Chapter 6

A Policy Roadmap for Defined Contribution Pensions

This chapter discusses policy options for improving the design of defined contribution pension plans with the aim of strengthening their role in retirement income adequacy.

6.1. Introduction

This chapter takes stock of the OECD work on defined contribution (DC) pension plans and presents policy makers with options for strengthening retirement income in these plans.

Saving for retirement is a long process that begins when one joins the labour market for the first time and ends when one passes away. It includes the active years when the main goal is to accumulate resources to finance one's retirement, the moment of retirement, and the choice of how to allocate one's accumulated resources to finance the retirement years. During the active years one sets aside for savings a certain proportion of labour income. In DC pension plans, this money is invested in assets according to certain investment strategies and earns a return. Once one reaches retirement, the assets accumulated would need to be allocated to provide a retirement income.

Retirement income depends on several factors, some controllable and others uncertain and risky. The controllable factors are those over which policy makers, regulators, employers, providers or individuals have some degree of choice. These are choice variables or plan parameters that refer to the general design of the pension system. They include the rate at which contributions are made (*i.e.*, the contribution rate), the length of time individuals put money into the plan, and the time at which individuals retire (*i.e.*, the contribution period). It also comprises the investment strategy, and the way assets accumulated are paid out at retirement (*i.e.* the structure of the payout phase). But there are other factors that are inherently uncertain, such as spells of unemployment (which impede setting money aside for retirement), the real wage career growth path (which determines the amount that can be saved), the return on investments, inflation, interest rates, and longevity. These risk factors can have a large impact on retirement income and its adequacy.

Concerns about the retirement income adequacy from DC pension plans began even before the 2008 financial and economic crisis. Contributions to DC pension plans in some countries were considered to be low, in particular when compared to contributions to defined benefits (DB) plans. There were also serious doubts that individuals were fully prepared to make all the decisions involved in DC plans. DC pension plans put all the risks squarely on individuals, but the level of engagement and financial literacy among the general population is typically low. The financial and economic crisis added to these existing concerns by showing that retirement income from DC pension plans can be very volatile. Some suffered large losses on their retirement savings just before their retirement, because they had high portfolio allocations to risky assets. In other countries, requirements to annuitize immediately at retirement compounded the problem of low retirement income. Additionally, rising unemployment reduced both contributions and the length of the contribution period.

6.2. Three guiding principles: Coherence, adequacy and efficiency

Coherence, adequacy and efficiency are the three principles underpining the recommendations in this chapter. Public pay-as-you-go (PAYG) financed, funded DB and DC pensions are all complementary. Together they are integral parts of a country's pension system. Thus, there is a need for DC pension plans to be coherent with the overall structure of the pension system. Moreover, DC pension plans also need to be coherent internally; that is, the accumulation and payout phases of DC pension plans need to be consistent, which requires that the investment strategies used to build up assets are properly aligned with the form that the payout phase takes.

The adequacy of total retirement income is also partly a function of DC pension plans, which are normally complementary to other sources to finance retirement. The issue of what constitute an adequate retirement income is highly controversial. First, the most common measure used to assess the adequacy of retirement income, the replacement rate,[1] has some major weaknesses.[2] For example, replacement rates are calculated at the time of retirement and fail to account for inflation.[3] Thus, they fail to signal problems of declining purchasing power or poverty as people age. Secondly, the level of the replacement rate that constitutes an adequate retirement income is far from straightforward and may vary with income levels. A general rule of thumb is a target replacement rate of 70%, around two-thirds of the final salary, based on the assumption that mortgage costs amount to one-third of income and that they are paid off just before retirement. However, for low income individuals, the level of retirement income may need to be higher than a replacement rate of 70% to be deemed adequate. Otherwise there is a risk that individuals may fall below the poverty line. Retirement income from DC pension plans is an integral part of this overall target replacement rate. The analysis in this chapter uses for illustrative purposes 70% of final salary as the overall target retirement income and a 30% replacement rate in DC pension plans.[4]

The design of DC pension plans also needs to be efficient. This chapter assesses efficiency in terms of reducing the impact of extreme negative outcomes on retirement income. For example, there are many investment strategies to choose from in the return-risk frame. However, if the main concern of policy makers and individuals is to avoid sharp falls in retirement income as a result of extreme events (*e.g.* the 2008 crisis) then they will set, at least as defaults, investment strategies that may avoid or limit these sharp drops, in particular for people close to retirement. Efficiency is also required to ensure the adequacy of retirement income. For example, the assets accumulated must be allocated efficiently if retirees are to be protected from longevity risk. The chapter also addresses the impact of efficiency and competition on fees as well as the effects of competition between providers of payout products.

6.3. Policy messages for better DC pension plans

With all of the above in mind, this chapter introduces 12 policy options for improving the design of DC pension plans and thus strengthening their role in retirement income adequacy.

6.3.1. The design of DC pension plans needs to be coherent

6.3.1.1. The design of DC plans needs to be coherent with the overall structure of the pension system

Policymakers directly determine key features of DC pension plans, such as contribution rates and retirement ages, where such plans are mandatory. Regulations and tax incentives also affect indirectly the design of both mandatory and voluntary DC plans. When designing DC plans or their associated regulations and tax treatment, policymakers should consider the ultimate role of such plans in the overall retirement income system. Separate assessments should be carried out for different socio-economic groups in the population.

The amount of retirement income that DC pension plans should aim to deliver depends on the overall structure of the pension system. Retirement income and associated replacement rates in DC pension plans should be higher in countries where they are the main source of funds to finance retirement. In countries where PAYG-financed public pensions and DB funded pensions already provide high benefits, DC pension plans will only need to target a low replacement rate to achieve overall retirement income adequacy.

The first step in the design of DC pension plans and associated regulations should therefore be for regulators and policymakers to consider a target retirement income. In order to identify such a target, regulators and policy makers need to consider both choice and risk variables, including the amount of contributions, retirement ages, contribution periods, labour market conditions, returns on investment, and life expectancy.

Much has been said already in previous chapters (in particular Chapters 1 and 2) about policy initiatives to increase retirement ages and extend working periods in order to improve benefit adequacy. The other key choice parameter that warrants close analysis is the contribution rate. A simple analysis shows that this is not always set at sufficiently high levels in OECD countries (see Box 6.1).

Other plan design features that can have a major impact on benefit levels are the extent to which withdrawals from the account are allowed. Clearly, the more flexible are withdrawal rules, the more likely it is that money will be taken out from the account, reducing the ultimate balance. While some countries allow withdrawals in case of major shocks (so-called

Box 6.1. **To what extent are DC contribution rates consistent with the size of public pension systems**

Throughout the OECD, DC pension plans are gaining foot. Already nine OECD countries (Australia, Chile, Estonia, Israel, Mexico, Norway, Poland, Slovak Republic, and Sweden) have established mandatory DC plans, in some cases as a result of a pension reform that has involved a transfer of part of the social security contributions to the new DC component. Iceland and Switzerland also have mandatory fully-funded arrangements with fixed contribution rates, but as a result of return or benefit guarantees, the plans resemble DB arrangements. Other countries, such as Italy, New Zealand, and the United Kingdom have introduced national automatic enrolment arrangements that aim to extend DC coverage to a large segment of the previously uncovered population. In most other OECD countries, DC pension plans are also growing in importance as voluntary complements to the public pension system.

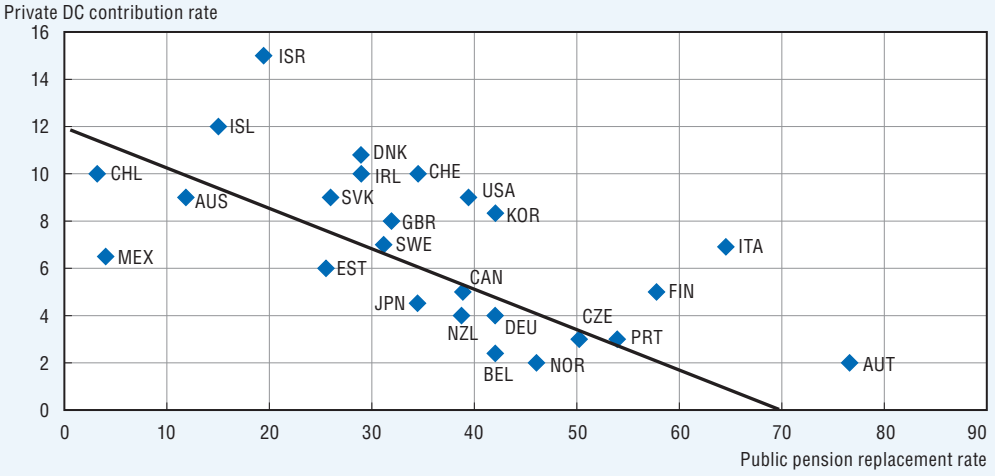
Box 6.1. **To what extent are DC contribution rates consistent with the size of public pension systems** *(cont.)*

Despite the growing importance of DC plans, contribution rates are not always set at a level that would seem appropriate to reach an adequate level of retirement income. The chart below compares projected public pension benefits with the mandatory contribution rate in mandatory DC plans or the typical or average contribution rate to voluntary DC plans, depending on the country. The public pension projections are shown as replacement rates (benefits as a percentage of final salary) for a young male worker earning average wages and entering the workforce in 2008 who accumulated benefit rights throughout his whole career and retires at the official or normal retirement age (as in OECD, 2011).

The graph shows a broadly inverse relationship between public pension benefits and DC contribution rates. However, there are some countries that clearly stand out in having both relatively low public pension benefits and DC contribution rates that do not seem to be sufficiently high. Such countries include Belgium, Germany, Japan, New Zealand, and Norway. These are also among the countries that fall below the black diagonal line, which shows the combination of public pensions and DC contribution rates (with a 40-year contribution period) that delivers an overall replacement rate of 70% on average. Other countries below the black line include Australia, Chile and specially Mexico. The Australian government recently announced that it would raise the mandatory contribution rate from 9 to 12%, which would bring the country above the red line.

It should be noted also that not all workers will have a full career, so the necessary contribution rates to compensate low public pensions may be higher than those depicted in the chart. Also, the contribution rates depicted for voluntary DC plans are averages for the country. Some employees will benefit from higher contribution rates than those considered here, while others will have lower contribution rates. The chart also ignores voluntary contributions to existing mandatory DC plans, as information on this is scant.

Public pension gross replacement rate *vs.* DC contribution rate



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hardship withdrawals), allowing access to the account for other purposes would be inconsistent with the retirement income goal of pension plans. A similar rationale justifies restrictions on the extent to which pension benefits can be paid as lump-sums.

The design of the accumulation and payout phases of DC plans also needs to be coherent with the overall pension system. During the accumulation phase, contributions and returns on investment build up into a certain amount of assets that will be used to finance retirement. Where the DC plan is mandatory or is the mainstay of the pension system, investment regulations, and in particular default options, may be designed so as to avoid excessive risk-exposures.

The length of the retirement period that needs to be financed depends on the age at retirement as well as on life expectancy. If a significant level of retirement income is already annuitized through public PAYG-financed and funded DB pensions, the payout phase of DC pensions may allow for more choice and flexibility. On the contrary, if DC pensions are the main source of retirement income, retirees may need to annuitize a larger share of their assets accumulated in DC plans in order to reduce the risk of outliving their wealth.

6.3.1.2. Coherence requires policymakers to monitor all risks affecting retirement income in DC pension plans

Any assessment of retirement income in DC pension plans that fails to account for risks affecting retirement income will fall short. The financial and economic crisis has highlighted the importance of the volatility of retirement income in DC pension plans. Antolín (2009) shows indeed how volatile retirement income in DC pension plans would have been in several OECD countries by calculating the impact of market conditions on hypothetical replacement rates in DC pension plans.

Retirement income in DC pension plans is uncertain as a result of financial and demographic risks. Future values of returns on different asset classes, and thus returns on portfolio investment, inflation and interest rates are unknown. Consequently, individuals cannot know in advance the amount of assets they will have accumulated at retirement and the resultant retirement income. It is known that the assets accumulated at retirement will need to finance certain amount of time in retirement. However, the length of the retirement period is unknown as it depends on uncertain life expectancy. Therefore, independently of the way individuals allocate the assets accumulated at retirement life expectancy will also make retirement income uncertain.

