to take into account also correlations between projected income from investment and those other streams of income.

Denmark has introduced a website (www.pensionsinfo.dk**,** in Danish) where all pension savings, from all three pillars, can be seen by individuals. All providers, including the State, have signed up to supply the necessary information and agreed on uniform assumptions.

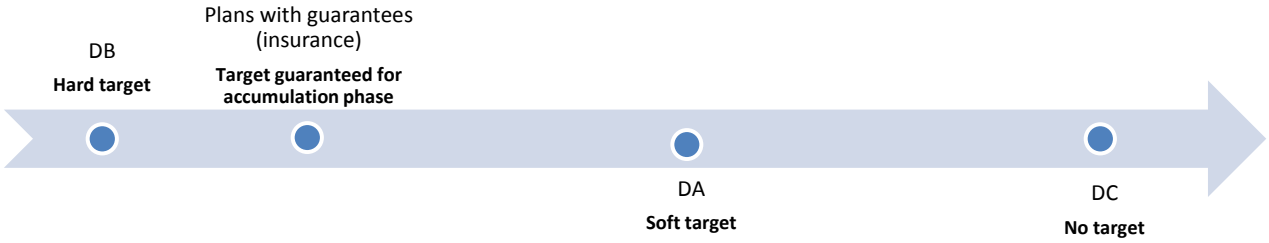
I. Elements of target retirement income (TRI) concept

Members of DC pension funds are unable to accurately determine the value of their future pension benefit in advance. It is so because the final value of their pension is uncertain and depends on numerous variables and also decisions that the savers need to take. They are exposed to various risks and are faced with decisions that need to be taken during the saving and, increasingly, decumulation phases. Individuals find it difficult to comprehend information about the on-going performance of their funds. Moreover, investment managers of DC pension funds tend to invest in a similar way (herding) and rather focus on the short-term. Managers might not be incentivised to create portfolios optimal for the long-term character of saving for retirement as they frequently are assessed against short-term performance and relevant decision-making is often left to members. Very often, accumulation and decumulation phases are fragmented because there are separate institutions responsible for pension management in each of these phases.

These problems in DC pension plans coupled with the diminishing role of DB pension arrangements call for consideration of a new paradigm in funded pensions. In several countries there are currently discussions about introducing some long-run retirement target to the DC private pension systems and/or combining desirable features of DB and DC schemes. The purpose of this section is to analyse key elements of such stylised target retirement income (TRI) frameworks. This can give some insights on what potential challenges might emerge with regard to supervising systems with retirement targets.

From the policy-making perspective, the span of current pension schemes ranges from those that do have stated, contractual outcome "hard" targets (many DB schemes) to those that do not have any explicit outcome targets at all (DC schemes). However, as Figure 1 shows, in between are situated intermediate structures with "soft" targets where some sort of defined ambition targets, risk sharing or guarantees are present. From the perspective of supervisors this variety results in different supervisory approaches to targets, reference portfolios (benchmarks), risk-sharing mechanisms and communication processes (Figure 2).

Figure 1. Stylised taxonomy of retirement targets depending on type of pension scheme



Source: IOPS and the World Bank.

Figure 1 presents the order of targets used during the accumulation phase. The *defined benefit schemes* (DB) offer their members a pension benefit guaranteed by a provider (sponsor). This target is expressed in terms of a replacement rate or an amount of lifetime income to be obtained at retirement. It should, however, be recognised that, even in DB schemes, there are vagaries faced by members, as factors such as their future employment status and salary profile are not known with certainty. As such, they still bear substantial uncertainty in the accumulation phase although they do have relative clarity as to the amount they will get in the decumulation phase for a given amount of contributions.

Schemes with guarantees from providers or insurers protect pension savings from risks present during the accumulation phase whereas each member bears decumulation risks (they need to buy an annuity or other retirement product).

Defined ambition (DA) schemes assume a target expressed as in the DB, albeit the benefit that is aimed for depends ultimately on the funding. Members bear decumulation risks unless annuities are directly supplied by a fund[4]. Investment risk may be shared between members via smoothing returns over time. Depending on the solution used, funds may provide annuities or participants may assume the decumulation risks when buying annuity or other retirement products.

Finally, *pure defined contribution schemes* do not have targets, at least defined as ones relating to final retirement income, and do not offer risk-sharing during accumulation and decumulation phases. The design of these schemes is more focussed on the inputs (amount and period of contributions) which, even where optimised can lead to large variances in members' pension outcomes.

[4] There could be some debate as to which is more certain –the guarantee or the DA. The answer very likely depends how one views the relative risks.

In many public unfunded DB pension systems, the retirement target has obviously been applied for a long time. It was the case both for systems that provide flat-rate pension benefits (as in Denmark, the Netherlands or, to some extent, the UK), as well as in some insurance-based public pension systems (like the old system in Poland), where it was traditionally assumed that the pension for the average retiree will be a certain percentage of his or her income during their working lives.

In some occupational pension systems (both DB and DC), especially those that are subject to collective bargaining, the TRI concept is also already present, albeit in less explicit terms. Other pension systems may also consider introducing the TRI elements in the future. Any new pension arrangements focusing on a retirement target, that might emerge, are likely to be based on substantially different rules across countries and will differ due to country-specific socio-economic and political considerations combined with the regulatory diversity.

In particular, the preferred approach may vary depending on whether pension schemes are individual (e.g. Chile) or collective (e.g. Netherlands), mandatory or voluntary. It seems that collective schemes represent the more obvious area for such innovations. They embody risk sharing and they can more easily introduce some retirement target elements to their current design.

With regard to individual pensions it is more difficult to implement such changes because individuals are likely to have a choice of investment strategy they want to follow. Nevertheless, even in the case of individual systems, projections of future pension income could be used and default strategies could be developed having regard to expected pension outcomes[5].

The retirement targets and corresponding default investment strategies might differ amongst income groups. This may be the case for nationwide pension systems where members are likely to be more heterogeneous. Heterogeneity complicates the definition of a single benchmark.

Notwithstanding the potential differences between countries and their various types of pension schemes, it is possible to distinguish some "building blocks" that could be utilised in developing a target retirement income (TRI): target, investment and risk management, risk sharing (if any), supervision and communication (Table 1).

Table 1. Elements of target retirement income (TRI) framework

Element	**Description**	**Domain(s) of**
Target	Lifetime retirement income expressed in relative terms (replacement rate) or absolute terms (nominal or real amount of money).	Employers/trustees, savers, pension managers or policy-makers (setting up and revising a target).
Investment and risk management Actual investment and risk management strategy	Strategy applied by pension managers to achieve the target	Asset managers.

[5] OECD *Good Practices for Financial Education Relating to Private Pensions* from 2008 postulates that plan sponsors, pension funds, fiduciaries and intermediaries "should be encouraged to supply prudent projections of retirement income which can be expected from pension funds and retirement products" (p. 6).

	under assumed level of risk.	
Risk sharing (optionally)	Mechanism to share (e.g. investment, longevity, inflation) risks between savers.	Social stakeholders (design).
Supervision	Measuring deviations against the reference portfolios and reacting to prudential risks to make sure target remains achievable. Assessing risk sharing. Assessing communication between stakeholders.	Supervisors (conducting ongoing investment supervision, carrying out performance evaluation, taking up supervisory actions). Supervisors. Supervisors.
Communication	Activities related to all stages of TRI framework.	Parties involved in a particular stage of TRI framework (predominantly asset managers, policy makers and supervisors).

Source: IOPS.

The next part of this section discusses five areas that build up a system focusing on retirement income target: the target itself, investment, risk sharing, supervision and communication.

I.1. Retirement target

The fundamental element of the TRI concept is the target. It can be defined as the ultimate result of saving for retirement, i.e. expected (desired) income.

Such a target depends on the level of risk taken and associated expected rate of return and level of costs. The target also takes into account the conditions that exist in a particular DC pension system, i.e. the contribution rate, the average (or individual) contribution density, expected length of contributing period, expected length of life on retirement, etc. In the context of DB schemes, the main input is the ability of the sponsor and/or employee to pay. This pension result can be guaranteed (sometimes at substantial cost) by a provider or, seemingly more sensible in the current demographic situation, can be aspirational, i.e. desired by savers but not guaranteed. In the latter case, the target should be a realistic expectation about the saver's future pension.

The target can be expressed in terms of the replacement rate at retirement needed to allow households to maintain their pre-retirement standard of living in retirement (Munnell et al., 2006: 9)[6]. This amount is usually lower than during the active work period as some expenditure is no longer necessary. For instance, retirees do not pay pension contributions and their income tax tends to be lower. On the other hand, the

[6] An example of a policy proposal that could be used in the US pension system is the National Retirement Risk Index proposed by Munnell et al. (2006). This index measures the percentage of working-age households that might fall into a risk of not being able to maintain their pre-retirement living standard in retirement. The authors make projections of replacement rates for a sample of representative different types of households, taking into consideration all sources of retirement income, and compare them with assumed target values. A household is considered to be at risk if its projected replacement rate is lower than the benchmark by 10% or more.

value of retirees' contingent health-related expenditure is high and is likely to increase dramatically in the later stage of retirement. Box 1 contains some discussion on replacement rates and their limitations.

