Pensions at a Glance 2021
OECD and G20 Indicators

Chapter 2

Automatic adjustment mechanisms in pension systems

The chapter describes automatic adjustment mechanisms in mandatory pension schemes in OECD countries. About two-thirds of OECD countries employ such mechanisms, including notional defined contribution (NDC) schemes, links of the statutory retirement age to life expectancy, benefit adjustments to changes in life expectancy, demographic ratios or the wage bill, and balancing mechanisms. The chapter discusses what automatic adjustment mechanisms can and cannot do, as well as possible alternative policies. AAMs can be useful tools to prevent pension schemes from becoming increasingly unsustainable as populations age. Finally, it proposes some guidelines for designing and implementing automatic adjustment mechanisms based on OECD countries' experiences with revising or overturning such mechanisms. This includes the need for wide political agreement on their introduction and avoiding mechanisms that reduce pension benefits in payment in nominal or real terms.

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Introduction

Pension systems are a crucial element of social protection for older people. They are designed to provide individuals with an income in the (distant) future, which makes them susceptible to uncertainties surrounding demographic and economic developments. How can pension adequacy be upheld if the evolution of wages and prices over the next decades is unknown? And how can financial sustainability of pension systems be ensured in the long term in light of population ageing with an increasing ratio of pensioners to contributors?

In the face of demographic, economic or financial trends, policy makers can choose not to act and accept the negative consequences these trends might have for financial sustainability or for the adequacy of the pension system. Alternatively, they can adjust pension parameters. These adjustments can be discretionary, by undertaking regular legislative action as circumstances change. Or, changes can occur automatically by setting rules about how pension parameters should be adjusted. Even though automatic rules cannot eliminate all the uncertainty, this last option can be attractive to policy makers as, while for example the precise extent of future ageing trends is unknown, the broad impact of how a given demographic evolution affects the pension system is typically well understood. Moreover, automatic rules are one way to better include future generations who have neither a vote nor a voice today.

Automatic adjustment mechanisms (AAMs) refer to predefined rules that automatically change pension parameters or pension benefits based on the evolution of a demographic, economic or financial indicator. They can protect pensions from uncertainties: pension indexation can protect pension adequacy against current and future inflation trends, and, more generally, automatic adjustments to benefits, contribution rates and retirement ages can serve various objectives. This chapter provides an overview of why AAMs came into being and what they look like, as well as of what they can and cannot achieve.

About two-thirds of OECD countries employ some form of AAM in mandatory or quasi-mandatory pension schemes. Six have notional defined contribution (NDC) schemes. Seven countries adjust qualifying conditions for retirement to life expectancy, and six adjust benefits to changes in life expectancy, demographic ratios or the wage bill. Finally, seven countries have a balancing mechanism.

As population ageing is the result of several demographic trends, several AAMs may be required to reach financial sustainability in the pension system, with each AAM linked to one specific demographic evolution. Increases in life expectancy should at least partially be offset by increasing the statutory retirement age, as this protects both adequacy and financial sustainability of the pension system. A supplementary correction is also likely to be needed to adjust for changes in the size of the population contributing to the pension system, thus determining its revenues. Moreover, those adjustments might not be sufficient to reach or maintain financial balance over time, and hence a balancing mechanism may be needed.

Whether to make adjustments to pensions, contributions or retirement ages depends on a wide array of factors, and is fundamentally the subject of democratic debate for both discretionary changes and automatic adjustments. When putting an AAM in place, choices for which pension parameters to adjust depend among others on their initial level and people’s preferences. However, some AAMs introduced at a time of crisis to restore financial sustainability – meaning that measures are needed irrespective of how some indicators will develop – might be questioned once the economy recovers. Hence, AAMs are not a substitute for bold discretionary measures in a financially unbalanced pension scheme. It is therefore important to distinguish changes that should take place in any case from those that are conditional to the evolution of circumstances in order to fulfil agreed objectives.