Future retirement outcomes are also uncertain because of unpredictable labour markets. Labour-market risk originates from the possibility that individuals suffer spells of unemployment or inactivity during their working lives, and from the uncertainty surrounding the trajectory of real wages during one's career.

During episodes of unemployment or inactivity, individuals may be forced to discontinue contributions set aside to finance retirement. As a consequence of these interruptions, the amount of assets accumulated to finance retirement would tend at the end of one's career to be lower than in the absence of such episodes. Additionally, spells of unemployment or inactivity may also affect wages. People that suffer spells of unemployment may re-enter the labour market at lower wages than they enjoyed at their previous job. This would tend, other things equal, to reduce their total amount of contributions and the amount of assets accumulated relative to an uninterrupted career (without spells of unemployment).

Real-wage gains during a career vary across individuals, according to their socio-economic situation (*e.g.* occupation, educational level and income). In general, real wages experience the largest gains during the early part of a person's career as productivity grows rapidly at young ages, with lower gains, even negative gains, in the latter part. This pattern results in real-wage paths that for some people reach a plateau at the end of their careers (high real-wage gains), while for others, real wages plateau earlier, around ages 45 to 55 (medium real-wage gains) and fall thereafter. A minority experience flat real wages throughout their working lives. Therefore, assessments of the adequacy of retirement income are incomplete if the likelihood of unemployment or the existence of different real-wage paths are not taken into account.

The main results from using a stochastic model to assess the impact on retirement income in DC pension plans of labour, financial and demographic risks can be summarised as follows:[5]

- The impact of labour, financial, and demographic risk is far from negligible. There is close to a 60% probability that replacement rates may fall short of expectations if uncertainty is not taken into account.
- Replacement rates in extreme negative situations can be dangerously low.
- The dispersion of replacement rates around the median replacement rate is relatively high.
- The examination of the relative impact of each of the risks shows that labour-market risk (either regarding employment prospects or real-wage growth career paths); as well financial-market risk (uncertainty about returns on investment and inflation) has the largest impact on retirement income from DC pension plans.
- The timing at which unemployment occurs in one's career affects retirement income. Those who suffer unemployment earlier in their careers will have lower retirement income than those who endure it at the end of their careers, as a result of the compound interest rate and the portfolio size effects.

6.3.1.3. The design of the accumulation and pay-out phases needs to be internally coherent

The accumulation and the pay-out phases need to be properly aligned. If the accumulation phase of DC pension arrangements is flexible (*e.g.* voluntary, the choice of asset allocations is flexible) then it may make sense to have flexibility in the payout phase. Similarly, if the accumulation phase is more restrictive (*e.g.* it is mandatory, or has restrictions about asset allocations), then the payout phase may also need to be restrictive, in particular, if the assets accumulated in DC plans are the main source of income to finance retirement.

Additionally, the assessment of investment strategies during the accumulation phase needs to take into account the structure of the payout phase. For example, investment strategies that may provide a better trade-off between potential replacement rates and replacement rates in extreme negative situations when the payout phase is structured around life annuities, may provide worse trade-offs when the payout phase is organised around programmed withdrawals or lump-sums. Also, if only annuities are allowed in the payout phase, the investment strategy during the accumulation phase needs to be designed so as to mitigate annuity rate risk. This can be achieved by moving the portfolio towards long-term fixed-income securities as the annuity purchase date approaches.

6.3.2. Ensure effective communication and address financial illiteracy and lack of awareness

In DC arrangements, individuals face a myriad of complex choices that will determine the adequacy of their retirement income, from how much to save to what kind of benefit payout option to choose. The OECD *Guidelines for the Protection of Rights of Members and Beneficiaries in Occupational Pension Plans* cover various aspects of disclosure that need to be addressed via appropriate regulation.[6]

Apart from ready access to the plan's documents and other relevant contractual material, individuals should be provided with a regular individualised benefit statement, which apart from a record of contributions and the account balances should also provide clear benefit projections under prudent assumptions. Such projections should ideally include information on how much higher benefits could be if additional contributions were to be made to the DC plan or if the age of retirement was to be delayed.

Members also need to be able to access freely and readily comparative information about the cost and performance of different pension providers and instruments as well as the main features of the different benefit options that they may select at retirement. Members and beneficiaries should also be notified in timely fashion if required employer and member contributions have not been made to the pension plan.

Disclosure materials need to be written in a manner to be readily understood by the members and beneficiaries to whom they are directed. This may be a particularly challenging task for members with very low levels of financial literacy, some of whom may not even understand basic concepts such as compound interest or the difference between a stock and a bond. Hence, communication policies need to be complemented with financial education programmes both at schools and among the adult population.

The OECD *Recommendation on Principles and Good Practices for Financial Education and Awareness,* approved by the OECD Council in 2005[7] provides some general guidance, including the need for such programmes to be provided in a fair and unbiased manner and to be co-ordinated and developed with efficiency. The OECD *Recommendations on Good Practices for Financial Education Relating to Private Pensions*[8] provide further detail on such programmes, which should include public awareness and communication efforts as well as more traditional educational programmes aimed more directly at raising financial literacy levels.

National Pension Communication Campaigns (NPCCs) should be used by governments at times of major pension reforms to inform individuals about the changes made and how they will affect their pension entitlements, but also to help individuals take necessary action (for instance, join a pension plan or increase contributions) or "nudge" them towards specific choices (for example, from the old to the new pension system). However, care should be taken with public campaigns to distinguish between financial education and political advocacy for a particular form of pension or retirement income system.

NPCCs need to be targeted as broadly as possible, as lack of understanding of pension issues tends to be fairly widespread. In addition specific programmes targeted at the most vulnerable groups, such as migrants and those with the lowest income and savings levels, can also have a significant positive impact. Ultimately, such programmes should work towards making individuals aware of their limited knowledge about financial matters, and about pension products in particular, stressing the risks of not having an adequate income in retirement.

NPCCs have been shown to increase understanding of the pension system and the need to save, which would be expected to lead to greater coverage rates (Atkinson *et al.*, 2012). In addition, employment based campaigns have been shown to increase participation and contribution rates in pension schemes (OECD 2005b). Agnew *et al.* (2007) find that financial literacy among workers in 401(K) plans is positively associated with higher participation rates or lower rates of people opting out in automatic enrolment plans, underscoring the importance of ongoing workplace financial education for participants in both voluntary and automatic enrolment plans.

Apart from improving awareness about the need to save for retirement, more effective information disclosure could also help in improving coverage as individuals will be better placed to make a decision. OECD work on communicating risks in DC pension plans (Antolín and Harrison, 2012) shows that effective communication strategies may help increase contributions by helping plan participants learn that higher contributions increase the likelihood of achieving the target replacement rate.

Finally, governments should work to ensure that financial education relating to pensions is started as early as possible – for example, as part of school curricula – in order to encourage individuals to start saving from as young an age as possible. This is particularly important in relation to DC systems. Governments should also ensure that financial education on pensions is available on an on-going basis at key points throughout an individual's life, such as when starting work, getting married and having children and around retirement.

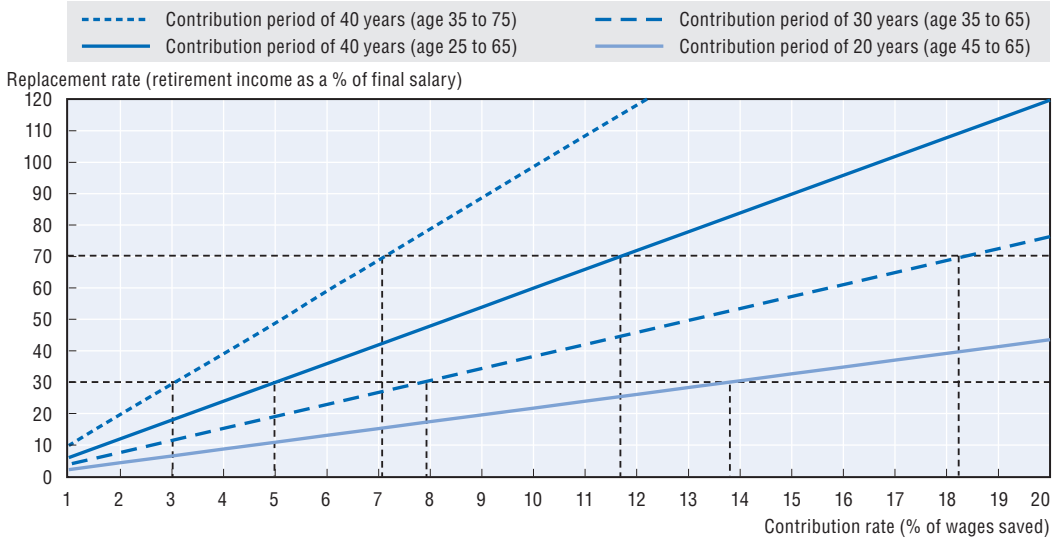
While important, such initiatives may only be expected to result in improvements in financial literacy over a long period. Furthermore, they will be insufficient to address the many concerns over cognitive biases and other aspects of individual behaviour, from procrastination to overconfidence, let alone the structural information asymmetry between pension providers and consumers. They can however complement and strengthen consumer protection regulations and other policy interventions discussed in other sections of this chapter, such as default investment options.

6.3.3. Encourage people to contribute and contribute for long periods

The best way to reduce uncertainty and to improve the chances of achieving an adequate retirement income is to contribute large enough amounts and for long periods. One of the main reasons to shift from DB to DC pension plans is that they provide a clear and direct link between contributions and benefits.[9] DB pension plans promise certain pension benefits. As a result, the link between contributions and pension benefits is far from straightforward.[10] In DC pension plans, however, the link is direct: what one puts into the account determines what one can take out at retirement, depending of course on investment returns. Therefore, the level of contributions would have a direct effect on retirement income and related replacement rates in DC pension plans. Indeed, Figure 6.1 shows how replacement rates increase as contribution rates increase. Focusing on the thick blue line for a contribution period of 40 years, increases in contribution rates raise the potential replacement rate that can be achieved at retirement. For example, moving from a contribution rate of 5% to almost 12% increases the potential replacement rate from 30% to 70% *ceteris paribus*. Obviously these results are dependent on the values that the other parameters assume over time, especially the contribution period and the return on portfolio investment.

Longer contribution periods allow for higher retirement income for a given level of contributions. The length of the contribution period determines for how long amounts contributed accumulate and benefit from compounding of interest. Hence, the longer is the contribution period the longer assets accumulated earn returns and the less money people need to put aside regularly to build assets to finance retirement. Consequently, the contribution rates needed to achieve a certain target retirement income decrease with the length of the contribution period. Figure 6.1 shows that a target replacement rate of 30% (70%) can be achieved, *on average*, by contributing almost 5% (12%) over a 40 year period. However, if the contribution period is only 30 years, the amounts one would need to set aside to achieve the same replacement rate would equal more than 8% (18%) of wages. For a contribution period of only 20 years, a 30% replacement rate could be achieved only by contributing almost 14% of wages, while the contribution rate necessary for achieving a 70% replacement rate rises to above 30%.

Figure 6.1. **Contribution and replacement rates**



Note: Contribution and replacement rates when assets are invested in a portfolio comprising 60% equities and 40% fixed income, assuming a nominal rate of return of 7%, a nominal discount rate of 4.5%, and a life expectancy of 20 years at age 65.

Source: OECD calculations.

StatLink http://dx.doi.org/10.1787/888932598778

Our estimates suggest that lengthening the contribution period by postponing retirement is the more efficient approach to increase retirement income. For example, the contribution effort needed to achieve a given replacement rate is lower when increasing the contribution period by postponing retirement than by joining the labour market earlier. Postponing retirement simultaneously increases assets accumulated to finance retirement and reduces the retirement period that those assets need to finance. Figure 6.1 shows that one needs to contribute 5% of wages to achieve a replacement rate of 30% when the contribution period increases 10 years from 30 to 40 years by contributing from age 25 to age 65. However, if all else is the same but the contribution period is lengthened to 40 years by retiring later (*i.e.* contributing from age 35 to 75), the contribution rate needed to achieve a 30% replacement rate would be lower, at only 3.1% of wages.