Box 1. Replacement rates: limitations as their measure of well-being

One of the common measures that specifies the ultimate outcome of long-term retirement saving is the replacement rate. It is the ratio showing generally the income of a retiree in comparison to his or her income received during working years.

This comparison can be done either on an individual basis (i.e. pension benefit of a retiree compared to his or her salary – the career average or final one) or a plan basis (not allowing for specific individual risks, such as labour-market risks). It may also be calculated on a national basis (i.e. the average pension benefit received by every retiree in relation to the average salary in the economy). Naturally, there can be variations. For example, this ratio can be calculated for a particular cohort where their pension income is related to the average salary in the economy prevailing at the moment of their retirement or the moment of calculation. There can be gross replacement rates where input values are calculated gross of taxes and net replacement rates, with values obtained after deducting taxes and social security contributions.

Replacement rates are subject to various limitations. Mitchell and Turner (2010: 141-144) provide a review of the key problems. They note that despite the simplicity of the replacement rate concept, in practice people come up with very different measures. It is because both economic flows (income and pension benefit) can be expressed in various ways and measured over different time periods. The first problem relates then to the question what period of earnings should be used in the denominator? Should it be the career average income gained by a worker or the remuneration income of only a few pre-retirement years, which are very often the most highly-paid of an individual's life?

Second, one needs to decide whether replacement rates used for comparing results should be calculated gross or net of taxes. This issue is arguable amongst the experts as application of either basis can result in substantially different results for people with different level of income. Low income workers usually pay lower taxes and tend to receive most of their retirement income from the state pension system, which means that their voluntary pension savings are small. That is why, when using the net approach, the replacement rate for low income people should be much higher to preserve their pre-retirement standard of living (c.f. Munnell et al., 2006: 10).

Third, replacement rates are static both in terms of the moment of their calculation (usually only on retirement) and their value – they do not account for the effect of inflation, nor indexation. As life in retirement can reasonably reach a 40 year span, the impact of inflation can be substantial and even a target of 70% of the final year's salary may ultimately be too low for people with low incomes (OECD, 2012: 61). Inflation is not the only risk that is not taken into consideration. Replacement rates represent the values that are obtained from deterministic models, whereas in reality both investment and labour-market risk are stochastic variables that influence the income.

Fourth, the other disadvantage of replacement rates as indicators of pensioners' well-being is that they do not take into consideration the type of the pension benefit and the length of the period over which such a benefit is to be paid. The resulting replacement rates should also be adjusted for household composition (the size of the family and presence of children). For programmed withdrawal, given its decreasing nature, the replacement ratio for first pension payments will be higher compared with fixed life annuity payments. That is why the replacement ratio for the programmed withdrawal should be calculated on the basis of its "equivalent life annuity" value.

There are also some comparability problems between replacement rates calculated for various cohorts. The structure of expenses for older retirees may differ from the expenditures incurred by younger retirees (Mitchell and Turner, 2010). In particular, elderly retirees tend to have rapidly increasing contingent health-related expenses.

Moreover, when comparing various pension systems one needs to remember that they can offer different bonuses and penalties for the individual depending on the age at which he or she retires.

Finally, replacement rates, a relative and technical concept, may be poorly understood by future pensioners. Nonetheless, their advantage is that they have been used for a long time and are at the moment the traditional measures of pension well-being.

Source: IOPS.

The target can also be specified as a nominal or real lifetime retirement income. This implies that at the beginning of the accumulation process one needs to calculate the value of savings needed to sustain a particular desired lifestyle, i.e. also project the future price of the annuity[7]. There is a strong trade-off between the amount of retirement income (target) that savers expect to achieve and the level of risk that should be assumed. Higher targets can be achieved only by taking on higher risk, i.e. increasing the probability of underperformance or/and by increasing the value of contribution. Decisions about the value of the desired target for a particular level of pension contribution therefore require analysis of savers' risk budget (i.e. their capacity and readiness to bear potential losses). Risk budgets differ between individuals with their socio-economic characteristics and tend to diminish as they age.

Deciding on the target level and the way it is expressed is not the domain of supervisors. It is rather part of a complex political and economic framework. The academic research suggests that this choice belongs to policy makers (Ashcroft and Stewart, 2010), especially in the case of a mass participation pension system. In the case of occupational pension schemes it could also be a task of employers and/or trustees (There are numerous countries with trustees-run pension schemes for which establishing the accepted level of risk might be the trustees' responsibility. Commercial pension asset managers can be part of this process if they are required to analyse the risk capacity of pension fund members).

I.2. Investment and risk management

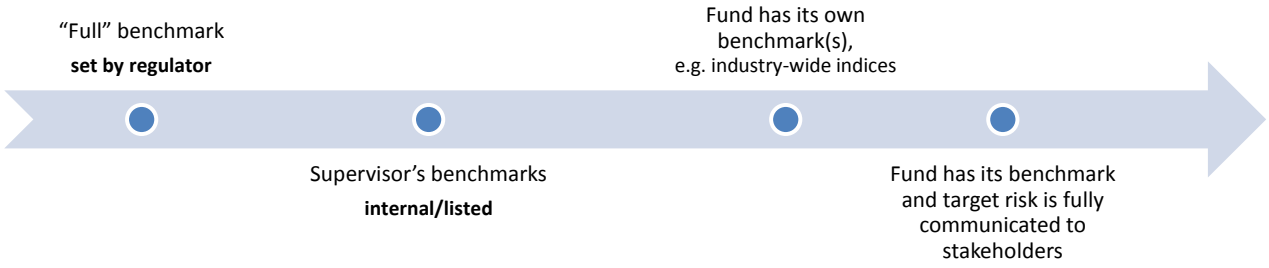
The second construction block of the TRI is the investment and risk management that aim to achieve the retirement target. Any investment policy adopted by managers to deliver the targeted outcome builds on long-term strategic asset allocation that involves setting target allocation for various asset classes with periodic rebalancing. Strategic asset allocation depends on a number of factors related to investors' situations, objectives and market expectations (Campbell and Viceira, 2002). Risk management aims to protect pension members against pension risks such as market risk (adverse price movements), labour market risk (unemployment, health problems or life events that may result in temporal or permanent loss of income from work), longevity risk (lifespan on retirement being longer than expected), interest rate risk, inflation risk, credit risk etc. In particular, one of the substantial pension risks faced in many DC pension systems relates to the uncertainty about future levels of interest rates that determine annuity prices at the moment of converting accumulated pension savings into a stream of income. Lower interest rates result in lower value of the retirement income stream.

Systems with target retirement income may, but do not necessarily have to, use reference portfolios. Reference portfolios (benchmarks) can be established in various configurations (Figure 2). They can also serve various purposes discussed further in Box 2.

It can be the case that a benchmark is *set by a regulator* (when it is not a pension supervisory body) or *any other body external to a supervisor*.

[7] The price of a lifetime annuity can be defined as an amount of pension savings that is necessary to receive a lifetime benefit of 1 euro paid out each month. For example, the price of a single life, level rate annuity for a 65-year old person in central London, UK would currently amount to about 206 euro (cf. http://www.sharingpensions.co.uk/annuity_rates.htm**)**.

Figure 2. Stylised taxonomy of reference portfolios from supervisors' perspective



Source: IOPS and the World Bank.

Reference portfolios can also be established *by supervisors themselves*. These supervisory benchmarks can be either used internally or displayed to market participants.

Another scenario from the perspective of a supervisor is when the *funds create their own benchmarks* communicated to and/or accepted by the supervisor. There can be also some industry-wide measures, especially when there is more than one benchmark[8].

Finally, the pension funds may operate with their own benchmarks that aspire to achieve *declared or desired target retirement goals*[9]. In this system, pension funds need to *communicate* to stakeholders whether they are on track towards the assumed target. All these various cases render different scope of tasks and challenges for pension supervisors.

Current experience (c.f. part II.2) shows that reference portfolios are applied at individual fund or scheme level. If benchmark portfolios were introduced at national level this might lead to market impact by asset managers massively adjusting their asset allocation at times when benchmarks are updated. In that case, one should probably consider target replacement rates serving as a general objective without specifying the way of achieving it.

At the national level, creating reference portfolio(s) is the domain of policy makers. Benchmarks should be established by parties who are independent from asset managers. Rudolph et al. (2010: 19) propose benchmarks to be established and revised by an independent body of experts, so as to immunise the decision-making process from political risk. Independence also helps to eliminate potential conflicts of interest. For example, setting up benchmarks by private stock-exchange companies could result in favouring particular equities to be included in a benchmark. The revision of benchmarks should be made periodically or follow any major changes in investment markets. Supervisors might have a role here in assessing and facilitating the process of creating and revising portfolios but there may be doubts about whether they should have any decision-making role in establishing or revising benchmarks.