The **main findings** of this chapter are the following:

- Automatic adjustment mechanisms (AAMs) protect pension systems from demographic, economic and financial uncertainties affecting pension adequacy and/or financial sustainability.
- While AAMs emerged as a tool to uphold pension adequacy through wage or price indexation, there has been a shift in focus over the last decades towards maintaining financial sustainability.
- As AAMs are conditional on a changing indicator, they reduce the risk of under- or over-shooting the mark compared to discretionary adjustments aiming to reach the same target. Uncertainty can further be reduced through procedures smoothing the adjustments over several years.
- Compared to the alternative of discretionary changes, AAMs can be designed to generate changes that are less erratic, more transparent and more equitable across generations.
- AAMs reduce the political cost of maintaining or improving financial sustainability of a pension system as well as the need for frequent pension reforms.
- Since AAMs are meant to operate in the medium or long term, it is critical that they remain politically sustainable. This can be reached through wide political support for their introduction and by designing mechanisms that avoid harsh adjustments.
- As for discretionary changes, AAMs have distributional consequences and their design should be subject to democratic debate. Once AAMs are in place, policy makers maintain full control over the development of pensions and can intervene if they deem the triggered adjustments undesirable.
- AAMs are meant to adjust for future trends and are not a substitute for bold discretionary measures in a financially unbalanced pension scheme. Countries in that situation should ideally have a wider reform plan consisting of discretionary steps that restore financial balance and of a set of AAMs that can in particular deal with ageing trends. If measures have not been taken to ensure a sound pension system, the AAMs used to restore financial balance are likely to be overturned if they lead to nominal or real losses in retirement income or too rapid increases in the retirement age.
- Automatic adjustments of pension parameters are unlikely to be sufficient to meet the main objectives of the pension system. In particular, they need to be complemented by an automatic balancing mechanism which aims at ensuring a balanced budget of the pension scheme.
- About two-thirds of OECD countries have at least one AAM in place. Mechanisms include those embodied in notional DC (NDC) schemes (6 countries), links of the statutory retirement age to life expectancy (7 countries), benefit adjustments to changes in life expectancy, demographic ratios or the wage bill (6 countries), and balancing mechanisms (7 countries). In funded DC (FDC), trends in life expectancy do not affect pension finances by design, but retirement-income adequacy may be weakened.
- Countries with no AAM are: Austria, Belgium, the Czech Republic, France, Hungary, Ireland, Israel, Korea, New Zealand, the Slovak Republic, Slovenia, Spain, Switzerland and Turkey. However, some of these countries have some medium-term plans to change pension parameters based on a set timetable, i.e. adjustments are not conditional on change in an indicator even though they were planned based on ageing projections. The Czech Republic and the Slovak Republic will continue to raise the retirement age until 2030 while France will extend the contribution period required for a full pension until about 2035.
- Sweden and Finland have the most effective AAMs. Sweden combines NDC pensions and a balancing mechanism to ensure solvency, and plans to introduce a link between retirement age

and life expectancy. Finland adjusts to changes in life expectancy in a DB scheme, by changing future retirement ages by two-thirds of changes in life expectancy and by adjusting new pensions. Finland supplements these with a balancing mechanism adjusting contribution rates if needed.

- Both Estonia and Italy account for changes in the size of the working population through adjusting benefits to changes in total contributions and GDP, respectively, while the statutory retirement age is linked to life expectancy. However, Italy has developed a temporary workaround for retirement age increases by facilitating early retirement without actuarial adjustments (Chapter 1). The German balancing mechanism adjusts to the ratio of pensioners to contributors through adjustments of both pensions and contribution rates.
- Backstop mechanisms in the Canada Pension Plan ensure a financially balanced pension system while explicitly prioritising a political solution in case of a deficit: the automatic balancing mechanism is only triggered if policy makers cannot agree on an alternative set of interventions.

This chapter is structured as follows. The next section briefly presents what AAMs are, which purposes they serve and how they came about. Some common criticisms of AAMs are dealt with in this section as well. The subsequent section delves into different types of AAMs in OECD countries and provides an in-depth overview of the mechanisms in place and their main characteristics. The fourth section discusses the limitations of AAMs in terms of their design and the politics surrounding them, as well as possible alternatives. The final section highlights the advantages of AAMs, and sets out some guidelines for their design and introduction to improve their chances of succeeding.