In addition to the impact of changes in the contribution period, changes in portfolio returns, interest rates, inflation and life expectancy also affect retirement income in DC plans. They all change the amount of contributions needed to achieve a given replacement rate. Table 6.1 below shows that lower returns on portfolio investment or on interest rates increase the amount of contribution needed to achieve a target replacement rate and *vice versa*. Additionally, Table 6.1 also shows that the amount of contributions needs to increase with the length of the retirement period. However, the marginal increase in contributions falls the higher is the life expectancy.[11]

Table 6.1. **Contribution rates needed to achieve a certain target replacement rate – deterministic case**

Target RR	Rate of return on investments (%)			Interest rate – Discount rate (%)			Life expectancy at retirement (yrs)		
	5	7	9	3.5	4.5	5.5	10	20	30
30	7.7	5.0	3.1	5.5	5.0	4.6	3.1	5.0	6.3
70	18.0	11.7	7.3	12.8	11.7	10.7	7.1	11.7	14.6

Note: Contribution and replacement rates when assets are invested in a portfolio comprising 60% in equities and 40% in fixed income, assuming a nominal rate of return of 7% (unless stated differently), a nominal discount rate of 4.5% (unless stated differently), and a life expectancy of 20 years at age 65 (unless stated differently).
Source: OECD calculations.

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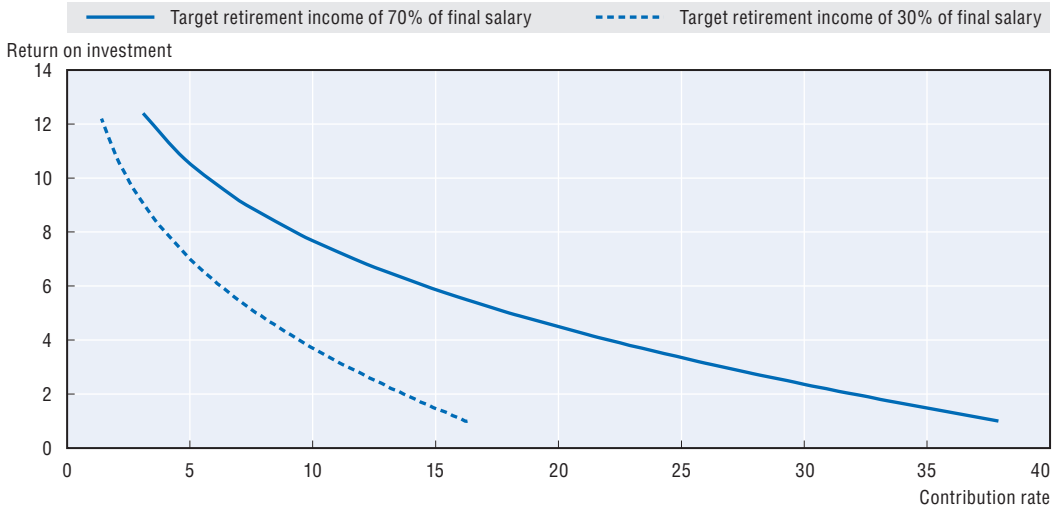
Policy makers and individuals should keep in mind potential returns on investment but focus on contribution rates. The interaction between contributions and the rate of return on investments is crucial to achieve a target retirement income. As expectations about future investment returns are highly uncertain, it is important to avoid overly optimistic assumptions. Historical returns on portfolio investment point out towards average annual nominal returns of around 7.5% over a 40 year period.[12] However, the current economic context and the experience of Japan over the last two decades suggest that returns on investment may remain low for the foreseeable future. Moreover, pension funds and asset managers are adjusting downwards their expectations about future returns on investment. Consequently, it is important to assess how contributions need to change were returns on investment to be lower. In this framework, Figure 6.2 shows this relationship between returns on investment and contributions to achieve a target replacement rate. People need to contribute around 11.7% over a 40 year period when assuming future average annual returns on investment of around 7% in order to achieve a target replacement rate of 30% of final salary. However, if returns were to remain lower, say at 5%, contributions to achieve the same target retirement income of 30% of final salary need to increase to 18% over a 40-year period.[13]

Increasing contributions or increasing the contribution period increases the probability of reaching the target retirement income and the associated replacement rate. Contribution rates and contribution periods are variables the levels of which need to be assessed in the context of a generalised stochastic model where all risks (labour, financial and demographic) are considered. Table 6.2 shows the probability distribution of replacement rates for a contribution rate of 5% and a contribution rate of 10% for two contribution periods, 20 and 40 years, based on a stochastic model with uncertainty about returns, interest rates, inflation, life expectancy, employment prospects and career real wage growth paths (see Antolín and Payet, 2010). The table shows that for a target retirement income of 30% and a 40-year contribution period, doubling the contribution

Figure 6.2. **Combinations of contribution rates and returns on investment to achieve a target retirement income**



Source: OECD calculations.

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rates from 5% to 10% increases the probability of achieving the target retirement income (*i.e.* getting a replacement rate at equal or greater) from 62% to 92%. However, if the contribution rate remains at 10% but the contribution period is halved to 20 years, the probability of achieving a target replacement rate of 30% falls from 92% to 33%. In short, the longer is the contribution period and the higher the contribution rate the more likely is the individual to achieve the target retirement income, which could only have been offset it by increasing contributions and the contribution period.

Table 6.2. **Distribution of retirement income relative to final wages**

	Percentile of distribution (%) for 40-year contribution period									Probability RR ≥ 30%	Probability RR ≥ 70%
	1	5	10	25	50	75	90	95	99		
5% contribution rate	9.0	12.7	15.9	23.4	36.3	55.0	78.4	95.8	143.5	61.6	13.9
10% contribution rate	17.7	25.5	32.0	47.1	73.3	111.0	159.2	194.8	293.4	91.7	52.8
	Percentile of distribution (%) for 20-year contribution period									Probability RR ≥ 30%	Probability RR ≥ 70%
	1	5	10	25	50	75	90	95	99		
5% contribution rate	3.4	4.6	5.3	7.3	11.4	17.0	22.7	26.7	36.2	2.8	0.1
10% contribution rate	6.9	9.2	10.7	14.7	22.8	34.1	45.6	53.7	72.8	33.0	1.3

Note: OECD calculations, which result from assuming uncertain investment returns, inflation, discount rates, life expectancy and labour market conditions. People contribute either 5% or 10% over a 20 or a 40-year period, and assets are invested in a portfolio comprising 60% in equities and 40% in long-term government bonds.

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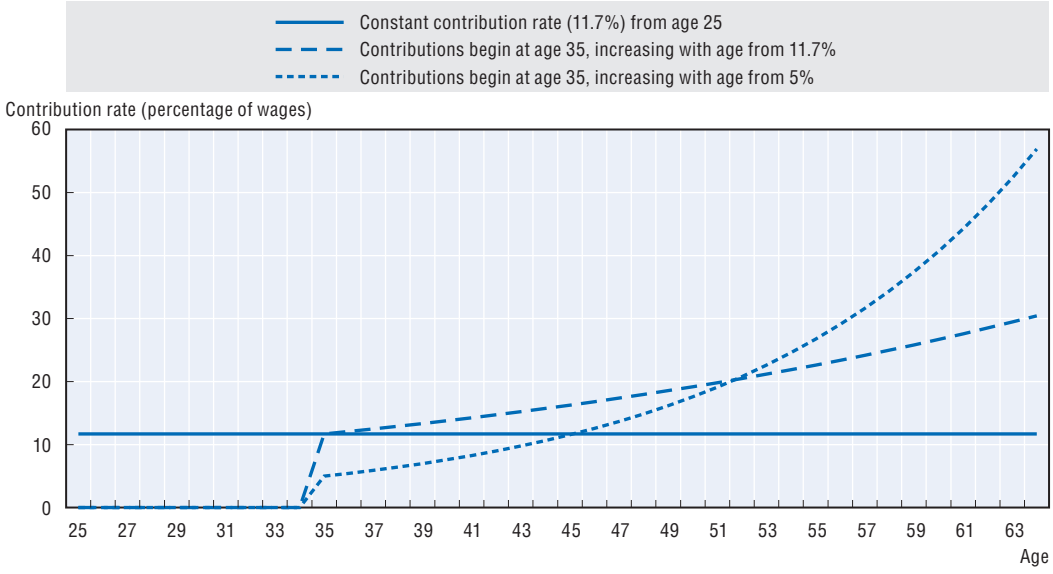
While it is critical to ensure that the contribution rate and period are sufficiently high to meet the target retirement income, there is no *a priori* justification to maintain a constant contribution rate over the whole accumulation period. In fact, there are good reasons to argue that contribution rates should increase with age.[14]

People at early stages of their working life have generally less income and greater consumption needs (*e.g.*, housing, kids) than later in their careers, making it harder to divert part of their income into retirement saving plans. In this context, it may be optimal to start saving for retirement later in one's career and have contribution rates increasing as people age (Blake at al. 2011a,b). However, this means that contribution rates may have to reach a high level at the end of one's career in order to attain the same target retirement income.

Figure 6.3 below shows three possible profiles of contribution rates that can (on average) deliver a target retirement income of 70% of final wages. The target income can be achieved with a constant contribution rate of 11.7% starting at age 25 (the straight line in the chart). If one begins contributing at 35 instead with an initial contribution rate of 11.7%, contribution rates would have to reach 25-30% of wages in the last years before retirement. Beginning with lower contribution rates at age 35 makes the increase in contribution rates at the end of the working life even higher. The steeper line in Figure 6.3 assumes that people begin contributing at age 35 at 5% and contribution rates increase steadily throughout their working career. In order to reach the target retirement income, contribution rates would have to reach 50% of wages at the end of the worker's career. However, such steep contribution rate schedules may lead to time inconsistency as people may lack the will power to raise their contributions rate to very high levels towards the end of their working lives. Shocks can also be experienced in later life which may force people to lower their retirement savings.[15]

Figure 6.3. **Contribution rates linked to age**



Note: OECD calculations, which result from assuming a 40-year contribution period, a target retirement income of 70% of final salary, and a constant nominal rate of return on investment of 7% (see Table 6.1).

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Summing up, in order to deliver adequate retirement income for people retiring mainly with income from DC plans, there is a need for comprehensive measures that encourage or ensure high enough contributions for long enough periods. Such measures include labour market policies that promote job-creation at all ages, allowing people to have long contribution periods. Policymakers should also provide incentives to lengthen

the contribution period by raising the maximum age at which tax-deductible contributions can be made to DC plans. Such a maximum age should be well-beyond the official retirement age. Authorities may also consider rising the age at which benefits from DC plans can first be drawn in line with increases in life expectancy.

6.3.4. Improve the design of incentives to save for retirement to increase contributions and coverage

Contributions could be increased through mandates or with the help of "nudge" measures. The previous section has argued that it is essential to contribute large enough amounts for long enough periods to have meaningful retirement income in DC pension plans. In countries where DC pension plans are compulsory, increasing contribution rates, although complicated by the political process, could be easier than in countries where saving in DC pension plans is voluntary. Contribution rates in voluntary DC pension plans can nonetheless be increased with the help of "nudge" measures, such as matching contributions from either employers or the State and auto-escalation.[16] Research shows that people tend to contribute up to the maximum contribution rate of the match. Programs like the Save More Tomorrow Program (SMTP) in the United States use auto-escalation, whereby people sign up today to increase contributions tomorrow in line with wage increases, seem to be quite successful in bringing in higher contributions rates as people improve through their careers.

It is also important to increase the number of people saving in DC pensions plans. One of the main OECD recommendations as regards pensions is to diversify the sources to finance retirement and to encourage the complementary role of defined contribution pension plans. In this context, it becomes important to have large levels of coverage in DC pension plans (*i.e.* working age people with retirement savings accumulated in these plans). Evidence reported in Chapter 4 suggests that coverage is around 50-60% in countries where DC pension plans are an important complement to finance retirement and these plans are voluntary. Even in countries where these plans are mandatory and are one of the main sources to finance retirement, coverage is below 90% because it is not compulsory for some groups of the population (*e.g.* self-employed) or there are problems related to informality.