[8] For example, Swiss funds use more than one benchmark, e.g. the Pictet BVG-25 (or BVG-40) index as a minimum target, then a typical peer average portfolio as a comparison and individual securities indices for each asset category, such as domestic bonds and global bonds. This reduces the risk that through simply copying one specific asset allocation and adding on some risk return targets can be achieved or exceeded.

[9] This was supposed to be the case of the UK. The Pension Schemes Act 2015 enabled employers/schemes to set their own benchmarks and other plan parameters such as targets, confidence level, investment strategy, risk-sharing methods or communication approach.

Box 2. Applications of reference (benchmark) portfolios

The reference (benchmark) portfolios can be used for several purposes:

- to serve as a performance evaluation tool, i.e. the benchmark to check the current performance against the long-term one;
- to guide investments and the acceptable level of risk so that a pension fund could meet its objectives and comply with its investment horizon;
- to indicate a desired ultimate value of retirement savings and to serve as a cost-efficiency control tool, i.e. providing low-cost passive or simple strategies;
- to indicate a desired particular stream of income (or alternatively, a long-term average or term accumulated rate of return required to achieve this income).

Source: IOPS.

Reference portfolios are just one example of dealing with the TRI concept and perhaps should not be seen as best practice. A potential shortcoming of reference portfolios expressed in terms of strategic asset allocation is that their existence may lead investment managers to concentrate on performance relative to this established benchmark, not on the target retirement income itself.

Finding an optimal investment strategy for achieving the target requires performing an asset-liability management (ALM) study because such optimal strategic asset allocation "crucially depends on the similarities and differences between financial assets and the implicit liabilities in the pension system (that is, the level of consumption or minimum wage that is being sought), combined with the financial situation of the representative individual for which the pension fund investments were designed" (Castañeda and Rudolph, 2011; 26).

TRI-model decision takers can seek an asset allocation or risk factor allocation, through the use of stochastic modelling techniques to maximise the target replacement rate, or target retirement income, given a level of risk. Based upon representative individuals, the pension risk model can produce a probability density function of expected replacement rates (c.f. Berstein et al., 2013), retirement income levels or accumulated benefits. However, its drawbacks are uncertainty about assumptions and parameters used for calculations and possible misspecification of the model and/or representative agents.

The second viable method of finding optimal asset allocation can be the "safety-first" approach, which attempts to minimise the likelihood of shortfall below a particular threshold. The optimisation process is performed subject to minimising this risk. The model is "asymmetric" in the sense of assuming that savers have highly different utility values for gains and losses. If a minimum threshold is chosen as an absolute and quite low value (such as subsistence income level or minimum pension), savers with average and above-average salaries will forego upside potential, i.e. chances of obtaining higher pensions were they allowed to follow a less conservative asset allocation policy. This problem can be solved by offering relative thresholds or a series of thresholds (where a part of contribution is dedicated to achieving a relatively low level of future retirement income, and another parts is invested more aggressively to attempt to produce additional amounts of income).

Reference portfolios can be found via stochastic programming to indicate strategic asset allocation that will take into consideration a number of variables and/or constraints (c.f. Rudolph et al., 2010: 21) such as:

- expected returns on selected asset classes (a vector of returns);
- a matrix of their variances and correlations;
- availability of main asset classes;
- contribution rate and wage growth path over the working career assumed for different categories of workers;
- a matrix of correlations of non-tradable, stochastic human labour with portfolio returns;
- a risk aversion parameter;
- a length of investment horizon related to planned retirement age; and
- projected costs of annuities (interest rates, longevity assumptions) or other retirement products.

The risk aversion is directly related to the age of savers and the relative role of funded pillars, i.e. whether some other sources of retirement income are present. Exogenous conditions such as local market capacity, availability of instruments and the risk aversion of policy makers should also be taken into account. This allocation should be calculated for each age group of savers so that they can be offered separate default saving options.

Under a third generic model, a pension portfolio can be split between two different components with distinct asset allocation processes. Part of pension contributions is invested in the hedge (income floor) portfolio and another part in the speculative (discretionary) portfolio (c.f. De Jong et al., 2008: 21; Zwecher, 2010).

A similar approach is currently used by the Danish ATP fund (discussed in section II.2) which extensively uses hedging techniques as a part of its risk management process. Contributions in the first portfolio are used to purchase assets that guarantee a nominal (or real) level of income, such as bonds (e.g. strips, TIPS), interest rate swaps, or deferred life annuities. Funds in the second portfolio are invested in a "conventional" way with the aim of maximising returns for an assumed level of risk. Profits from this portfolio could then be used to increase the floor level of income achieved already with the hedge portfolio. Technically, the conservative fraction of contributions could vary with the age of a worker and increase as they approach retirement age.

The calculation of reference portfolios should be followed by an examination of whether such a strategy is realistic. This should be performed by independent experts. It might be the case that both the strategy and target need to be modified. The adopted strategic asset allocation would be passive in the sense that, due to cost considerations, it would very likely hinge upon selected stock market indices (or more generally, risk factors), but active in the sense of its periodic adjustments undertaken by a relevant body.

Established reference portfolios need to be revised periodically, preferably by an independent board, based upon the financial markets outlook and pension system performance. This stage therefore requires policy makers to establish the rules related to rationales, and frequency of updates as well as the structure

of the decision body and legal procedures. There might be some role for supervisors with regard to supervision of these default options and monitoring their current performance against the benchmarks applied.

I.3. Risk sharing

Depending on the type of pension schemes, the TRI concept may or may not contain some risk-sharing mechanism. In DC collective pension schemes, investment, longevity and inflation risks can be shared amongst various cohorts of savers. The system may also offer some kind of protection to retired members of pension plans as well as those in the accumulation phase. Risk-sharing mechanisms such as these are present in occupational pension plans in the Netherlands.

The design of such device depends on the policy makers and social stakeholders involved in the dialogue; nevertheless if introduced, risk-sharing mechanism, rules and current outcomes must be subject to a consensus building process and to close monitoring.

The next two elements are supervision and communication. These are present in any pension system/scheme, but due to the nature of the TRI concept they pose some specific challenges.

I.4. Supervision

Where a specified target is a part of the undertaking made to members, supervisors should conduct constant supervision of pension fund operations to make sure that achieving the ultimate pension target is realistic. They should therefore calculate or verify ongoing investment results against assumed projections and decide on supervisory responses should significant risks of not achieving the target emerge.

If relevant, supervisors would also have to assess whether the risk burden is shared fairly enough amongst TRI system participants. This would require an analysis of the way benefits are distributed and is likely to affect future generations, i.e. measuring of the degree of redistribution amongst participants under a current risk-sharing system. Supervisors would need to judge whether any current shock to the system is of a transitory or systematic character and assess the adjustment measures proposed by pension providers. In case of negative systematic shocks these measures could involve increasing contribution rates, lowering the target (by decreasing the indexation rate of accrued rights and/or benefits), increasing exposure to investment risk, extending the investment horizon (by postponing retirement) etc. It seems sensible that in some systems supervisors could be empowered to propose such measures themselves.

I.5. Communication

The last building element of the TRI concept relates to communication which spans over all previous elements. Communication is required between stakeholders during all phases of the process and involves such key elements as:

- informing stakeholders about the nature of the TRI system and its rules. In particular, it is essential for policy makers and supervisors to make sure that TRI members are aware of these rules and of the probabilistic nature of the declared target and inevitable fluctuations of investment results;

- providing of information, and preferably explaining, by pension fund managers to pension fund members the target assumed and the assumptions made during its calculation. The projections (scenarios) must be properly communicated to members both in terms of the methodology used and outcomes obtained;

- providing by policy makers and/or independent board of experts information with regard to the nature and composition of reference portfolio(s), and its/their announced revisions;

- informing by pension fund managers and explaining to fund members and the supervisor actual investment policy and reasons for deviation from the reference portfolio(s);

- reporting by pension fund managers to savers current investment performance and explaining how it relates to assumed long-term projections. Specifically, members should be informed if the saving process is "on track" to the assumed target and if not – whether the deviation from the projected trajectory can be treated as transitory;

- communicating by pension fund managers about the options available to TRI members with regard to the saving process, and making sure they understand what decisions they can make in case of prolonged underperformance and how these decisions may impact their future pensions;

- communicating and explaining by supervisor decisions taken to relevant parties with regard to its supervisory actions.

It is important to emphasize to pension fund members the link, even if obvious, that exists between the uncertain level of targeted retirement income and the contributions needed to achieve it for a given level of risk: the higher the aspired target, the higher the contribution rate and/or the longer the saving period should be. Members should be also made aware of a similar link that exists when they want to increase the probability of achieving the desired target. At least one of the following would need to be increased: the required contribution rate, the length of saving period or the level of investment risk.