Automatic adjustment mechanisms: objectives and common criticisms

Automatic adjustment mechanisms (AAMs) in pension systems refer to predefined rules that automatically change pension parameters or pension benefits linked to the evolution of a selected indicator. Hence, rules regularly changing pension parameters without adjustment to an indicator, such as a one-month increase in the retirement age every year, are not considered as AAMs in this chapter. The indicators used in these AAMs can be demographic (e.g. life expectancy at a given age), economic (e.g. wage or wage-bill growth) or financial in nature (e.g. funding balance), or a combination of those. The mechanism can affect benefit levels, contribution rates and/or the statutory retirement age. 'Automatic' means that the parameters or the benefits are adjusted in accordance with a predefined rule when the indicator changes or crosses a critical threshold without the need for discretionary decisions or political interventions. While fully automatic mechanisms require no legislative intervention, some others can be classified as 'semi-automatic' or 'soft' mechanisms (Vidal-Meliá, Boado-Penas and Settergren, 2009[1]): in that case, the changes they trigger require parliamentary confirmation. Finally, others function as a backstop triggering a predefined set of adjustments in case no political agreement can be reached on an alternative way to improve pension finances – such backstops are needed as a disciplining device to help take difficult decisions –, which could be classified as automatic backstop mechanisms (the next section provides more details).

Objectives of automatic adjustment mechanisms

AAMs help insulate pension systems from the impact of a changing and uncertain environment, and protect pension benefit levels or pension finances from changing demographic and economic circumstances. While AAMs come in different forms and with different goals, one common purpose is to reduce the impact of uncertainties affecting pension systems, including the future development of inflation, life expectancy and financial returns. In pay-as-you-go (PAYG) systems financial uncertainties also arise from trends in the ratio of the number of contributors per retiree, which in turn depend on changes in longevity, fertility rates, employment and migration. AAMs avoid that pension adequacy or the financial sustainability of the pension scheme is undermined as a result of these uncertainties by adjusting pension parameters.

AAMs cover a wide range of pension policy areas. Indexing pensions in payment and rules to uprate past wages when calculating pension benefits reduce uncertainty surrounding the purchasing power of pensioners. Other AAMs, such as automatic balancing mechanisms, aim to ensure solvency or improve financial sustainability, reducing uncertainty surrounding the pension system's capacity to fulfil its future commitments. Links between the statutory retirement age and life expectancy can serve a wider set of goals, including financial sustainability, pension adequacy, intergenerational equity and higher labour supply.

AAMs can reduce the political cost of improving financial sustainability. By providing a default scenario that adjusts some pension parameters, they increase the required political efforts of those who want to deviate and potentially undermine sustainability (Bosworth and Weaver, 2011[2]): as AAMs reveal the trade-off between short-term interests, such as contribution and benefit levels, and long-term financial sustainability, the long-term consequences of pension policy interventions become much clearer if AAMs have to be overturned. Instead of pleading for interventions improving financial sustainability, AAMs result in policy makers having to legitimise interventions negatively impacting sustainability – not only towards their electorate, but for example also towards the capital markets that might respond adversely to abandoning commitments to financial sustainability. Hence, AAMs reduce the asymmetry in ease with which policy makers spend surpluses compared to the difficulty they face to reduce deficits in the pension system (Diamond, 2004[3]). By reducing the frequency of the need for interventions and by making decisions that deviate from the mechanism – whether interventions negatively affecting financial sustainability or, though less likely, harsher reductions in pension adequacy than needed to maintain financial sustainability – more politically costly, AAMs reduce uncertainty surrounding future changes in the pension legislation. Moreover, if AAMs are consistently applied, they can also contribute to maintaining or restoring trust in the pension system by providing long-term financial sustainability and/or upholding pension adequacy.

Development of automatic adjustment mechanisms

AAMs in pension systems have existed since the 1930s, initially as pension indexation, i.e. increasing pensions automatically in line with price or wage increases in order to sustain pension adequacy. Pensions were introduced from the late 19th century, and when, decades later, concerns rose about the long-term purchasing power of pensions, pension indexation emerged (Fernández, 2012[4]). Initially benefit increases were discretionary, meaning that the value of a pension depended on economic and political cycles. In order to reduce uncertainty and improve social sustainability, Denmark introduced the indexation of pensions in payment to prices in 1933, followed by France after the Second World War and most other OECD countries in the following decades. Indexation of pensions to average wages was first introduced in the Netherlands in 1956, followed by Germany the year after. Periods of high inflation encouraged countries to introduce indexation mechanisms, in particular the high inflation rates following the oil crisis in the 1970s (Hohnerlein, 2019[5]). Moreover, pension indexation was supposed to reduce class conflict by avoiding recurring political discussions on revaluing pensions (Fernández, 2012[4]). By accounting for inflation and removing the need for political agreement to maintain the purchasing power of pensioners, indexation provided certainty through offering older people a predictable real income stream.