Governments throughout the OECD are highly active in designing and implementing policies to encourage private pension savings.[17] The most obvious route is through compulsion, by mandating contributions to private pensions. Several countries have achieved both high and uniformly distributed levels of coverage across age and income levels through compulsion.[18] However, compulsion may not be an available policy option for some countries, not least because saving for retirement beyond a certain threshold is considered an individual choice. Unfortunately, when people are left by themselves to provide for retirement, empirical evidence suggests that some of them will not save enough for retirement. Consequently, if compulsion is not viable, authorities may wish to consider other policies to encourage voluntary private pension savings.

Soft compulsion is one example. Experience shows that high levels of coverage could be achieved through such measures of soft-compulsion as automatic enrolment. In fact, it has been suggested that automatic enrolment in pension plans with appropriate default options with respect to contribution rates and investment allocation may achieve the dual goal of preserving individual choice and ensuring an adequate level of saving for retirement, even if individuals do nothing on their own. Recent findings from the behavioural finance literature

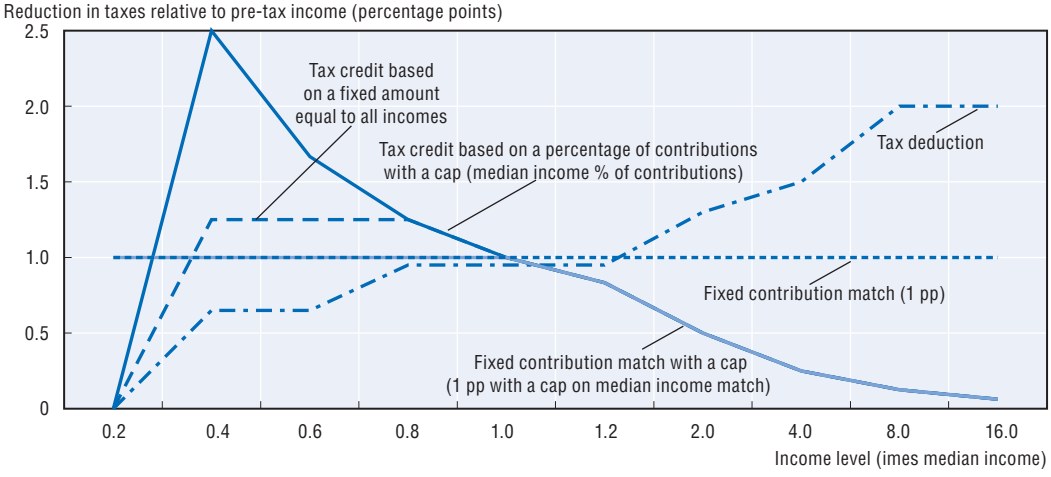
highlighting the importance role that "inertia" or "passive decision" plays in the decision to participate in retirement saving plans (Choi *et al.*, 2002; Mitchell and Utkus, 2003; and Beshears *et al.*, 2006) suggest that by changing the design of pension plans (*e.g.* 401(k) plans) and making enrolment the default option, enrolment in voluntary funded plans can be boosted substantially as few employees ever take explicit action to unenroll.[19] However, despite growing enthusiasm for automatic enrolment, actual experience with its use and evidence of its impact is fairly limited and comes mainly from the United States. Automatic enrolment with an opt-out clause has recently been introduced in New Zealand with positive effects, but the same approach is not working as expected in Italy.[20] The United Kingdom will start its NEST programme with automatic enrolment in 2012.

Another option is to strengthen the value of tax incentives embodied in DC pension plans for low and middle-income individuals, which should help boost the enrolment rate for these population sub-groups.[21] Contributions to voluntary DC pension plans enjoy tax advantages in most OECD countries in order to promote savings for retirement.[22] However, in most countries these tax advantages take the form of a deduction on the income tax base (*i.e.* the amount of income subject to income tax that it is used to determine the tax rate), *tax deduction*.[23]

Tax deductions provide incentives that increase with income as it reduces marginal tax rates. Measuring tax incentives as the change in tax payments relative to pre-tax income stemming from each of the different forms of introducing tax incentives, a tax deduction provides higher incentives to save to higher income earners and it may be of little or no value for workers with low income (Figure 6.4).[24] In addition, given that enrolment and retirement savings increase with income, an incentive structure skewed toward higher income may be far from the best way to increase participation and contributions to DC pension plans.[25]

An alternative way of introducing tax incentives that change inversely with income is to use *tax credits*. Tax credits entail that after calculating taxable income and applying the tax rates relative to the income brackets to determine the tax due, one can apply a

Figure 6.4. **Incentives of tax deductions, tax credits and matching contributions by income**



Note: The tax incentives are designed such that, given the tax brackets, the reduction in taxes relative to pre-tax income is the same for the person with the median income.

Source: OECD calculations.

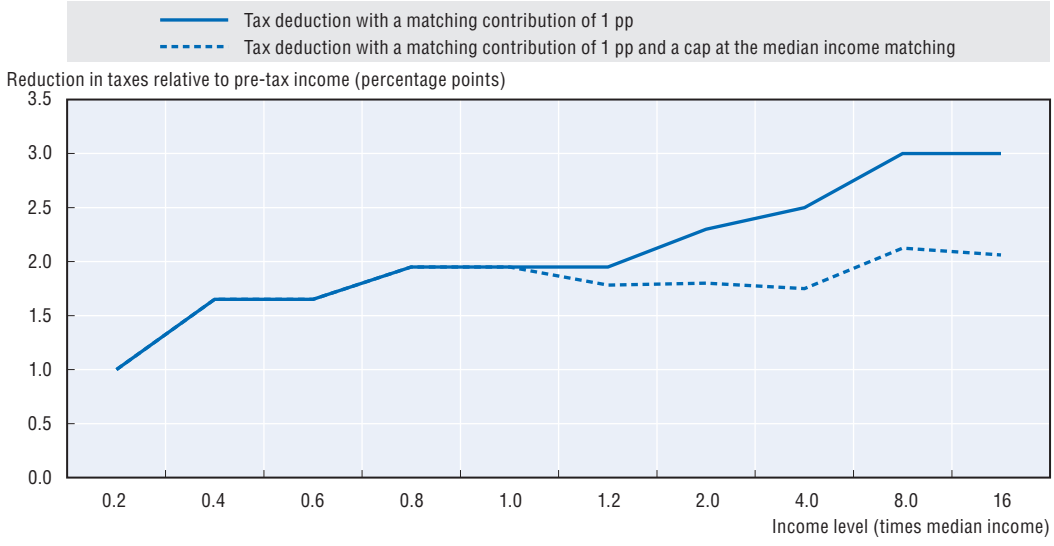
StatLink http://dx.doi.org/10.1787/888932598835

deduction to the tax due. This deduction can be a fixed amount equal for all income levels or a percentage of contributions with a cap. Figure 6.4 shows that in both cases the incentive of tax credits is lower for higher income individuals. Replacing tax deductions with tax credits may therefore help increase coverage among middle-to-low income individuals. However, as shown in Figure 6.4, the low paid, who pay little or no income taxes, hardly benefit from tax credits.

Targeting the low paid requires a third type of incentive, in the form of a *government subsidy* or *matching contribution* into the individual's retirement savings account.[26] For example, for every 5 percentage points of one's wage that is saved in a DC pension plan governments or employers will pay the equivalent of a percentage point of wages. The match can be capped so it is less valuable as income increases. Figure 6.4 shows that the tax incentive of matching contributions is income neutral (*i.e.* the incentives are the same for all income levels), but it could fall with income after reaching a cap when one (*e.g.* a cap equal to the match for the median income) is introduced.[27]

Tax deductions combined with capped matching contributions can make tax incentives more neutral with respect to income. Most countries have tax incentives in the form of tax deduction and are considering adding matching contribution to encourage saving for retirement further, in particular for mid to low income individuals. Figure 6.5 shows the overall incentive in terms of reduction in tax payments as a share of pre-tax income of having tax deductions of contribution to DC pension plans and adding a matching contribution of 1 percentage point, given a contribution rate of 5%. The tax deduction increases incentives with income, adding the incentive of a 1 percentage point match just shifts the curve upwards, increasing the incentive but without changing the income structure of the incentive. However, adding a matching contribution of 1 percentage point with a cap on the match (*e.g.* a cap equal to the match for the median income as in Figure 6.5) changes the tax incentive relationship with income by making it more flat.

Figure 6.5. **Incentives of adding matching contributions to tax deductions by income**



Source: OECD calculations.

StatLink http://dx.doi.org/10.1787/888932598854

Additionally, better communication for plan members and improving financial education can also be a means of improving coverage and increasing contribution rates in voluntary funded pensions, as discussed above.

Summing up, tax subsidies provide incentives that increase with income, while tax credits provide incentives that are greater for middle than higher income workers, but provide few benefits for low income households. Matching contributions provide incentives that are constant across income classes. Matching contribution with a cap provide incentives that are inversely related to income, with the highest tax benefits going to low income individuals. As most countries currently provide incentives via tax deductions, adding matching contributions with a cap makes the overall tax incentive to save in DC pension plans more income neutral.

6.3.5. Promote low-cost retirement savings instruments

There are also steps that can be taken on the supply side to improve retirement income. The amount of fees that pension providers charge can have an important adverse impact on retirement income. Pension providers charge management fees for the services they offer, such as account administration and investment management. Such fees may be charged on contributions or assets under management or paid separately by the plan member. Ultimately, the level of charges affects the benefits that plan members receive: the higher the charge, the lower will be the benefits that members receive for a given contribution, or the higher will be the total contribution required to achieve the same level of benefits. Table 6.3 below shows the impact of different levels of asset management charges in terms of reductions in benefits, assuming a 40-year contribution period. Halving the management fees from a level of 1% of assets under management to 0.5% can raise pension benefits by 10%. High fees may sometimes be worth paying for a better quality service or for higher risk-adjusted returns. However, more often, they are symptomatic of a seller-dominated pension industry, in which individual plan members have a clear informational and financial disadvantage compared to the pension providers.

Table 6.3. **Comparison of fee levels and impact on benefits**

Fee as % assets	Reduction of pension (%)
0.05	1.2
0.15	3.6
0.25	5.9
0.50	11.4
0.75	16.5
1.00	21.3
1.50	29.9

Note: The impact of fees on pensions is calculated assuming an individual that contributes 10% of wages, wages growth at an annual rate of 3.8% (resulting from 2% inflation and 1.8% growth in productivity). The individual contributes for 40 years since age 25 until age 65 when he retires. The assumed return on portfolio investment is 7%. Lower returns decrease the impact of fees on pensions. For example, the impact of a fee of 1.5% on pensions falls by almost 3 percentage points when returns to portfolio investment fall from 7% to 5%

Source: OECD calculations.

StatLink http://dx.doi.org/10.1787/888932599310

Policymakers therefore need to ensure that there are incentives in place to improve efficiency and reduce costs in the pensions industry, especially in cases where they are clearly beyond reasonable levels.[28] They also need to consider ways to protect lower income

households, who have smaller account balances and are proportionately more costly for providers. These objectives are particularly important in mandatory DC systems and in general in any country where policymakers aim to broaden DC pension plan coverage.

Various policy solutions have been considered, which can be divided into three main groups, disclosure-based initiatives, pricing regulations, and structural solutions. Disclosure-based solutions include ensuring that members receive timely information on the fees they pay, including comparisons between providers. Such disclosures may need to include standardised fee tables in countries where the charge structure may differ across providers. The main limitation of such initiatives, especially in countries that target lower income employees, is the general apathy among individuals towards retirement savings and a much greater response among individuals to providers' marketing strategies than to fee levels.

Pricing regulations include allowing a single charge structure (only contribution-based or only asset-management charges) and setting ceilings on the fees that pension providers can apply. Such solutions can be effective in avoiding high fees, but they are not necessarily conducive to cost-reductions and efficiency improvements in the industry. They can also intensify incentives among providers to promote their products among wealthier households as they can obtain a better cost recovery.