As noted by de Vaan et al. (2015: 71), even though some pension plans do report expectations of future returns, they do not convey information on the range of future pension benefits and the effect of contribution rate and asset allocation on possible outcomes[10]. De Vaan et al. (2015) provide a conceptual framework for standardised projecting and presentation of pension outcomes to pension fund members. They propose to refer pension forecasts to the long-term retirement horizon of the pension plan members and to use a benchmark for evaluating pension fund performance (expressed, for example, in real terms).

According to de Vaaan et al., asset managers should present, on annual bases and also on longer-term basis such as 5-year horizons, their realized risk-return performance with comparison to their own previous projections. This device should "discipline" the managers not to present overly optimistic projections. Forecasts presented to pension scheme members should, instead of an average single result, include a great amount of simulated pension outcomes against the money-back benchmark (i.e. the amount of contributions paid in), so that members could visualize the idea of likelihood of obtaining outcomes under each type of asset allocation chosen and the effect of risk taken.

Future pension outcomes could be provided in two alternative formats (de Vaan et al., 2015: 72):

- with reference to accumulated pension assets, to enable tying past returns to projected performance on a rolling basis, and

[10] The Chilean pension simulator performs these functions. It provides the members with a projection of expected pension, but also gives them an interval of possible outcomes by considering a pessimistic and an optimistic scenario. Also it invites members to modify key variables such as: retirement age, amount of voluntary savings, and the investment strategy to see online, in an interactive way, the effect of these changes on pension outcomes.

- with reference to monthly pension payments, to allow members to compare the actual performance with a second intuitive benchmark - projected current income expressed in real terms. The second approach also better illustrates the interest rate risk present at the moment of converting assets into an annuity.

Supervision of the TRI system would require that the monitoring of the communication process between stakeholders meets criteria of integrity, timeliness and clarity. In particular, a supervisor of TRI would have to make sure that:

- promises of pension fund providers to participants are feasible and communicated in understandable language;

- projections and ongoing results of pension funds are communicated to participants in understandable language and are in line with declared investment policy of the fund;

- assumptions for projections and promises are sound and appropriately communicated to participants;

- the judgment and proposed actions of commercial pension fund managers entailed in their communication with savers and the supervisor are in line with an assumed stochastic risk model and underlying assumptions.

II. Examples of existing TRI-like solutions

A number of private pension schemes or systems reveal certain features pertinent to the TRI concept (Table 2). As already mentioned, the Netherlands and, until very recently - the UK[11] were deliberating over the so-called defined ambition schemes (c.f. Kortleve, 2013; NAPF, 2012) that would generically correspond to the concept of targeted retirement income provision. Other examples are set out in Table 2.

Table 2. Example cases of existing pension schemes that contain elements of the TRI concept

Target	
Jurisdiction (scheme)	**Description**
Danish ATP (statutory supplementary labour-market pension scheme)	Guaranteed nominal stream of lifetime income: This stream is built gradually by regularly adding immediately annuitised contributions (hedge portfolio). The stream can be potentially increased by gains on investment portfolio.
Iceland (mandatory occupational DB/DC funds)	Replacement rate: Ambition at least 56% of average lifetime salary in the DC system but no guarantees; Guaranteed up to 76% of average lifetime salary in the DB system.
Switzerland (mandatory occupational hybrid DB pension schemes)	Replacement rate: 27% of final gross salary (occupational hybrid pension plans), non-binding (general consensus), aspired but not guaranteed.
US (occupational DC) and Canada *target benefit plans*	Targeted benefit: The value of this benefit is determined by an employer, albeit it is not guaranteed.
Investment and risk-management	
Danish ATP	Liability hedge portfolio: Used to protect promises of lifelong nominal retirement income streams.
Lithuania (mandatory pension schemes)	Reference portfolios: Target replacement rate or market parameters (volatility, risk free, market rates, etc.). Benchmarks developed by pension managing company agreed with the regulatory body.
Chile (mandatory pension system)	Reference portfolios in preparatory phase: Efficient frontier in terms of expected target replacement rate vs volatility of the outcome.
Risk sharing	
Iceland (mandatory occupational DC pension funds)	Change of accrued benefits depending on the total actuarial position (i.e. accrued and future assets and liabilities).
Netherlands (occupational DB and collective DC pension schemes)	DB plans: indexation of accrued rights and benefits contingent on funding status (sharing investment risks across generations). Collective DC plans: investment pools and buffer funds (sharing investment risk across generations and time).
Switzerland (mandatory	Modification of actual values of interest on savings and conversion ratios

[11] The UK introduced permissive primary legislation for collective DC and share risk schemes under the Pension Schemes Act 2015 which set out a very high level framework. It was envisaged that more detail would be provided by secondary legislation but this secondary legislation will not be pursued under the new government.

occupational DB hybrid pension schemes)	(boards of trustees). Changes of legal minimum interest rates (government). Changes of legal conversion rates (parliament subject to potential referendum).
Canada (New Brunswick's Shared Risk Pension Plan)	Changes of contributions, calculation rules for early retirement benefits, accrued benefits; accrual rates or accrued base benefits depending on the funding status of a plan.
Communication	
Chile (mandatory DC pension funds)	Pension simulator (http://www.spensiones.cl/apps/simuladorPensiones/): expected pension benefits.
UK NEST (National Employment Savings Trust)	Ongoing research programme of communication: simplified language and real-word examples with regard to choice of funds and the notion of risk.
Netherlands (occupational pension schemes, DB, DC and DA)	A working group on communicating future pension benefits.

Source: IOPS.

II.1. Retirement target

The purpose of the Danish ATP (*Arbejdmarkedets Tillaegs Pension*, statutory supplementary labour-market pension scheme)[12] is to secure the highest possible real value of pension. ATP's guaranteed pension target is a promise of a guaranteed lifelong nominal income stream at retirement. There is a clear link between the contributions that are paid to the scheme and the pension rights accrued by the individual member (ATP, 2014: 8). Future pension is gradually built up as a sum of promises acquired year by year during savers' working life.

In Iceland, the law (chapter 1, article 4 of the Pension Act 129/1997) requires occupational DC pension schemes to target a minimum replacement rate of 56% under the assumption of 40 years' contributions, giving an average accrual rate of 1.4% for each year of service[13]. Even though in Iceland there is a legal target (56%) for DC funds specified by law, the target is not monitored by the supervisor (or any other agency).

A recent study done by the Icelandic pension industry and financial supervisor (FSA, 2014b) indicates that members need to contribute for up to 43 years to reach the 56%, mainly due to age-based accrual calculation. The DB benefits for civil servants are fully guaranteed by the sponsor (FSA, 2014a: 2), offering a higher accrual rate (1.9%) as stipulated in the law. Which with 40 years of contributions, this represents a theoretical maximum of 76% replacement rate. The earnings base in this calculation is average lifetime salary for each year of membership where past earnings are valorised in line with inflation plus 3.5% interest rate. The retirement age is 67 years (with possible modifications to start receiving early/delayed pension at age 65-70). There is no ceiling to pensionable earnings (OECD, 2013: 269). In the context of DC pension schemes, the target is aspirational, i.e. is not guaranteed.

In Switzerland the target for occupational pension funds (hybrid type, with annuitisation carried out within the funds) is set up in conjunction with the state first pillar although the joined perspective is not explicitly expressed in legislation. The Swiss Constitution stipulates that the second pillar combined with the first pillar should enable the insured persons to maintain their previous lifestyle in an "appropriate"

[12] ATP can be described as a fully funded, insurance based, top-up to the basic pension. Even though considered as part of first pillar, ATP applies methods that are in line with practice in funded pillars.

[13] The accrual rates in Icelandic DC system are age-dependent (highest for young workers, lowest for elderly workers) to account for different investment horizons.

manner. The general consensus assumes that the final replacement rate from *both* pillars should be at least 60% of the gross final salary (Box 3). This is a targeted, not guaranteed, outcome and is set up under the condition of obtaining a full pension (which requires 44 years of contribution payments in the first pillar and 40 years in the second pillar until the age of 65). As the maximum pension under the first pillar is 33% for a median income earner, the rest, i.e. 27% is supposed to come from the occupational pension(s). Some Swiss funds also show projected pensions in absolute terms with of 0% interest credits[14] assumed for the future, which is a conservative forecast of the real value of a pension.

Box 3. Calculation of benefits in Switzerland occupational pension schemes

The values of interest credits on retirement savings are defined under the so-called "golden rule" originating in 1985 and are equal to pensionable salary contributions. This is a rather pessimistic assumption, as usually the interest credits are higher, at least for employees close to the retirement. The law stipulates the following fixed values of contributions: 7% for people aged 25-34, 10% for aged 35-44, 15% for 45-54 years-old and 18% for 55-65s. The employer pays at least 50% of all contributions (valid for all plans, regardless of whether they pay only the legal minimum or more). Typically, an employer pays 60-70% of the contribution.

The accrued savings are summed up without the interest, i.e. 10 years x 7% + 10 years x 10% + 10 years x 15% + 10 years x 18% makes up 500%. As the pensionable salary for a person with an income close to the median is 2/3 of salary, the expected savings at retirement is 500 % x 2/3 = 333%. There is an interest guarantee, which is slightly above a 10-year yield of government bonds. However as there are ways to lower this guarantee and obtain additional contributions from employers and employees if the plan is in deficit, the cost of this guarantee is not very high.