With population ageing resulting in increasing concern about the financial sustainability of pension systems, several countries adjusted their pension indexation rules to generate savings. Some countries that were previously at least partially indexing pensions to wages moved towards price indexation; others made indexation of pension benefits conditional on economic metrics other than consumer prices or average wages, such as the growth in the total wage bill or GDP. In this way, indexation took into account changes in the size of the working population. Germany, for example, adjusted pensions to the ratio of pensioners to contributors and Sweden introduced an adjustment to financial balance of the system, defined as the ratio of future pension expenditures to future revenues. Several countries are linking benefit levels or statutory retirement ages to changes in life expectancy. Finally, some countries completely changed the structure of their pension systems and moved away from defined benefit pension schemes to defined contribution schemes, both funded and notional, which include some forms of automatic adjustments (see below).

Common criticisms of automatic adjustment mechanisms

AAMs have been presented as ‘depoliticising’ pension policy (Fernández, 2012[4]; Vidal-Meliá, Boado-Penas and Settergren, 2009[1]) as political interventions in pension management would be less necessary. However, implementing an AAM is a highly political process balancing interests of different stakeholders and allocating risks, which in turn have implications on who bears which risks. Both setting objectives for AAMs and deciding which parameters to adjust require open political debate as they have important distributional implications. Policy makers, of course, maintain the power to change the AAM if they no longer deem its outcomes desirable, confirmed by the frequent changes observed in pension indexation rules over time (Chapter 1). Several countries introduced AAMs more recently and then suspended their implementation or even removed the mechanisms altogether, which shows that it is not always politically easy to keep AAMs in operation once they have been introduced.

AAMs, such as those linking benefit levels at the moment of retirement to life expectancy in old age, are sometimes criticised because with rising life expectancy they automatically reduce replacement rates at a fixed age, and thus could be seen as improving financial sustainability at the expense of retirement income security. While that argument might be true, it misses the fact that if no additional financial resources can be allocated to pensions, upholding the replacement rate will require increasing the pension age or the contribution levels in order to keep the system financially sustainable. This might generate more insecurity, especially if these changes are discretionary, with potentially some erratic timing and magnitude of adjustments. Thus, AAMs should not be criticised against the scenario of no policy change, which is not credible, but should rather be assessed against a sustainable policy alternative. That is, the challenges driven by increasing longevity need to be addressed in any case through a parametric change, whether automatic or discretionary.

The no-policy-change scenario, maintaining the same promises at the same retirement age while keeping the same contribution rate, is likely to result in financial imbalances that will ultimately entail uncertainty about pension adequacy: governments cannot guarantee that pension levels will be sustained in a financially unsustainable system. At some point, as happened in fact to various countries facing intense financial pressure, adjustments need to take place, and they may then be made hastily, be more erratic, abrupt and potentially inequitable across various groups than what carefully designed AAMs, decided after a broad consultation, could deliver.

It should, however, be noted that while AAMs can improve pension finances, they might not, depending on their design, be sufficient to provide financial sustainability in the long term, and some might even be difficult to sustain politically over time. For instance, by fixing the amount of years cohorts can expect to live in retirement, as is the case in Denmark, the share of adult life spent in retirement will fall as life expectancy increases, which raises questions of intergenerational justice. On the other hand, AAMs can also result in a better relative income position of older people over time. The UK’s triple-lock indexation, adjusting pensions to whichever is the highest of three options – inflation, wage growth or 2.5% –, might improve the situation of pensioners relative to workers while increasing pension expenditure.[1] These measures change the status quo, with some distributive implications.

One criticism of AAMs refers to the unequal impact they may have within generations on different social groups as they are linked to average and aggregate indicators. This is particularly a concern regarding links between the retirement age and life expectancy and is discussed in greater detail below (in the section on Adjustment of the retirement age to life expectancy). This potential criticism actually extends beyond AAMs to pension policy more generally, as even fixed pension parameters such as a common retirement age for everyone may produce unequal outcomes.