The third type of policy solutions is structural in the sense that it involves a specific industrial organisation set-up. Occupational pension plans, for instance, involve the employer and trustees (or equivalent pension fund directors) acting as intermediaries between plan members and pension providers. The employer or trustee can negotiate contracts for DC plan administration and investment management on behalf of all plan members, ensuring greater negotiating power.

In personal plans, a structural solution may involve the establishment of a centralised institution that is in charge of either delivering the various pension services, directly or via an outsourcing arrangement, or of negotiating better terms (lower fees) on behalf of individual plan members (*e.g.* the Swedish PPM system or NEST in the United Kingdom). This policy solution can be very effective in achieving low fees as it ensures economies of scale and can avoid the marketing expenses of the retail model. However, it may be difficult to implement once a DC industry of competing providers is established, at least in a mandatory system. A centralised institution can also raise governance challenges that call for effective and independent oversight.

There are other structural solutions which can also be conducive to lower fees that may work better when a DC industry of competing providers is already established. This includes establishing a tender process, for example by the regulator, for assigning new or undecided workers to a low-cost pension provider (*e.g.* Chile, Mexico and New Zealand). Again, such a solution calls for strong public sector governance and institutional capability.

6.3.6. Consider the pros and cons of investment guarantees

The financial and economic crisis brought into sharp contrast the volatility resulting from financial market risk (see Antolín, 2009). Moreover, the analysis above (Table 6.2) also shows how important the impact of labour, financial, and demographic risks on retirement income in DC plans can be, in particular, in extreme negative situations in which retirement income can turn out to be quite low. This risk has led regulators, policy makers and market participants to discuss several measures to address this volatility in retirement

income, especially the possibility of low retirement income as a consequence of extreme negative outcomes for the risk variables. The main measures being discussed include introducing guarantees in DC pension plans, in particular, minimum return guarantees like capital guarantees; and establishing appropriate default investment strategies.

The effects of market risk on DC pensions can be alleviated by introducing minimum return guarantees. Minimum return guarantees only ensure that the amount of the accumulated savings at retirement does not fall below a certain value, but the actual pension benefit received after retirement will vary above that ceiling depending on the type of pay-out product chosen and market conditions at that time of retirement. Minimum return guarantees thus protect retirement income in DC plans against major investment losses. They could also enhance people's appreciation of and confidence in DC pension plans and in turn boost the coverage of and contributions to these plans. However, as guarantees have to be paid for, they reduce the expected value of retirement income from DC plans.

The cost of minimum return guarantees can be relatively high depending on risk aversion and the trade-off protection and reduce expected value of retirement income. In this context, Chapter 5 shows that capital guarantees that protect the nominal value of contributions in DC pension plans can be relatively cheap to provide, offer an attractive cost-benefit trade-off for DC pension plan members, and are valued highly by plan members as they address one of the main concerns about DC plans among the general population: people are often disinclined to save in DC plans because they feel they can lose even part of the money they put in. However, such capital guarantees are relatively cheap and easy to implement in the very specific context considered in Chapter 5: a DC pension plan with a fixed and long contribution period (40 years), a pre-set life cycle investment strategy and "normal" capital market conditions. Relaxing any of these features would raise the cost of the capital guarantees. For example, the annual cost of the capital guarantee for a 40-year contribution period rises from 0.06 percent of assets, as shown in Table 6.4, to 0.24 percent of assets with a 20-year contribution period. Whether capital guarantees without those constraints are necessary or affordable would depend on risk aversion and the trade-off between the willingness to pay for certainty and the reduction in retirement income that paying for the guarantee entails.

Table 6.4. **Cost of minimum return guarantees for a 40-year contribution period**

	Capital guarantee	2% guarantee	Inflation-indexed capital guarantee	Ongoing capital guarantee	4% guarantee with annual fees	Floating guarantee
% of net asset value	0.06	0.22	0.24	0.39	0.89	1.22
% of contributions	1.24	4.94	5.58	18.36	18.71	26.09

Source: Antolín *et al.* (2011)

StatLink http://dx.doi.org/10.1787/888932599329

Guarantees in DC pension plans are less necessary in countries where the PAYG-financed public pension already provides a high level of retirement income and where there are public safety nets that compensate workers – especially low income ones – from a low investment return on their funded pension contributions. On the other hand, guarantees are most useful where DC pension plans provide a large part of the overall retirement income and when membership of such plans is mandatory.

Establishing minimum return guarantees requires addressing additional concerns. Guarantees in DC systems can hamper members' mobility across providers or fund managers, a key feature of DC systems, as providers will charge a fee on the switcher's account to compensate them for the lower contribution period over which they have to meet the guarantee. The investment choice inherent to a DC system also makes the design of guarantees cumbersome, as the price of the guarantee varies with the riskiness of the investment portfolio. Indeed, in countries where there are minimum return guarantees in DC plans, individuals often do not have investment choice.[29] In fact, in some cases, the introduction of guarantees has led providers to move to very conservative investment portfolios, reducing expected long-term returns. Therefore, although guarantees can limit the impact of investment risk, their use to achieve this objective may be inherently inconsistent with DC pension plans. Finally, guarantees raise the need to ensure adequate protection from the insolvency of the guarantor.

6.3.7. Establish default investment strategies with appropriate risk exposure

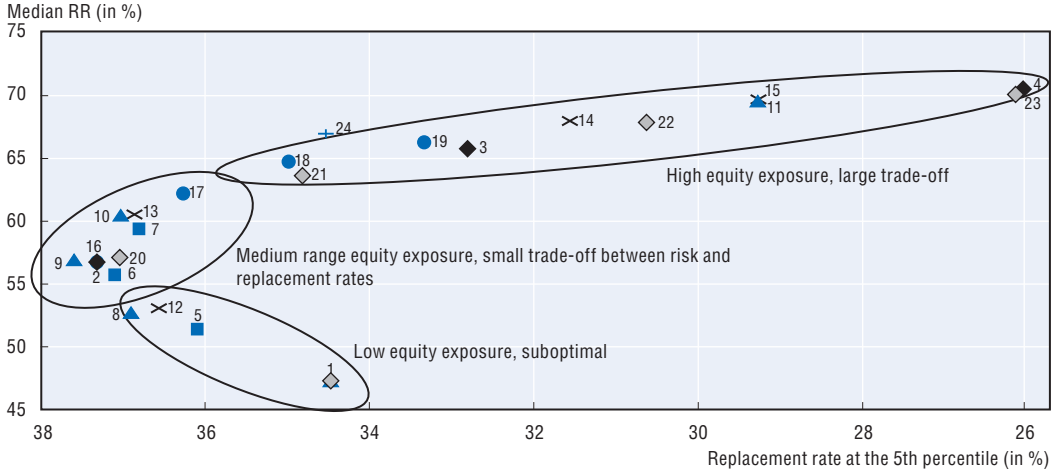
It is possible to partially offset the impact of the uncertainty on retirement income by introducing appropriate default investment strategies. One of the main arguments for supporting DC pension plans is that people are able to choose their investment strategy, they provide choice. People would choose the investment strategy best suited for them according to their risk profile and their level of risk tolerance, as well as their different overall pension arrangements.[30] However, behavioural economics and the financial literacy research show that some people are either unwilling or unable to choose, let alone to actively manage their own portfolio investments. Therefore, default investment strategies would be ideal, as they incorporate the lessons learned from behavioural economics on the importance of inertia and passive decision making, to make sure that those people are assigned to appropriate investment strategies.

Default investment strategies should concentrate on reducing the risk of extreme negative outcomes on retirement income. Indeed, default investment strategies can be designed to minimize the impact of market conditions and reduce the risk of sharp falls in retirement income as a result of extreme negative outcomes (*e.g.* a sharp negative shock to equities just before retirement, as happened to some pension holders in 2008). They are useful in protecting pension benefits from market swings, in particular for people close to retirement. Obviously, risk and reward go hand-in-hand, so ensuring protection from negative market outcomes means lower potential gains during market upswings. Although having a default investment strategy for people with different risk profiles may not be ideal (one-size-fits-all type of problem), when the main concern is the impact on retirement income from extreme negative outcomes, such default options may be appropriate, in particular when choice is given. In this regard, default investment strategies may need to come with an opt-out clause for those who are willing and capable of making investment choices.

Finally, the question comes down to choosing the appropriate default option. Choosing among different investment policies requires balancing the trade-off between higher potential retirement income and the associated risks. The analysis of different investment strategies using a stochastic model shows that an all-bond strategy and most strategies with very low equity allocations (less than 20%) are seemingly inferior in the sense that there is always an investment strategy that provides a higher return (median replacement rate) for a lower risk (higher replacement rate at the 5th percentile). Similarly, investment strategies with high equity exposure (*e.g.* more than 80%) can always been

improved upon by other strategies that provide relatively less return at a much lower risk. Therefore, investment strategies with both very low allocations to equities (below 20%) and very high ones (above 80%) look unattractive in terms of the trade-off between replacement rate expectations and risk, measured by the replacement rate at extreme negative outcomes (*i.e.* the 1st and 5th percentiles). In between, however, there is a wide range of options for regulators and supervisors to consider (Figure 6.6).[31]

Figure 6.6. **Trade-off between potential retirement income (median replacement rate) and risk (replacement rate at 5th percentile)**



Source: Antolín *et al.* (2010).

StatLink http://dx.doi.org/10.1787/888932598873

Which default strategy to choose depends on the probability threshold established to assess risk. For example, risk adverse regulators or individuals might aim at investment policies that reduce the downside risk of extreme negative outcomes from DC plans in 99.5% of the cases, which may lead to very conservative investment policies, where the share of assets allocated to bonds is quite large (higher than 60%). For less risk adverse regulators or individuals, the risk threshold can be reduced, say to 80% and then the range of possible investment strategies increases as well as potential retirement income. It is important to stress that there is not a single correct trade-off; the choice depends on the specific country context and the risk aversion levels deemed acceptable therein. For countries where payments from DC pension plans are the main source of retirement income, the cost to the society of downside risks or unfavourable outcomes is much larger than in countries where they have other sources of retirement income (public pensions).

6.3.8. Establish life-cycle investment strategies as defaults

Investment strategies based on the life-cycle approach may be appropriate default investment strategies. Life-cycle investment strategies state that the amount of assets accumulated to finance retirement allocated to risky assets (*e.g.* equities) should fall as people get closer to retirement. The OECD work using a stochastic model (see Antolín and Payet, 2010) shows that:

- Life-cycle strategies provide protection for those close to retirement in the case of a negative shock to the stock market just before retirement, in particular for individuals who experience unemployment and who have medium to low growth in income.

- Among the life-cycle strategies, the one with a sharp decrease in equities in the last decade just before retirement performs best, at least when the shock occurs within one or two years before retirement.
- The positive impact of life-cycle strategies dwindles as shocks to equity markets occur further from retirement age.
- Life-cycle strategies also provide protection when contribution periods are short.

Indeed, the table below shows that life cycle strategies provide protection against negative equity market shocks. Table 6.5 presents estimates for the probability that life-cycle strategies provide higher retirement income than fixed portfolios (given the same age-weighted equity exposure) when a negative shock to equity markets occurs before retirement when there is uncertainty on investment returns, inflation, interest rates, unemployment, career real wage growth paths and life expectancy. The table also shows that for shorter contribution periods (*e.g.* 20 years as opposed to 40 years) the likelihood that life-cycle strategies provide a higher replacement rate when there is a negative shock to stock markets the year just before retirement is higher.

Table 6.5. **Estimated probability that pension benefits based on life-cycle strategies will be higher than those based on a fixed portfolio strategy for two different contribution periods**

	Entire random sample (10 000 obs.)		Negative stock market shock[1]	
	Contribution period		Contribution period	
Life-cycle investment strategies	20 years	40 years	20 years	40 years
Sharp decrease after age 55[2]	30.2	42.1	71	61.5

Note: Calculations assume a contribution rate of 5% over a 20- and a 40-year period. Results are from the OECD stochastic model with uncertain returns on investment, inflation, interest rates, life expectancy, unemployment and weighted average real wage growth – weighted by the probabilities of having high (42%), medium (55%) and low (3%) real wage growth.