In 1985, the conversion factor was 7.2%, implying that the life annuity should be equal to 7.2% of 333% = 24% of the last gross salary. This value was somewhat lower than the target itself, but it was calculated under conservative assumptions. As a result, if returns turn out to be too conservative, some surpluses may be achieved. The law stipulates that the minimum conversion rate is applicable for the amount that would have been accrued if only the legal minimum would have been in place. Above this level, setting the actual minimum rate is decided by the board of trustees.

Over time, the annuity factor had to be reduced and it will further be lowered due to increases in life expectancy and the prevailing low interest rate environment. Nevertheless, the above "golden rule" proved to be overly conservative – savings credits have been increased and are likely to increase further.

Source: IOPS based upon the information from the Swiss Occupational Pension Supervisory Commission OPSC.

A *target benefit plan* is one of the possible organisational forms of US occupational DC ("money purchase") plans. Employer contributions are actuarially calculated and should enable achieving a targeted benefit for an employee under various reasonable assumptions. A target benefit plan has a benefit formula, as is the case with DB plans. However, the value of retirement benefit ultimately delivered to an employee is not guaranteed but depends on the investment performance of the employee's individual account, as in the case of DC plans. Therefore, the employee still bears the investment risk (McGill et al., 2005: 283).

According to McGill et al. (2005: 283-284), target benefit plans are a relatively rare type of plan design in the US. Even if an employer desires to provide a specific retirement income benefit for an employee, they are more likely to choose DB form; especially in the case of larger employers. The target benefit plan requires larger contributions for older workers. It can also be inferred that target benefits plans are more complicated in terms of communication with the plan members.

In the Canadian context, a target benefit plan called *Shared Risk Pension Plan* (SRR) was introduced in New Brunswick in 2012. Four New Brunswick DB plans (three public and one private sector plan)

[14] I.e. the interest rate at which contributions paid by the employer and the employee are accumulated in a pension account.

decided to adopt the SRR approach (Munnell and Sass, 2013: 3). Employer and employee contributions can vary between 8% and 10% of salary depending on the funded status of the plan. The accrued benefits may be subject to a reduction if the funding level falls below a given threshold[15] (c.f. section II.3). The target is expressed as a replacement rate as is done in an "ordinary" DB pension plan. However, benefits are calculated on the basis of career average salary, usually lower than final salary, with possible indexation of employee salaries to wage growth or inflation. These indexing increments depend on the financial health of the pension scheme (Munnell and Sass, 2013: 3).

II.2. Investment and risk management

The contributions to ATP are divided into two parts: 80% of the contributions received relate to already guaranteed pension rights (building up the so-called "liability hedge portfolio" which is designed to back its pension guarantees) and the remaining 20% is transferred to the bonus potential (ATP's undistributed reserves building up the investment portfolio) that is expected to generate investment gains (ATP, 2014: 3, 14). This is similar to the income "floor" approach mentioned above in section I.2.

With regard to its hedge portfolio, ATP has offered a return guarantee on each year's contribution for as long as 80 years. However, obtaining such a guarantee has become expensive as it requires using the longest end of the interest rate curve where liquidity has been falling. In effect, the cost of hedging with the use of interest rate derivatives for longer horizons has become expensive. Therefore, from 2015, each year's contribution is guaranteed a certain return for 15 years, based on prevailing interest rates. At the end of this period, the next year's contribution will be guaranteed a return for another 15 years set at the latest market interest rate. The process will be repeated until retirement. The new guarantees will still be hedged fully, albeit the interest rate sensitivity of these guarantees will become substantially lower (by approximately 25%). Shortening the return guarantee period will lower the costs of hedging (due to higher liquidity and a wider range of financial instruments available). The change applies only to a new contribution payments (affecting members born in 1965 or later), whereas all existing guarantees remain unchanged[16].

Until very recently, the ATP investment portfolio was allocated in five risk classes with very different risk profiles: interest rates, credit, equities, inflation, and commodities (ATP, 2014: 29)[17]. Under the ATP model, pension contributions are annuitised from the start, which means technically that savers purchase specific deferred annuities each year when contributing. The stream of future lifelong income consists in principle of a large number of year specific deferred annuities and is guaranteed with the use of financial instruments (interest rate swaps). The size of the guarantee depends on actuarial assumptions about mortality and the interest rate curve[18]. The funds are invested and if there is any surplus in excess of guaranteed pensions it is used to finance further increase of guarantees.

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[15] http://www.newswire.ca/fr/story/1270305/are-target-benefit-plans-the-solution-to-defined-benefit-and-defined-contribution-plan-problems.

[16] http://www.ipe.com/atp-shortens-return-guarantees-to-15-years-to-win-investment-flexibility/10002723.article.

[17] In the end of 2015 ATP announced that its investment portfolio would be invested into four risk factors categories: "interest rate factor", "inflation factor", "equity factor" and "other factors". (http://www.ipe.com/countries/nordic-region/atp-unveils-final-shape-of-return-seeking-portfolio/10010827.article).

[18] Until 2002, each DKK 396 of contributions earned DKK 100 of pension benefits paid from 65 regardless of the age at which they were made. This implied an average (across all accruing cohorts) fixed interest rate of around 4.5%. From 2002, a nominal interest rate of 1.5% has been assumed, whereas from 2008 the new model is based on (prevailing) swap interest rates (OECD, 2013: 239).

In the Danish model once pension contributions have been made, the security of promises is not affected by the future credit quality of the employer. It is so because the investment process is done within the ATP fund and not by the employer (Rohde, 2011: 222). ATP uses a cohort mortality model that explicitly balances longevity risk amongst fund members. The longevity trend is estimated with the use of international data to provide more robust estimates. Annuity conversion rates are calculated, updated, and fixed for all contributions made that year taking into account the longevity trends (Rohde, 2011; 225).

As has already been mentioned, reference portfolios can serve as a tool to guide the investment strategy of a pension fund to meet its objectives (for TRI it would be to deliver targeted stream of income at retirement) and to make sure the investments are done in line with the fund's investment horizon. Reference portfolios can also be used in monitoring how a pension fund's current investment strategy relates to the assumed long-term trajectory towards the target. This section provides two examples of how reference portfolios employed for retirement target could be structured in practice.

Life cycle funds are widely used in pension systems in the world. They are based on reference portfolios (based mainly on market indices) and aim to reduce the risk of sudden and substantial losses incurred before reaching the retirement due to market risk. By gradual moving toward a fixed income portfolio before the retirement, life cycle funds also decrease the interest rate risk at the moment of conversion of retirement savings into a life annuity. However, these funds still do not factor in inflation (unless the latter is limited by moving into index-linked bonds in the final years of accumulation) and longevity risks. Therefore they do not fit for the TRI purposes.

Moreover, many experts (e.g. Hickman et al., 2001, Shiller 2005, Basu, Byrne and Drew, 2011) question the rationale of an increasingly conservative glide path assumed by the life cycle approach based only on the number of years to retirement. For example, Estrada (2013) analyses large sample of international financial data and finds out that in comparison to life cycle strategies, contrarian strategies (i.e. ones that increase risky asset allocation over time) or fixed strategies (with allocation stable during most of time) provide higher upside potential and more limited downside potential, albeit with higher uncertainty (but largely limited to how much higher their terminal wealth is expected to be).

Lithuania is an example of a mandatory DC pension market where the regulatory authority introduced a benchmark requirement related to the accumulation phase. The benchmark is compulsory for second-pillar pension funds managers. However, each fund managing company is free to choose a methodology of such benchmarking that is approved by the regulatory body. Their reference portfolios (benchmarks) can be based on target replacement rates or market parameters such as volatility, risk free rate, market rates and assumed correlations (Stewart, 2014: 18). In practice, none of the managing companies uses the benchmark expressed in terms of target replacement rates or target income even though the regulation permits doing so.

There is a requirement in the Lithuanian pension system that the correlation between the actual returns and benchmark returns should not fall below 0.7 for any six month period. However, there are no penalties for excessive deviation from the benchmark. Generally, there are no restrictions with regard to changing the investment benchmark by pension fund administrators apart from some exceptions when the management company must revise its benchmarks if, for example, essential changes in investment strategy were made or if correlation coefficient between the benchmark and actual portfolio performance is permanently or systematically lower than the required level of 0.7. Changes in benchmarks must be approved by the supervisor and then published on the website of a fund's administrator.[19]

[19] Information courtesy of the Bank of Lithuania.

The current problem with the Lithuanian reference portfolios is that even though pension fund managing companies are required to inform the supervisor about their benchmark portfolio, "the regulation does not impose explicit requirements for following such a benchmark and there are no penalties for diverting from it" (Stewart, 2014: 18). As a result, actual investment strategies may deviate from stated investment policy, which implies unknown levels of risk are present in pension fund portfolios. If each company managing pensions can follow their own strategy, serious obstacles to comparability occur.