Types of automatic adjustment mechanisms

Automatic adjustment mechanisms (AAMs) come in a variety of forms. Table 2.1 provides a summary of AAMs in place in OECD countries, with details provided throughout the section. As this chapter hones in on AAMs related to mitigating the impact of demographic changes, 'pure' wage or price indexation or a combination of both is not included here, but is discussed in Chapters 1 and 3.

About two-thirds of OECD countries employ at least one type of automatic adjustment for at least one of the (quasi-)mandatory components of their pension systems. The countries without any AAM are Austria, Belgium, the Czech Republic, France, Hungary, Ireland, Israel, Korea, New Zealand, the Slovak Republic, Slovenia, Spain, Switzerland and Turkey. None of the non-OECD G20 countries currently has an AAM.

Defined contribution (DC) schemes adjust pension benefits to demographic and economic changes in several ways (see below). Twelve OECD countries have mandatory or quasi-mandatory funded DC (FDC) schemes and six operate notional or non-financial DC (NDC) schemes. In addition, seven countries adjust qualifying conditions for retirement to life expectancy, and six adjust benefits to changes in life expectancy, demographic ratios or the wage bill. Finally, seven countries have a balancing mechanism.

Most of these mechanisms are fully automatic, while some are semi-automatic as each adjustment requires political approval in order to be activated. One scheme (Canada) could be described as an automatic backstop mechanism: when the contributory public pension plan is estimated to be financially unsustainable, this triggers a political process and the back-up adjustment is only automatically applied in the absence of a political agreement on an alternative solution. This section presents these different adjustment mechanisms and discusses similarities and differences in how countries have been operationalising the mechanisms.

Funded defined contribution schemes

In an FDC scheme, retiring individuals can draw the money accumulated in their account. This can take various forms, from lump sums to annuities; the latter are priced taking into account expected mortality rates: the longer the life expectancy, the lower the value of the pension annuity, thus automatically including an adjustment of pension levels to life expectancy. Retirees choosing a lump sum will have to manage their pension assets throughout their remaining life themselves. Hence, FDC schemes with lump sum withdrawals by definition allocate the risk of increasing life expectancy to pensioners as accumulated pension assets have to cover longer average retirement periods at a given retirement age, and pensioners have to account for this when withdrawing their pension assets. Moreover, the individual retiree and not the pension provider is exposed to longevity risks, i.e. to the risk of living longer than projected on average and of consuming all the assets.[2] Programmed withdrawals fall in between these two polar cases, mixing lump sums and annuities.

An FDC pension system is thus financially sustainable in the face of economic fluctuations and demographic trends as no pension promise is made until a person starts drawing an annuity upon retirement. Economic and financial shocks as well as demographic changes affect FDC pensions through the realised return on investment of the pension fund. While financial sustainability is ensured in FDC schemes – unless pensions are paid out as annuities and mortality rates are consistently overestimated, resulting in the annuities being mispriced –, pension adequacy might be at risk without further automatic adjustments as increases in longevity then translate into lower retirement income. The pension replacement rate is likely to fall gradually if the minimum age to draw the FDC pension

Table 2.1. **Automatic adjustment mechanisms in mandatory pension schemes**

AAMs mitigating the impact of demographic changes in mandatory pension schemes in OECD countries

	Funded defined contribution (FDC)	Notional defined contribution (NDC)	Retirement age linked to life expectancy	Benefits linked to life expectancy, demographic ratios, wage bill or GDP (incl. sustainability factors)	Balancing mechanism
Australia	A				
Austria					
Belgium					
Canada					B
Chile	A				
Colombia	A				
Costa Rica	A				
Czech Republic					
Denmark	A		S		
Estonia	A		A	A	
Finland			A	A	A
France					
Germany					A
Greece		A [a]	A	A	
Hungary					
Iceland	A				
Ireland					
Israel					
Italy		A	A		
Japan				A	
Korea					
Latvia	A	A			
Lithuania				A	
Luxembourg					S
Mexico	A				
Netherlands [b]			A		A
New Zealand					
Norway	A	A			
Poland		A			
Portugal			A	A	
Slovak Republic					
Slovenia					
Spain					
Sweden	A	A			A
Switzerland					
Turkey					
United Kingdom	A				
United States					A