1. The negative shock to equity markets is defined as an annual fall in the return to equities of 10% or more in the year just before retirement. The sample of cases in which a negative shock to equity markets of 10% or more happens is 15%. Antolín and Payet (2010) presents results when the shock to equity markets occurs two years before retirement, or in any of the five years before retirement.
2. The life-cycle portfolio is designed such that the age-weighted average exposure to equities during the accumulation period is equal to that of the fixed-portfolio exposure to equity, 65% in this case. The gliding path with respect to age is such that the initial allocation of 77% or 87% to equities (depending on contributing for 40 or 20 years, respectively), is kept constant during the most of the accumulation period and decreases to zero only in the last 10 years before retirement.

Source: OECD calculations.

StatLink http://dx.doi.org/10.1787/888932599348

Life-cycle strategies differ on their glide paths. OECD work suggests that life-cycle investment strategies with constant exposure to equities during most of the accumulation period that subsequently reduce it rapidly during the last 10 years before retirement seems to offer the best protection (see Antolín *et al.*, 2010). They are one of the more efficient life-cycle strategies in reducing the risk of sharp reductions in retirement income, in particular when a negative shock to equity markets occurs in the years just prior to retirement (as occurred in 2008). This result owes mostly to the *portfolio-size effect*: the biggest impact of negative-market outcomes occurs at the end of the accumulation period because this is when accumulated balances are at their highest level.

However, it essential to stress that life-cycle investment strategies are not a panacea. First, when using the stochastic model without focusing on extreme negative outcomes (Table 6.2) or looking at historical data and calculating hypothetical replacement rates (see below), it is unclear whether a fixed-portfolio or relatively straightforward life-cycle strategies perform better in terms of the probability distribution of replacement rates. Moreover, life-cycle strategies do not address the problem of volatility of retirement income resulting from market fluctuations or the problem of inadequate or low pensions.

Life-cycle strategies can be organised around a single fund or around several funds. The former are target date funds (*e.g.* as in the United States) in which the allocation to risky assets falls with age. In multi-funds or a life-styling funds system (*e.g.* Chile), each fund has different allocations to risky assets, with an upper and a lower limit to equity exposure, with the middle of the bracket as a possible default option. Individuals are shifted from one fund to the next according to their age. Multi-funds provide flexibility as people in each fund can have different exposures to risk depending on their risk tolerance parameter. Additionally, after a negative equity shock the multi-fund system with upper and lower limits allows for the exposure to equities to be increased and thus take advantage of a possible market rebound. Although this flexibility sounds good, the rationale behind a default strategy is exactly to avoid having people make those kinds of active management decisions that they are not prepared or willing to do.

Finally, the relative performance of investment strategies depends on the type of benefit during the payout phase. Using a stochastic model with different payout phases, life cycle strategies do best – measured in a risk-adjusted manner when risk is assessed by replacement rates in extreme situations (1st or 5th percentile) – when benefits are paid as life annuities but are less valuable when benefits are paid as programmed withdrawals. Dynamic strategies, in which rules link asset allocation to the performance of each asset class in each period of time, seem to work better with programmed withdrawals.[32] A mixed of life-cycle and dynamic strategies may be required when benefits are paid combining programmed withdrawals and deferred life annuities bought at the time of retirement. However, dynamic management strategies fail to add much value. Such strategies provide at best a marginal improvement in the trade-off between median replacement rate and replacement rate at the 5th percentile than life-cycle strategies, and they are much more complicated to explain to the public in general.

Life-cycle investment strategies are the safest bet when sharp drops in retirement income as a result of extreme negative outcomes are the main concern. Moreover, life-cycle investment strategies are easier to explain to the public in general and much easier to implement than more sophisticated investment strategies. One of the most challenging aspects of life-cycle strategies is setting an adequate investment glide path, including a starting and end allocation for equity investments. The choice of glide path will be affected by many factors, including the role of the DC plan in the overall retirement income system.

6.3.9. Combine programmed withdrawals with deferred life annuities indexed to inflation as the default option for the pay-out phase

The design of the payout phase needs to strike a balance between flexibility and protection from longevity risk. One of the main objectives of pension provision is to protect people from outliving their own resources – that is, to insure them against longevity risk. Protection from longevity risk is achieved through life-long pension benefits. Public PAYG-financed pensions and funded DB pension plans promise to pay a constant stream of

income through retirement, hence providing protection from longevity risk. In DC pension plans, individuals bear the longevity risk and only by using part or all of the assets accumulated in these plans to buy life annuities can they be insured against longevity risk.

Unfortunately, life annuities are illiquid and inflexible, and do not allow for bequests. They may also involve high intermediation or marketing costs and are generally perceived as low value for money in many countries. There are "psychological" reasons why people dislike annuities. They do not like to "give away" large amounts of money (annuity premiums are large one-off payments) for a small amount (payments are relatively smaller). Moreover, people tend to view annuity providers as institutions taking their money away. There is also the issue of insolvency risk. People wonder whether the institutions taking their money now for promised pension payments 20-30 years hence will be around over that time. They may think that they can manage their own money better.

The main alternative to buying an annuity is to draw down the accumulated funds gradually while leaving the remainder invested in the DC account. These so-called phased or programmed withdrawals (and lump-sum payments) provide full flexibility and liquidity to face contingencies (*e.g.* health care, pay down debt), and permit bequests. Programmed withdrawals also offer access to portfolio investment gains that traditional annuities fail to provide, although variable annuities offer access to returns from capital market investments.

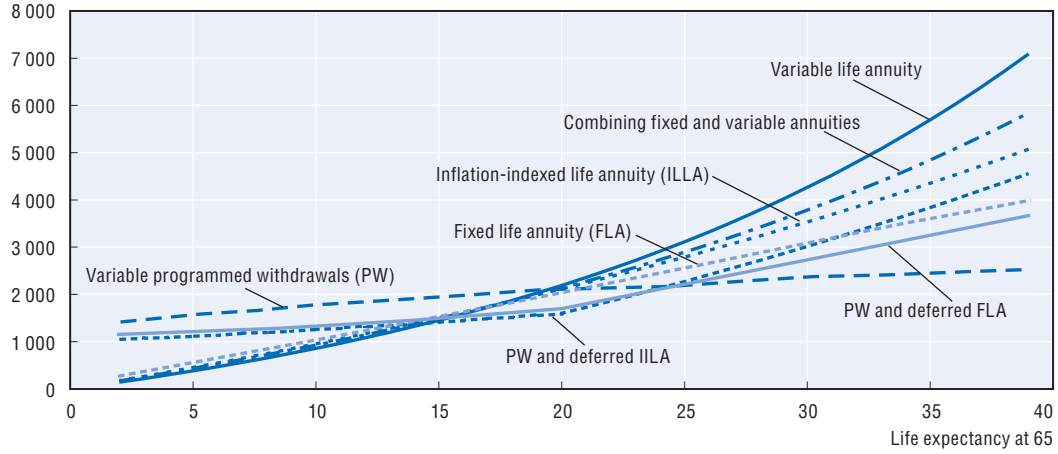
The key policy question to address, therefore, is which arrangement for the payout phase policy makers and regulators may promote or recommend. Despite the clear advantage of life annuities in providing protection from longevity risk, there are also strong arguments for people preferring programmed withdrawals. One key criterion for policymakers to consider is the overall structure of the country's pension system, as well as whether the DC pension plans are mandatory or voluntary.[33] The arguments for mandatory annuitisation are most compelling in mandatory DC systems that provide a large part of retirement income. Some degree of annuitization of balances accumulated in DC pension plans, at least as the default arrangement, may also be appropriate in voluntary DC systems in order to provide some insurance against longevity risk.

From the individual's perspective, the choice of arrangement for the payout phase depends on an age threshold. For example, calculations of total accumulated retirement income under several arrangements for the payout phase (Figure 6.7) show that those individuals who would live below a certain life expectancy at retirement, which determines an age threshold, would have higher accumulated retirement income with programmed withdrawals. Under programmed withdrawals, at the moment of passing away, balances remaining in each person's account go to their heirs. After that age threshold, life annuities become a better value. Therefore, as long as an individual's life expectancy is below the average life expectancy of his or her cohort or socio-economic group (used to calculate pension payments and annuity premiums), said individual would be better off with a programmed withdrawal.

However, individuals do not know whether they will live within or beyond their cohort's life expectancy. If fact, there is widespread evidence that most people underestimate their life expectancy, which is yet another reason why people shy away from buying annuities and instead take programmed withdrawals when offered the choice.

The age threshold depends not only on average life expectancy but also on other financial factors. The average life expectancy is the one corresponding to the individual's

Figure 6.7. **Accumulated retirement income for different payout arrangements according to life expectancy at 65**



Source: OECD calculations.

cohort or socio-economic group, which is used by providers of annuities and variable programmed withdrawals to calculate pension payments and annuity premiums. Accordingly, 50% of people may be better off with variable programmed withdrawals. Yet, other factors can shift the age threshold to the right, making the percentage of people better off with programmed withdrawals higher than 50%. The difference in returns between the equity-bond portfolio of variable programmed withdrawals and the bond-only of life annuities means that as the difference increases the age threshold will shift to the right. Higher inflation would also shift the age threshold to the right. Finally, higher amounts of assets accumulated at retirement also shift the age threshold to the right, thanks to the portfolio size effect of having access to portfolio investment gains in variable programmed withdrawals.

All the above suggests that there are strong incentives against taking up a life annuity at retirement. However, life annuities may need to be part of any default arrangement for the payout phase, depending on the overall pension system, as they provide insurance against longevity risk. Balancing these various risks, the main recommendations are:

Firstly, life annuities are insurance products but are sold as investment products. Life annuities are insurance and, therefore, the entire framework should be changed and focused on insurance for longevity risk. As insurance, one may argue that typical insurance products require small regular payments, while life annuities require a large one-off payment (money illusion). However, there is no particular reason why it should not be possible for individuals to buy life annuities by making small payments throughout the accumulation phase in which the fixed income component of the default life-cycle strategy consists of participations in life annuity products that accumulate over time.

Secondly, standard life annuities are best seen as part of a default arrangement for the payout phase. As life expectancy at retirement is unknown, the age threshold is uncertain. The annuitization of a minimum level of assets accumulated at retirement is advisable to provide protection from longevity risk at least as a default.[34] Among life annuities, variable life annuities look better than standard life annuities, as they provide access to portfolio investment gains (Figure 6.7 above). However, they raise concerns about sharp reductions in retirement income when extreme negative outcomes occur.

Thirdly, the main recommendation for a default arrangement for the payout phase is to combine programmed withdrawals with a deferred life annuity. This combination achieves a balance between protection from longevity risk, flexibility, liquidity, possibility of bequests, and access to portfolio investment gains. An attractive and potentially economical compromise would be to combine variable programmed withdrawals with a deferred life annuity bought at the time of retirement that starts paying at old ages (*e.g.* 85). The programmed withdrawal provides some flexibility and liquidity to face any contingencies, as well as access to potential portfolio investment gains, and the deferred annuity insures against longevity risk at a cost of only a relatively small portion of the assets accumulated in DC plans. Although, standard calculations of its cost suggest that it may be reasonable (15-20% of balances accumulated at retirement), there is a lack of international evidence on the existence of a market for these combined arrangements.[35] The true cost may be higher than standard calculations of premiums may suggest, as the deferred annuity would cover the longevity tail risk and providers may find it difficult to hedge this tail risk, in particular when there is a lack of suitable financial hedging instruments (see discussion below).

Fourthly, lump-sum distributions should be limited to a small part of the accumulated balance at retirement (*e.g.* at most 20%), except perhaps for very small accounts.

Finally, the structure of the payout phase may need to include protection from inflation. In some countries retirement income from DC pension plans may not always be indexed to inflation. The lack of inflation indexation could reduce the purchasing power of retirement income by as much as one third over a 20- year period. To avoid such important losses in purchasing power at old ages, retirement incomes from DC plans need to be indexed to inflation. Unfortunately, indexing retirement income to inflation requires a bigger saving effort. For example, contribution rates need to increase a little over 1 percentage point over a 40-year contribution period to have benefits indexed to inflation given a 20 year life expectancy at age 65. In this context the deferred life annuity in the combined arrangements may need to be indexed to inflation.