In Chile, although work on the determination of exogenous benchmarks for pension funds is at the research stage, these are already implemented for the investment of the unemployment insurance funds[20]. A similar methodology can be used to create a reference portfolio in the pension system.

The unemployment insurance (UI) system in Chile aims to provide monetary benefits to affiliated eligible workers who are unemployed. The system is financed by a combination of employer and employee contributions which are saved in two different funds: the CIC, fund operating individual unemployment accounts, and the FSC (Solidarity Unemployment Fund), which is a collective fund. The state also contributes some resources to the FSC fund. Both funds are managed by a private administrator, determined in a public tender. The tender is won by an entity that offers the lowest administration fee for management of the funds over a period of 10 years.

Since 2009 there are different exogenous reference portfolios for these two funds, recognizing the way the unemployment benefits are defined and the eligibility requirements for affiliates to qualify for benefits in each fund. The CIC is a short-term fund, whereas the FCS is a medium-term fund but with the need to be available at critical times (when benefits claims accumulate, for instance during a financial crisis; recession; periods of increased unemployment, etc.) The goal of these portfolios is to evaluate the performance of the investment manager considering the horizon and objective of such investments. The characteristics and founding methodology of these reference portfolios are presented in Box 4.

Box 4. Reference portfolios in the Chilean mandatory unemployment system

To determine reference portfolios for CIC and FCS funds, efficient portfolios were selected according to Markowitz's portfolio theory (1952). The goal was to choose the optimal proportion of assets in a portfolio, minimizing risk subject to some level of return, within the limits established by the Investment Regime.

Black and Litterman (1992) methodology was applied to determine the vector of expected returns which are the equilibrium returns based on the CAPM model and the market portfolio. Monte Carlo simulations were run to obtain N-efficient frontiers with each Kth portfolio. The efficient frontiers were averaged to obtain a resampled efficient frontier. Two alternatives for the risk-free asset were used: 5-year inflation indexed government bonds for the FCS and 1-year inflation indexed deposits for the CIC.

Benchmarks portfolios were selected as a set of the most efficient portfolios given a tolerable level of risk, based on the estimated efficient frontier, the investment regime limits and expert judgment for their final definition (considering previous studies and national and international evidence on benchmark portfolios).

Also, the Investment Regime stipulates that benchmarks portfolios for the UI Funds must: reflect investment criteria that are aligned with the protective role of the unemployment insurance, be replicable, and ensure investment stability and diversification. The information upon which the reference portfolios are determined need to be freely accessible, not altered or manipulated. The Investment Regime also states that the pension regulator may review the composition of reference investment portfolios every 36 months, and submit it to the CTI (Investment Technical Committee) if the above considerations change significantly.

Source: IOPS based on the information from the Superintendence of Pensions, Chile.

[20] This part of the section benefits from the input of the Chilean Superintendence of Pensions.

The structure of reference portfolios is presented in Table 3. The system establishes an incentive scheme with performance rewards and penalties that are triggered once managers' returns depart from a central band. The centre of the band is the semi-annual real return of the reference portfolio and the upper and lower limits are determined by subtracting and adding to the centre of the band a fixed range width (0.35 percentage point for the CIC fund and 1 percentage point for the FCS fund). The band width for each fund was defined as the computation of a tracking error. Each month when a fund's return goes above (below) the upper (lower) limit, the administration fee charged by the administrator is increased (decreased) by 10%. So far, this system of incentives has never been triggered. The funds' performance has averaged slightly higher than the reference portfolios.

For the UI Funds, reference portfolios have helped to guide investments to meet the fund's objectives and provided an objective way to evaluate the performance of the manager. The defining criteria for these benchmarks were crucial for the implementation success.

Table 3. Composition of reference portfolios for unemployment insurance funds in Chile

Asset class	Individual Unemployment Accounts (CIC)	Solidarity Unemployment Fund (FCS)
Domestic financial intermediation instruments	45%	10%
Domestic fixed income instruments	45%	75%
Foreign debt instruments	10%	5%
Domestic variable income instruments	---	5%
Foreign variable income instruments	---	5%

Source: The Superintendence of Pensions, Chile.

The Chilean supervisor is currently exploring possibilities to determine an exogenous reference portfolio that would guide and evaluate whether pension fund managers (AFPs) comply with the objectives and investment horizon of the pension system. The distinction from the unemployment scheme is that the retirement target here would not be the profitability itself but the probability that pension fund members will obtain a given replacement rate considering the lifetime of the contributor and the main types of risks (such as investment, human capital, annuitisation and longevity risks). Stochastic simulations can give a set of such possible pension outcomes in terms of replacement rate against the risk expressed as standard deviation of the replacement rate.

Currently the only existing benchmark for pension funds' investment is a relative benchmark. The members are offered a relative return guarantee which does not contain the absolute risk. As the regulation does not provide for a long-term benchmark in terms of absolute risk for pension fund managers, they tend to take high levels of risks, and in some cases, the greatest possible risk allowed by investment limits. Even though these limits provide a certain guide, there is no benchmark that would link the portfolio investment decisions with a long-term goal in terms of the members' main outcome of the system which is to get a "reasonably" high replacement rate with "limited" risk.

The Chilean regulator has developed a pension risk model based on stochastic simulations. The methodology delivers a pension risk measurement, with the potential of fulfilling the objectives of: (1) Information: define useful and easy ways to inform relevant risks to members; (2) Policy design: use the

pension risk methodology to determine optimal investment strategies and absolute benchmarks (to potentially replace the actual minimum return guarantee); and (3) Supervision: define risk metrics to monitor the risk of pension funds managers and determine supervision activities based on those risk measures.

Progressing with these three objectives is a long-term project and very difficult task. The Chilean pension regulator is of the opinion that the best way to address these issues is to approach first the information objective, then the policy design objective and lastly the supervision objective. The first objective has been initially fulfilled with the publication of a pension simulator (Antolin and Fuentes, 2012).

The Chilean Pension Regulator has identified the following challenges and considerations to address the policy design objective. Any proper specification of benchmarks for the pension system should take into account:

- that the composition of the resulting benchmark depends directly on how returns are modelled. Past returns are not necessarily a good predictor of future returns and longer-term forecasts increase uncertainty. The predictive power of the model and avoiding the misspecification of returns are relevant aspects to address in the methodology;

- other key elements of the model: predicted wage profiles and the number and timing of contributions. Labour market conditions have a significant impact on pension savings outcomes and generate several types of individuals with different projected replacement rates. Some individuals would most probably not reach the replacement rate target. This heterogeneity makes it difficult to define a single benchmark;

- that the benchmark needs to be periodically revised and updated accordingly to newly released data and performance;

- that multi-fund schemes (life cycle portfolios) allow allocating pension fund members to a particular investment strategy according to the years left for retirement and therefore that each multi-fund should have its own benchmark according to the relevant horizon of the target group. This consideration makes the task of defining benchmarks more difficult;

- that when defining the investment horizon, it is necessary to decide if one wants to take into account not only the accumulation phase but also the decumulation phase. However, it is impossible to know in advance if a particular individual is going to choose a programmed withdrawal or a life annuity.

II.3. Risk sharing

In Icelandic occupational DC pension funds, the accrued benefits can be changed (increased or decreased) depending on the fund's actuarial situation. In DB funds such changes are not possible (FSA, 2014a: 36):

"In case of overfunding, the fund has to create a reserve, but above a certain level of actuarial balance, it has to redistribute the money by increasing accrued benefits and pensions in payment. In case of underfunding, benefit cuts may be needed (the risk is shared across members and pensioners). Pension funds are allowed to operate with a 10% deficit or overfunding for one year, or with a 5% for five consecutive years. The actuarial position is calculated on the assumption of a real interest rate of 3.5%. Both the DC and DB funds offer only life-long annuities and for that reason no annuity providers exist in the pension market. Funds may be underfunded, but if they have not yet agreed on a benefit cut, the accrued benefits reflect the target of 56% or the fund-specific target which may be higher than 56%".

Any possible reductions in pension benefits affect (in the same proportion) both retirees and active members. After the financial crisis of 2008 many Icelandic pension funds were forced to decrease pension accrued rights and deficits by up to 20% for the following 2-3 years.

The Dutch collective DB pension schemes members build up their future pension rights equivalent to a fixed percentage of the salary. The contribution rate is the same, irrespective of individual characteristics (such as age, gender, health or income). Unisex life expectancy tables assume some sort of redistribution from men to women (who tend to live longer). As of 2012 most DB pension plans offer career average benefits with conditional indexation (Turner, 2014: 8-9).