Policy proposals mandating partial annuitization of assets accumulated in DC pension plans can only be operational if there are providers and annuity markets function appropriately. However, there are many challenges facing annuitization, which include who the providers could be as well as demand and supply constraints in the market for annuities.

6.3.10. Promote cost-efficient competition in the annuity market

Countries should promote cost-efficient competition in the annuity market. For example, by allowing any financial institution to act as annuity provider, as long as they are sufficiently regulated and fair competition is guaranteed. In particular, solvency ratios should be relatively high to protect retirement income from default on the part of the provider.

In practical terms, life insurance companies are better prepared than other types of intermediaries to offer life annuities, as they have the technical capabilities, the expertise and, in theory, may be naturally hedged as they may operate in both sides of the market (life expectancy and mortality).

However, in some cases, life insurers may face problems in participating in the market for life annuities, which has the effect of reducing competition and increasing costs. One of the main arguments to explain this lack of participation relates to the problems in dealing

with longevity risk, in particular, the lack of financial instruments to hedge against longevity risk and the need to use well defined mortality tables so that provisions and capital put aside can be adequate. However, longevity risk can be managed in house through actuarial valuations and provisioning to withstand fluctuations.

Pension funds could also be providers of annuities in DC plans. This may help in smoothing out the transition between the accumulation and the payout phases and in mitigating the reputational risk to private pensions of insurers going bankrupt.

When pension funds pay benefits in the form of annuities, appropriate prudential funding regulations need to be in place to protect retirement income. These rules need to take into account the risks that pension funds are exposed to as well as the nature of benefit promises and other sources of financing and protection. In particular, pension plan sponsors – and in some cases members – may be ultimately responsible for any pension shortfall, and there may also be collective guarantee arrangements in place in case of sponsor insolvency. Moreover, any agreed "social contract" may allow *ex post* adjustment of benefits.

Alternatively, separate specialised financial institutions dedicated exclusively to the annuity business could operate in the market. Such specialised insurers offer the benefit of protection from solvency problems in other insurance branches, but they may lack the broad-based business needed to ensure sufficient scale and low costs.

Finally, a single entity or state annuity fund could provide annuities. This alternative is attracting interest among policy makers, though the issue of how to combine a state annuity fund and life insurance companies competing in the same market may need to be assessed further. In this sense, a state annuity fund should not crowd out private financial institutions and it should avoid reducing incentives to develop private markets. Countries with small or non-existent annuity markets could institute a centralised annuity provider, but should allow insurance companies and other providers to enter the market, guarantee full equal competition, and the role of the centralised annuity provider should dwindle down as the market develops.

6.3.11. Promote the demand for annuities

Annuity markets are fraught with problems posing a challenge to the recommendation of partial annuitization of assets accumulated in DC plans. Annuity markets face a myriad of demand and supply constraints that need to be addressed in order to promote annuitization.

On the demand side of annuity markets, changing the framing could promote annuitization. Annuities are often viewed as investment instruments and as such they may be quite unattractive. As investments, annuities are far from perfect, in particular when people underestimate their life expectancy and think it is below the average life expectancy of their cohort. The correct view of annuities is of course as insurance products, which are designed to protect people from outliving their resources; annuities also help to smooth out consumption as an individual moves from working life into retirement. Correcting individuals' perception of annuities, by changing the framing of annuities, may help foster increased demand.

Additional factors affecting negatively the demand for annuities include the crowding out from public pensions, tax disincentives to buying annuities; lack of adequate financial literacy and financial awareness of individuals; and the lack of innovative products that address some of the needs that potential annuity buyers may have, as well as bequest

motives and personal circumstances (*e.g.* family support, need to cover medical care expenses) that compel individuals to have precautionary savings. Taxes need to be examined to make sure that there are no incentives against buying annuities.

On financial education, there is a need to implement programs aiming at improving the financial literacy and financial awareness of individuals, as well as improving the qualification of pension and annuity intermediaries using, for example, certification programs

Another serious problem in the demand for annuities is the dichotomy between prospective annuitants' requirements and cost. Surveys always highlight that prospective annuitants want annuity products with several features and guarantees (*e.g.* access to stock market gains, bequests), and they also want annuity products that are not too costly. However, the more features and guarantees involved the more costly annuity products are. Hence, some innovative products combining these features and sharing costs may help in this regard.

Finally, annuity markets and prospective annuitants may benefit from innovative annuity products such as variable annuities that provide access to capital gains at retirement, reverse annuity mortgages that permit tapping into housing wealth, and products that combine pension annuity payments and long-term care coverage. However, design and regulatory issues need to be sorted out. For example, pension payment flows are constant and certain but health disbursements can be unpredictable and quite large. The market for variable annuities has been growing, in particular in the United States, as they allow people access to capital gains, which it is one of the advantages of programmed withdrawals. In theory, access to capital markets gains can also provide a hedge against inflation and potential losses in purchasing power.

6.3.12. Facilitate the supply of annuities by further developing risk-hedging instruments

On the supply side, annuity markets suffer problems of adverse selection affecting pricing, incomplete markets (*e.g.* lack of inflation protection, lack of exposure to equities), concerns with regulatory capital requirement for the risk involved, as well as the exposure to the uncertainty surrounding future mortality and life expectancy (*i.e.*, longevity risk), and the lack of adequate or enough financial instruments to help in hedging longevity risk.

Successful annuitization requires pension funds and providers of annuities to have at their disposal suitable mechanisms to manage longevity risk. This requirement includes the need for a better understanding of what is longevity risk, more appropriate modelling of longevity in actuarial valuations, and instruments to hedge longevity risk.

Longevity risk is the risk that future outcomes in mortality and life expectancy will turn out higher than expected and accounted for. Pension funds and annuity providers determine through actuarial valuations contribution rates or premiums and pension benefits. If the assumptions on mortality and life expectancy incorporated in those actuarial valuations fail to materialise and improvements in mortality and life expectancy turn out to be beyond what has been assumed, the liabilities of pension funds and annuity providers will be much larger than covered by reserves, which could affect their solvency.

Longevity risk affects individuals, pension funds, annuity providers and governments. As a result of the uncertainty about future mortality and life expectancy outcomes, individuals risk outliving their resources (assets accumulated to finance retirement) and

being forced to reduce their standard of living in old age. Pension funds, governments and annuity providers risk having to pay benefits for a longer period than reckoned in their actuarial assumptions, which they may not be able to afford.

Longevity risk comprises idiosyncratic and aggregate longevity risk. Idiosyncratic or individual specific longevity risk refers to the uncertainty or risk that an individual will live longer than expected given the average life expectancy of his/her cohort or socio-economic population subgroup. The aggregate or cohort longevity risk refers to the risk that an entire cohort will live longer than expected as a result, for example, of some medical advances or better dieting. Financial markets can address the idiosyncratic longevity risk by pooling risks, but they may find it more difficult to address aggregate or cohort longevity risk.

Pension funds and annuity providers can manage longevity risk in-house as part of their internal risk management systems. Pension funds and annuity providers can retain the risk and hold enough capital to withstand fluctuations. This arrangement has traditionally been facilitated by the actuarial valuation process. Longevity risk can be reduced by using appropriate models to estimate future improvements in mortality and life expectancy, for example, through stochastic models that allow probabilities to be calculated, which enable risks to be priced accordingly. In this context, the longevity risk will be the difference between the improvements in mortality and life expectancy assumed in the actuarial valuations and the actual improvements that occur in the future. Hence, the first step to manage longevity risk is to recognise its existence and to incorporate it in the actuarial valuations, using stochastic modelling to introduce future improvements in mortality and life expectancy. Furthermore, mortality and life tables should be updated regularly. Moreover, recognition of the long-term nature of longevity risk requires improvements to be incorporated for a long enough period (*e.g.* at least 50 years).[36]

Pension funds and annuity providers can also manage longevity risk using asset-liability management. Asset-liability management or liability driven investment (LDI) has been increasingly adopted by the pension fund industry. This approach tries to link asset allocation strategies to liabilities so that investment returns can match and outperform liability streams. For example, as longevity risk might increase pension liabilities and their duration, investments in long-dated bonds would become more attractive.

Pension funds and annuity providers can also use risk-sharing to manage longevity risk. Innovative products that link payments partially to life expectancy would allow all stakeholders to share longevity risk. Moreover, contributions determined in the actuarial valuations can also be partially linked to changes in mortality and life expectancy. These instruments may be quite useful in sharing, in particular, aggregate or cohort longevity risk.[37] However, risk-sharing may lead to an unequal distribution of costs and benefits between, for example, males and females, the sick and the healthy, or between current and future generations.

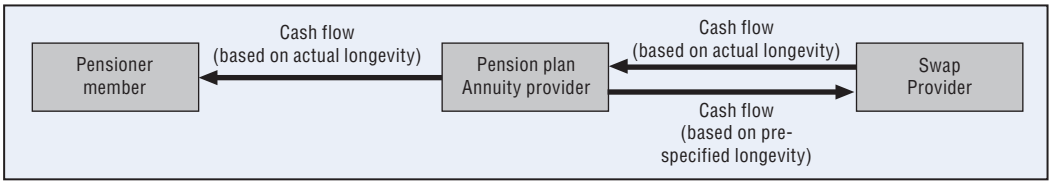
Pension funds and annuity providers can additionally remove some or all the longevity risk by transferring it to a third party. There are several mechanisms at their disposal currently being implemented in the market. These include pension buy-outs, pension buy-ins, longevity hedges and derivatives. Pension buy-outs (passing the entire scheme to a specialist insurer) and pension buy-ins (insuring the liabilities) are generally for defined benefit (DB) pension plans and in termination.[38]

Longevity hedges are contracts that reduce the exposure to longevity risk by transferring some or all of this risk to a third party. A longevity hedge is commonly

executed through a longevity swap. In a longevity swap, the entity buying the hedge (*e.g.* pension fund or annuity provider) pays a series of fixed amounts for the duration of the contract ("fixed leg") based on pre-specified mortality tables (q-forward contracts) or survivor tables (s-forward contracts) in return for receiving from the provider of the hedge a series of variable payments ("floating leg") that are linked to actual mortality (q-forward contracts) or survival rates (s-forward contracts) of pensioners or members.

Longevity hedges (or swaps) carried out so far have some important drawbacks. They are under-the-counter as they tend to use private longevity indices that are not fully publicly available (*e.g.* JP Morgan, Deutsche Bank) based on specific subpopulations of members or pensioners to allow pension funds and annuity providers to transfer all the longevity risk of those specific populations. Moreover, longevity swap contracts may have a duration that does not match to the long-term nature of longevity risk.

Figure 6.8. **Longevity swaps**



Longevity hedges (or swaps) can be constructed so that they transfer all the risk of a specific group of pensioners or members, or transfer only part of the risk. Bespoke longevity hedges allow pension plans or annuity providers to fully transfer all the longevity risk of members covered. The floating payment is linked to the actual lifetime of the specific group of members. These hedges are therefore only viable for large schemes, as a large group of members or pensioners is required to efficiently price the hedge.

Index-based longevity hedges transfer only part of the risk, providing protection against unexpected increases in longevity of a general population, and the scheme or annuity provider is left holding the specific longevity risk of its members. This residual risk of the actual experience of members or pensioners from the index is known as basis' risk.

Bespoke longevity hedges are a better hedge than index-based hedges, because they reflect the pension fund or annuity providers' liabilities more accurately. However, index-based hedges are easy to standardise, which makes them more tradable in the capital markets and, hence, more liquid and perhaps less costly. Index-based contracts could be the basis for derivatives – standardised contracts which exchange realised longevity for pre-specified fixed longevity, which can be traded over-the-counter.

A final instrument involving the transfer of all or part of longevity risk to a third party is a longevity bond. These are bonds whereby the coupons are linked to a longevity index. They provide partial longevity protection for pension funds and annuity providers buying them, but are not a full hedge against all the actual longevity risk. Longevity bonds unfortunately require much heavier funding requirements, making them rather expensive.[39]

All the above options to manage longevity risk, whether through in-house management or different approaches to transferring risks to a third party, are not mutually exclusive. They all should be part of a comprehensive approach to risk management.

However, among the different options to transfer risk to a third party only some have the potential to become a standard approach to managing such risk. For example, buy-outs and buy-ins are quite specific for DB and schemes in termination. Longevity hedges based on specific groups are over-the-counter and cannot be standardised. Index-based swaps by contrast have the potential to become one of the main instruments to partially transfer risk to third parties, once a standard longevity index is available. Longevity bonds also have potential, but unfortunately, longevity indexed bonds issued by private institutions may be too expensive until a market develops further.

Summing up, there are a number of possible policies to facilitate the supply of annuities. First, mortality and life tables should include stochastic forecasts of future improvements in mortality and life expectancy. The attached probabilities would allow for a better assessment of the degree of uncertainty and help to price risks accurately. Moreover, life tables should be updated continuously as new data comes along. Secondly, longevity risk could be managed through a combination of in-house management (*e.g.* through their actuarial valuations and holding reserve capital), some asset-liability matching, risk-sharing products and longevity hedges.

Pension funds and insurance companies need financial instruments in order to better hedge their liability risks (inflation, longevity, interest rates) and expand their roles as providers of pensions and annuities. In this context, index-based longevity hedges have the potential to be come standard capital market solutions to hedging longevity risk.

There is a clear role for governments to play in order to promote capital market solutions to hedging longevity risk and thus facilitate the supply of annuities. Governments could produce standard and reliable longevity indices by different socio-economic subgroups that would help the creation of standard longevity swaps (derivatives), making them more tradable, increasing liquidity and promoting over-the-counter instruments. National statistical institutes are the institutions with the largest wealth of information on mortality and life expectancy by socio-economic variables in each country.

Governments could additionally consider in certain contexts issuing longevity indexed bonds (LIB) and issuing very long-term bonds in sufficient quantities. Governments with low exposure to longevity risk through their social security or public pensions' balance sheets could easily issue longevity indexed bonds to kick start the market. However, governments with exposure to longevity risk in their balance sheets could as well, although some changes in the mandates of government debt management institutions may be required. Alternatively, governments could issue very long-term bonds to help pension funds and annuity providers to hedge longevity risk.[40]

6.4. Conclusion

This chapter has shown that much can be done to improve the design of defined contribution pension plans and to strengthen retirement income adequacy in these plans. Policy options include:

- Ensuring that DC plans are coherent between the accumulation and payout phases, and with the overall pension system.
- Establishing effective communication about pension plans and improving financial literacy.
- Encouraging people to contribute to pensions and for long periods, so that their DC pension plans will provide adequate benefits.

- Improving the design of incentives to save for retirement.
- Promoting low-cost retirement savings instruments.
- Establishing default life-cycle investment strategies to protect people close to retirement against extreme negative outcomes.
- Establishing a minimum level of annuitization as a default for protection against longevity risk, and combine programmed withdrawals with deferred life annuities indexed to inflation.
- Fostering the demand for annuities, facilitating the supply of annuities and encouraging cost-efficient competition in the annuity market. Changing the framing in which annuities are considered from investment instruments to insurance products could foster the demand for annuities, while further developing risk-hedging instruments could facilitate the supply of annuities.

Notes

1. The replacement rate is generally defined as retirement income relative to final salary. Although, sometimes it is calculated relative to career average wages instead of final salary.
2. Antolín (2009) and Antolín and Payet (2010) show situations in which replacement rates may not be appropriate indicators.
3. Antolín (2009) shows that purchasing power can fall as much as one-third in 20 years after retirement if benefits are not indexed to inflation.
4. The (un-weighted) OECD average replacement rate from public pensions is 42% (OECD, 2011). Therefore, for an overall replacement rate of 70%, private pension plans may need to provide a 30% replacement rate.
5. Antolín and Payet (2010) describes the stochastic model used to support the results provided in this chapter. The Chilean Pension Superintendency (see Berstein *et al*., 2010) also carries out such a modelling exercise.
6. *www.oecd.org/dataoecd/16/33/34018295.pdf*.
7. *www.oecd.org/dataoecd/7/17/35108560.pdf*.
8. *www.oecd.org/dataoecd/4/21/40537843.pdf*.
9. There are other reasons explaining the shift from DB to DC plans such as the need to reduce the burden on employers. In DB pension plans any shortfall due for example to underperformance of investments or longevity changes is the responsibility of plan sponsors, generally employers. In DC pension plans the individual bears all the risks and is responsible for any shortfall. Additionally, the shift from DB to DC has also been implemented to reduce costs to sponsors or employers. In most cases, employers do not contribute to DC plans as much as they had to contribute to DB pension plans.
10. In a perfect world given the promised pension benefits, actuarial calculations will determine the contribution rate. However, in the real world the parameters used in the actuarial calculations change but the promise remains constant, breaking the link between contribution and benefits.
11. The rate of growth of contributions to achieve a certain replacement rate falls as life expectancy increases. For example, in Table 6.1 falls from 1.65 to 1.25.
12. For example, the average annual nominal return for a portfolio invested 60% in equities and 40% in government bonds taking into account continuous annual contributions from 1970 to 2010 (40 years) and using historical returns for the same period in equities (including dividends) and long-term government bonds, would have been 7.3% for France and 7.6% for the United States. This period includes the crisis of 1973-74, 1979-81, 1990-91, 2000-01, and 2008-2010.
13. Assuming potential real GDP growth of 2.5%, inflation of 2% and an equity premium of 4% (the equity premium over the last 110 years has been around 5.5% for countries such as France, Germany, Japan and the United States, according to Credit Suisse Global Investment Returns Yearbook 2011), a portfolio invested 60% on equities and 40% on long-term government bonds

would yield an average annual return of 6.9% (4.5%*40% + 8.5%*60%). Taking the EU GDP growth projections of 1.4% for EU27 over the period 2010 to 2060 (see 2012 EPC Projections of Age Related Expenditure), and assuming a lower equity premium of 3%, average returns on a 60-40 portfolio would be around 5.2% (3.4%*40% + 6.4%*60%).

14. There is also an argument to have contributions falling as people age: the power of compound interest. Thanks to the compound interest formula lower contributions early on in one's working life bring in the same amount of accumulated savings at retirement than higher contributions later on. In this context, some of the communication and financial education programmes aim at making people realise that the earlier they begin contributing to retirement the less they need to contribute annually.

15. The main thrust of the analysis (*i.e.,* large increases in contribution rates at people ages) is validated when using a life-cycle investment strategy with historical US equities and government bonds returns.

16. See Chapter 6 in Thaler and Sunstein (2008).

17. See Chapter 4 in this volume for a detailed description.

18. Membership of funded pension plans is mandatory in Australia, Chile, Estonia, Iceland, Israel, Mexico, Norway, Poland, Slovak Republic, Sweden and Switzerland. However, self-employed as well as employees earning very low income are not subject to the mandatory rule in Australia and Switzerland. In Australia, only employers are obliged to contribute for employees to funded pension plans. In addition, Denmark, Netherlands, and Sweden have quasi-mandatory occupational pension plans, achieved via broad collective agreements between social partners. New Zealand, Italy and the United Kingdom have automatic enrolment.

19. For instance, Madrian and Shea (2001), and Choi *et al.* (2002) have shown that participation is higher at firms where employees are automatically enrolled unless they signal their wish to opt out.

20. See Chapter 4 for details.

21. Most OECD countries use tax incentives to encourage retirement savings in funded pension plans. The most common approach is to deduct contributions from the income tax base, to exempt from taxation or tax at a preferential rate accrued returns on investment, and tax withdrawals or pension benefits arising from assets accumulated in pension plans as income. These tax arrangements are commonly referred to as "exempt-exempt-taxed" or EET schemes. The tax incentive is the exclusion of investment income from income tax as long as benefits are taxed at the same rate that exempt contribution would have been.

22. The analysis focuses on which tax incentives may increase workers' contributions and participation in DC pension plans. The assessment of the tax incentive is done according to different income levels given the bracket structure of income tax, the progressivity of the income tax. The tax incentive is measured as the change in tax payments relative to pre-tax income stemming from each of the different forms of introducing tax incentives.

23. There are different approaches to introduce tax incentives for saving for retirement by exempting contributions from the income tax. Exempting contributions from the income tax can take the form of deductions from the income tax base (tax deductions) or deductions on tax due (tax credits). Alternatively, governments (or employers) could match contributions to private pension plans in order to encourage retirement savings. In a standard income tax form people first report all sources of earned income, to which one can apply certain deductions or exemptions (*e.g.* charity). The result of deducting these exemptions from income is the taxable income. This taxable income is the income to which one has to apply the tax rates of each of the income brackets to determine the tax due. For example, given two tax brackets (EUR 0 to EUR 1 000 taxed at 10%; and EUR 1 000 to EUR 2 000 taxed at 15%), a person with EUR 1 500 taxable income would have to pay EUR 175 ($1\,000 \times 0.1 + 500 \times 0.15$), an effective tax rate of 11.67%. Additionally, there are some tax credits to the amount of tax due (*e.g.* credit per child). Deducting the tax credits from the tax due determines the amount of tax to pay.

24. The interaction between income levels, tax deductions and tax brackets could produce spikes in the tax incentive profile depicted in Figure 6.4 when tax deductions shift tax payers to lower tax brackets.

25. Chapter 4 on coverage shows that coverage is higher for high income people. Hence, policy should focus on increasing coverage for mid- to low income individuals.

26. Matching contributions enable certain groups to be targeted. For example, governments can match contributions only for women, the young or low income individuals (*e.g.* Chile). Matching

contributions are also common in some occupational pension plans (*e.g.* 401(k) plans in the United States), where sponsoring employers match the contribution made by employees up to a certain percentage of the worker's salary.

27. A matching contribution may not be exactly a tax incentive. However, it can be assessed as the percentage change in tax payments (assuming the match is like a tax rebate) relative to pre-tax income.

28. Determining an "adequate" level of fees is country specific, and depends on a variety of factors. However, as a general rule, there is a strong case for investigation and possible government action when total fees surpass 1% of assets under management in an established and broad-based DC pension system.

29. See Chapter 5.

30. Those with DB pension plans would tend to choose different investment strategies, generally more risky, than those with DC pension plans as the main source to finance retirement.

31. Antolín *et al*. (2010) describes in detail the stochastic model and the full analysis.

32. Investment strategies can be *passive*, which are rule based and defined in advance (*i.e.,* rules are established at the onset), or *active*, which are based on the discretion and expertise of asset managers. Within passive investment strategies one could distinguish between *deterministic strategies* (with rules linking asset allocation to external factors such as age) and *dynamic strategies* (with rules linking asset allocation to the performance of each asset class in each period of time).

33. This overall and internal coherence of the payout phase was discussed at the beginning of the chapter.

34. Blake *et al*. (2010) in the context of ending mandatory annuitization in the UK argues that minimum annuitization is difficult to implement in practice when coupled with means-tested arrangements as it will be individual specific. A general or standard minimum level may be easier to implement in practice.

35. Evidence from Chile seems at first glance not to bear well for this recommendation. This combined arrangement exists in Chile as an option for the payout phase, but there is no demand for it. The lack of demand may have more to do with the fact that while there is a requirement for providers to offer quotes for life annuities and programmed withdrawals to people reaching retirement, they are not required to provide a quote for the combined arrangement programmed withdrawals – deferred life annuity. To get a quote people has to request it, but people may not be aware of this option.

36. Longevity risk is a very long-term risk. For example, when buying an annuity at age 60 if an individual were to live 10 years beyond his/her cohort's average life expectancy (say age 85), longevity risk covers 35 years. A member joining a pension fund at the start of his/her career (say age 25-30) will be adding 65 years of longevity risk.

37. The Dutch collective DC pension system is a specific application of this approach of risk-sharing among stakeholders, in particular the risk-sharing between current and future generations (see Steenbeek, and Van Der Lecq, 2007).

38. Annuity providers can also remove all the longevity risk by transferring it to a reinsurer.

39. The only longevity bond issued by a private institution the EIB/BNP bond in 2004 was undersubscribed as it was thought to be expensive, and it was based on a cohort of English and Welsh males aged 65 in 2003, making the basis risk quite large.

40. Current interest costs of issuing long-term government bonds for certain OECD countries are very low.

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