The rules of indexation vary across pension schemes. In a career average Dutch DB plan, the indexation of accrued benefits and pensions in force aims to keep pace with inflation. Nevertheless, such annual indexation is contingent on the plan funding status. In effect, conditional indexation shifts some of the investment risk as well of the longevity and interest rate risks from employer to participants. Under new regulation introduced as of January 2015, the following rules apply: If the funding ratio is lower than 110%, indexation does not take place. If the funding ratio is equal or higher than 110%, partial or full indexation is given based on the growth in prices or wages, depending on the plan. The level of indexation is such that it can be granted not only in a particular year, but also over the long term. Pension funds may take into account the expected return on equities in determining this sustainable indexation rate.

In Dutch collective DC pension schemes benefits depend on the employee's average career salary and number of years in the plan. Various types of risk are pooled across participants and spread over time, rather than borne individually (Turner, 2014: 9). Both employees and employer pay a percentage of wages that is fixed for at least five years. In collective DC schemes in the Netherlands, longevity risk can be shared between participants and employers, whereas investment risk is borne by participants. However the impact of investment risk is reduced due to risk sharing across plan participants (via a common pool of investment) and generations (via a financial buffer). Risk-sharing rules can be determined in advance or can be discretionary (decided by a governing board). Collective DC pension plans offer some economies of scale and do not involve participants in investment decisions. Neither do they extend them to interest rate risk as they receive annuitised benefits that are already determined by a benefit formula (Turner 2014: 11-12).

The members and retirees of Swiss occupational pension schemes (see section II.1) share investment risk because the actual values of interest on savings can be changed depending on the financial situation of the fund. The decision about possible modifications of interest on savings is taken by boards of trustees factoring in actuarial calculations. The Swiss funds are governed by not-for-profit boards with representatives of employer and employees. The board is independent from the actual providers (banks, insurance companies, etc.).

The system is quite flexible and is evaluated every 10 years with parameters being changed accordingly. The legal conversion rate can be changed by parliament subject to potential referendum if sufficient number of votes have been collected. However, reducing the conversion rate has become politically difficult. In 2010, a reduction was rejected in a referendum by a high margin (with more than 70% of the population voting against). The conversion rate applies only to the minimum savings at retirement (so-called "mandatory savings"). With regard to savings in excess of the minimum level, a lower rate may be (and is) applied, which enables most pension funds to use other, more accurate parameters. However, the system is affected by increasing life expectancy and falling interest rates, with both factors pressing for lower conversion rates. Some pension funds use their own system of target retirement income.

The plan of New Brunswick in Canada applies an interesting risk-sharing model that clearly spells out how the sponsor would respond in the case of worsening or improving financial situation of a plan. The new design splits plan benefits into highly secure "base" benefits and moderately secure "ancillary" benefits (Munnell and Sass, 2013: 2). Depending on the quality of the funded ratio, changes can occur in several key parameters of the plan. A deteriorating funded ratio may, for example, result in: an increase of contributions (that can be split between employer and employee): a change of the rule for calculating early benefits to more strict (actuarial) ones; a reduction of "base benefit" accrual rate or a reduction of 'base benefits'. Improvements of the funded ratio can reverse such previous deficit-recovery measures and, if sufficient, can increase the individual benefits (c.f. Munnell and Sass, 2013: 3).

The New Brunswick regulatory framework uses stress testing to assess the ability of such pension plan to meet promised benefits. The simulations are run to check whether a particular pension plan is able to pay full "base" benefits over the 20-year horizon in 97.5% of all scenarios and to pay, on average, at least 75% of "ancillary" benefits (i.e. to provide at least 75% CPI indexation). Pension plans unable to meet this forward-looking test have to modify their investment, funding, or benefit rules until they are able to pass the stress test. The funded ratio for Shared Risk plans does not include in its denominator "ancillary" (conditional) pension liabilities such as indexing (Munnell and Sass, 2013: 4).

II.4. Communication

The Chilean supervisory authority provides pension members with a pension projection via an on-line pension simulator (Antolin and Fuentes, 2012). The pension simulator was launched in September 2012 and is available at the website of the supervisor[21]. Since 2014, the simulator offers the possibility to use pre-filled personal data of a pension member to improve the accuracy of the estimation, given that users rarely remember the actual level of accumulated savings and other relevant variables of the system. This interactive tool is based on a pension risk methodology developed by the regulator. The stochastic model takes into consideration the main risks faced by members: investment risk, labour or human capital risk, and annuitisation risk. The goal is to make members aware of how to mitigate risks associated with their expected pensions and what actions they can take to increase their expected pension outcomes.

The pension simulator does not give outcomes expressed as replacement rate but as a value of pension in Chilean pesos. It also provides information about the probability of reaching a user's desired level of pension.

According to the National Employment Savings Trust (NEST) in the UK, members who are able to understand investment and its likely outcome will be able to make informed decisions. To achieve this goal, NEST is running an ongoing research programme of communication with its members (cf. NEST, 2010). NEST developed some new ways to talk about investment using plain language and real-world

[21] http://www.spensiones.cl/apps/simuladorPensiones/.

examples: “For example, we’ve named our funds to help our members understand their options. We don’t have a ‘higher growth fund’, we have the NEST Higher Risk Fund. This makes savers aware that this fund faces higher volatility than our NEST Retirement Date Funds”[22].

The government of the Netherlands has mandated a working group to create a model for communicating retirement income in terms of today’s money and its value under bad/good economic scenarios. The model is expected to provide information about benefits at the individual level aggregated for both pension pillars and be available on line[23]. Other requirements include ease of implementation and its uniform character (across institutions and different pension contracts).

The input data will cover economic assumptions (inflation, interest rates, equity returns), characteristics of the pension contract (contribution policy, investment policy, benefit policy) and characteristics of the individual (retirement age and salary). The economic scenarios are to be developed by an independent committee. The output data for DA and DB pension plans will present benefits in the purchasing power per scenario per year and account for possible (upward or downward) indexation of benefits. With regard to DC pension plans, the model will provide information about the development of pension wealth per scenario per year with the assumption that this wealth will be converted into an annuity (immediate or deferred) at or before the retirement age at some applicable conversion rate prevailing in each scenario in each year.

In Iceland individual private and personal pension funds are required by regulation to disclose to active members their accrued rights and future projections of benefits at retirement. Projections are only on the baseline scenario with 3.5% real rate of return. The Icelandic Pension Fund Association has created an online web portal[24], where both active and deferred members can find out their total accrual rights and benefit projections, from all the pension funds they have been contributing to during their careers.

In some jurisdictions, members are also provided with projections of future replacement rates based upon stochastic simulations. The replacement rate has the advantage of being a measure related to income, and in this sense, it implicitly links the result given by the DC pension system to the level of contributions made. This replacement rate could be calculated and communicated alongside a minimum contribution density (that is required to achieve this result), so as to emphasize the role of the affiliate in obtaining his or her final pension amount. Nevertheless, such forecasts are subject to substantial uncertainty and are not guaranteed by fund managers. Most participants find it difficult to understand the concept of results expressed in probabilistic terms (cf. Box 1).

It is worth mentioning that in the Slovak quasi-mandatory[25] personal DC fund system some efforts were taken to introduce new and more objective ways of providing pension savers with projections about their possible future returns and pension pot, as well as the impact of charges. However, this initiative was abandoned due to the great complexity of the subject matter and consequent difficulties with achieving conflicting goals. On one hand, the aim was to provide pension savers with reliable information about desired amount of savings and required length of accumulation phase. On the other, it was important to ensure that the savers understand the fact that investment returns and projected future pension pots are not guaranteed.

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[22] http://www.nestpensions.org.uk/schemeweb/NestWeb/includes/public/docs/Developing-and-delivering-NESTs-Investment-Approach,PDF.pdf.

[23] www.mijnpensioenoverzicht.nl.

[24] http://lifeyrisgattin.is/ (in Icelandic).

III. Supervisory challenges within the TRI concept

The TRI concept goes well beyond the remit of pension supervisory bodies. As with any pension systems, the scope of supervisory tasks and requirements are defined by the decisions taken by designers of the system. The most important policy-making and regulatory processes that must be determined are as follows:

- setting up the target for the assumed level of risk, i.e. deciding on the probability of achieving the target. Attendant questions here are what type of target and what level of risk?; how to combine pension system's roles of poverty alleviation with consumption smoothing?;

- supervising the simulation process to minimise the model risk;

- regulating investments by establishing restrictions and, if relevant, reference portfolio(s). Attendant questions here are whether such restrictions and portfolios should be age-specific or group-specific; deciding who will create and revise them; appointing the independent committee responsible for creating and updating reference portfolios;

- regulating the governance of pension funds that pursue assumed retirement target and building fiduciary responsibilities in such a way that herding of fund managers or, overly conservative/aggressive investment behaviours will be avoided;

- if relevant, regulating solvency rules;

- setting up the acceptable deviation level from projected results and regulating supervisory response policy to such deviations;

- deciding whether to introduce risk-sharing and if so, deciding on

    - What risks should be involved – investment, longevity, interest rate, inflation risks;

    - Amongst whom risks should be shared: active members only, members and beneficiaries, sponsors and members, taxpayers[26]);

    - Appropriate risk-sharing mechanisms: contribution increase, retirement age postponement, help from employer, smoothing investment results between members/retirees, varying accrual rates amongst the members in collective DC schemes, possible changes to the indexation of current benefits including even benefits reduction;

- establishing communication rules for providing aggregate, understandable, uniform (comparable) information about future expected retirement income via the Internet;

- deciding on other policies such as taxation (of contributions, investment gains, benefits) and the form of preferred retirement products;

- establishing methods to avoid the reputational risk of creating some normative or unfounded expectations amongst beneficiaries with regard to the desired target.

[26] For example, longevity or inflation risk faced by retirees can be shared with current taxpayers via longevity or inflation-index bonds issued by the State.

From the supervisory perspective, the most important areas involve supervision of pension funds' governance, investment and risk management activity, and supervision of communication between TRI system stakeholders. In the case of DB-hybrid schemes supervisors need to monitor their solvency.

The higher complexity of the TRI framework suggests a greater role for a pension supervisor in monitoring current investment performance against any assumed trajectory. Under such a framework a key objective of a supervisor will be to ensure that expectations are clearly explained to beneficiaries and that the resultant reasonable expectations of the beneficiaries are fulfilled (Kortleve et al., 2011, and Broeders et al., 2012). Supervisors and providers must help pension fund members understand the system and must ensure that information is clearly and properly communicated. In this respect, contribution, investment and benefit policy in line with the system must be communicated to beneficiaries. Perhaps insights from behavioural economics could be of great importance in this process. If risk-sharing mechanisms are present, supervisory bodies need to address this area too.

Supervisory challenges can be therefore summarised as the following key responsibilities:

- How to supervise the governance of asset managers with regard to investments and risk management, e.g. tactical asset allocation decisions to depart from the structure of reference portfolio(s) with the intention of improving interim investment results but prone to on excessive risk-taking;

- How to monitor the solvency of DB-hybrid schemes such as, for example, target-benefit plans;

- How to measure risks being transferred to various stakeholders and how to assess whether these risks are shared fairly;

- How to oversee communication between pension funds and their members about:

    - the target being a concept of expected but not guaranteed (probabilistic) benefits expressed in nominal or real terms;

    - long-term projections of investment outcomes under various scenarios;

    - current investment results and reasons for deviations from the target/projections;

    - meaningful options available to the members to improve the likelihood of realising pursued retirement income (increase of contribution rate, increase of retirement age, increase of investment risk and its implications).

Specifically, designers of the system (and/or a regulator) need to establish a proper set of incentives for asset managers and rules for supervisors with regard to monitoring the current performance of pension funds' actual portfolios versus the reference portfolios. Supervisors should therefore be equipped with a set of rules for measuring and comparing the actual results with projected trajectories, assessment horizon and its frequency, as well as the definition of range of acceptable deviations (tracking error) from projected trajectories, the acceptable duration of such deviations, and possible courses of actions to be taken in the light of strong or prolonged underperformance[27]. Supervisors need to provide the necessary incentives for managers to follow the long-term exogenous benchmark close enough that managers do not take excessive risks in the short term.

[27] These rules should be communicated ex-ante to asset managers.

Supervisory bodies should possess the power to centralise the system of reference portfolio(s) by establishing guidance on and standardisation of reference portfolios to avoid problems noticed in the Lithuanian pension system (c.f. Stewart, 2014: 18) mentioned in section II.2. In this vein, supervisors should have the power to verify if the actual investment policy followed by pension managers is consistent with their declared investment policy as communicated to members.

Supervisors need to have an ALM model good enough to decide if the current results are in line with projections and whether the cost of economic and demographic shocks that cause the deviation of interim results from the long-term trajectory be shared over generations or require structural adjustments as discussed in the previous section. This places great responsibility on regulators and supervisors to make sure declared targets are achievable. Supervisors might also need to have the capacity to analyse funds' internal models, if relevant.

It seems that the most important element is the communication that presents "the rules of the game" and takes into account the dynamics of interim losses, i.e. accurately explains to pension members the nature of long-term investment and shows that short-term losses are not only possible but practically inevitable. Such communication should build trust amongst stakeholders. Members should be given some comfort with regard to the long-term ultimate result by being provided with projections illustrating the most likely outcomes as well as the minimum outcomes to be achieved under the worst scenarios.

IV. Conclusions

Currently DC pension systems are facing several challenges. First of all, DC scheme participants are confronted with substantial and demotivating uncertainty about the ultimate value of their future retirement benefits. They do not know how much income they will receive on retirement. Many DC systems do not integrate accumulation and decumulation phases, consequently exposing future retirees to interest rate risk when converting accumulated savings into a lifetime stream of retirement income or investment risk when withdrawing benefits over a long period. Nor have asset managers been motivated sufficiently to act on a long-term investment horizon. Savers are exposed to various retirement risks and are required to take complex financial decisions.

At the same time, guarantees offered by sponsors of DB pension arrangements are subject to negative pressure due to increasing longevity, ageing of the population and regulatory costs. This results in the decrease of DB-like arrangements.

The paper discussed the conceptual elements of a target retirement income (TRI) framework that may alleviate some of the problems noted above. The TRI model can operate at the individual scheme level or national level. Although the actual design of such a system would differ across jurisdictions, its main building blocks can be identified as the target, investment, supervision, risk sharing and communication. The TRI model may use reference portfolios. However, one needs to be aware that these may lead to emphasis on relative performance rather the retirement target itself.

There are already certain practical examples of pension schemes that incorporate at least some elements of the TRI concept. They provide interesting case studies offering possible strategic and operational solutions that can be applied by policy makers elsewhere.

Denmark's ATP fund applies the target expressed as guaranteed nominal stream of lifetime income at retirement to be gradually built during the accumulation phase. Only Iceland and Switzerland apply retirement income targets at the national level. These targets are expressed as replacement rates. In trust-based systems, it is the trustees' responsibility to determine the actual level of accepted risk. Occupational pension schemes in Iceland and Switzerland are closer to the TRI framework because they combine both accumulation and decumulation phases by incorporating annuitisation within pension funds. As a result, their targets can be expressed in terms of the targeted replacement rate a saver will achieve at retirement and their investment is driven by liabilities. These replacement rates can always be "translated" for pension fund members in terms of their expected income on retirement. Experience shows that reference portfolios are applied at the level of individual funds (schemes) and do not take into account the target retirement income. It seems that at the moment there are no examples of nationwide reference portfolio(s), although Chile is currently investigating the possibility of constructing reference portfolio(s) for TRI purposes. Risk-sharing mechanism can be found in Dutch, Icelandic, and Swiss pension schemes. They are also present in the US and Canada target benefit plans that combine elements of DB and DC schemes.

The main domains of TRI-related supervision belong to investment and governance activities, risk sharing and communication. Setting up retirement targets and, if necessary, reference portfolios is beyond the remit of (most) supervisory authorities. However, supervisors need to be able to verify the feasibility of economic and actuarial assumptions that underlie these concepts. They should assess whether such macroeconomic and actuarial assumptions are uniform to avoid providers competing on these.

Supervisors would have to assess projections presented to the members as well evaluate interim results against assumed long-term trajectories and react if they find pension funds' current investment policies impose excessive risk-taking or do not seem reasonably on course to achieve their target. This requires technical ability (models, staff, and resources) and legal instruments (e.g. describing their

supervisory actions in the case of underperformance). Supervisors or market conduct authorities need to follow closely pension funds' communication with members in terms of promises; disclosure how these promises are being realised; and what options are available to members in the case of serious underperformance.

Members should be aware that the assumed target is conditional and not guaranteed. As soon as there are substantial deviations from the original assumptions, members need to be informed about available options so that they can take concrete actions to either bring the projections back to the assumed trajectory or to lower their expectations. All these imply active engagement of supervisory bodies with regard to their own communication policy and supervision of communication led by other stakeholders.

Pension supervisors should make sure that under the TRI framework:

- the retirement target is defined and presented to the members as a lifetime income or range of income levels expected (but not guaranteed) in return for assuming a pre-defined level of risk and key input variables (contribution rate, length of saving period, longevity, etc.);

- both expected risk and return are measured and presented in a meaningful way;

- projections as well as the probability of meeting the stated retirement goal are reasonable;

- pension fund members understand the fundamental link between the level of target and contribution rates and are offered a range of choices when the ongoing investment results suggest the target is unlikely to be reached;

- members understand the consequences of the above choices.

From the policy perspective, it means that policy makers should develop pension regulation that will be based on sound economic and actuarial principles and will give supervisors detailed rules and power to oversee the investment and communication of pension funds. There should be full disclosure on realising targeted retirement income or undershooting that target; and members should be offered meaningful options to react to the deviations from assumed investment results.

An important element of the TRI concept that must be considered is the costs that need to be borne with regard to designing and implementing such a system (i.e. additional resources for supervisors). Inevitably, creating and supervising a system with explicit target retirement income renders some reputational risk to policy makers and regulators. There might also be some indirect costs that relate to providing insurance against those scenarios where the target is not met.

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