Note: A = fully automatic adjustment; S = semi-automatic adjustment (adjustment requires political approval each time in order to be activated); B = automatic backstop mechanism (a political process is triggered and the back-up adjustment is only automatically applied in the absence of a political agreement on an alternative solution). [a] The NDC scheme in Greece applies to auxiliary pensions, which account for 12% of total public pension expenditure. As of 2022, the auxiliary pension for new entrants in the labour market will build up as FDC instead of NDC; workers younger than 35 will be able to join the FDC scheme voluntarily. [b] The Dutch Pension Agreement foresees a transition from DB to DC occupational pensions by 2027, but this has not been legislated yet.
Source: OECD based on information provided by the countries.

and/or the contribution rate are not increased as life expectancy increases. Without an automatic link between life expectancy and retirement age, workers would have to decide themselves to postpone retirement in order to uphold pension adequacy. As many people tend to retire as early as possible or fail to correctly estimate their future financial needs (Davidoff, Brown and Diamond, 2005[6]; O'Dea and Sturrock, 2018[7]), counting on individuals' own decisions to delay retirement may not work for many. Hence, even in FDC schemes, either the minimum retirement age or pension contributions should be linked to life expectancy to help achieve adequate pensions over time.

Notional defined contribution schemes

NDC schemes are modelled after FDC schemes and hence share many of their characteristics, but are financed on a pay-as-you-go (PAYG) basis. Pension accounts accumulate as individuals pay contributions at a set contribution rate and interest is credited to the account with a notional rate of return. At retirement the account value is transferred into an annuity, based on a conversion formula that takes into account life expectancy at retirement (or more generally mortality rates in old age) in a very similar way to that of FDC schemes. However, unlike in an FDC scheme these accounts are notional: the contributions of active workers are used to pay the pensions of current retirees instead of being saved in individual accounts.

NDC schemes are meant to automatically adjust pension benefits to changes in life expectancy through both the conversion formula (directly) and the notional interest rate (indirectly), and the financial balance of NDC pensions is in principle immune to longevity trends. In its ideal-typical, generic form, an NDC scheme ensures financial sustainability over time by adjusting to the effects of demographic changes beyond the sole effects coming from changes in longevity. As for all PAYG pensions, the internal rate of return – i.e. the highest rate of return that can apply to paid contributions in a financially sustainable way – of NDC pensions is equal to the growth rate of the contribution base (total amount of contributions paid) which is well proxied by the growth rate of the wage bill under a constant contribution rate. Generic NDC schemes are thus based on a notional interest rate equal to the growth rate of the contribution base, while pensions in payment are indexed at the same rate and the pension at retirement is equal to the value of the accumulated notional account divided by the projected remaining life expectancy. In short, longevity trends are accounted for in the conversion of the notional account value into pension benefits, and changes in the working age population driven in part by demographics are reflected in the notional interest rate. Changes in the wage bill affect pensions through both the notional interest rate and the indexation during retirement.[3]

None of OECD countries with an NDC scheme, however, has introduced the generic NDC model, and these countries deviated in the way they calculate the pension at retirement. Italy, Latvia, Norway, Poland and Sweden have an NDC scheme with varying rules (Table 2.1, column 2). Deviations from generic NDC may pertain to: the notional interest rate, the measure of life expectancy and the formula calculating the initial pensions based on the chosen indexation.[4] Greece has applied NDC to its auxiliary pension scheme for contributions paid as of 2015, but has very recently decided to transform the auxiliary pension scheme from NDC to FDC for new labour market entrants as of 2022 (Chapter 1).[5]

Table 2.2 summarises the NDC parameters in these six countries. In contrast to the generic NDC, no country applies the same rate for compounding notional assets (notional rate of return), for indexing pensions in payment and for discounting pension flows to convert the accumulated NDC assets into pension benefits. Moreover, countries differ widely in their notional rates of return. For example, both Latvia and Poland use the growth rate of the total wage bill and Italy uses GDP growth which equals wage-bill growth if the labour share is constant, while Norway and Sweden use the average wage. In these two latter countries, the notional rate of return, therefore, does not account for the evolutions in the size of the working age population. Greece uses the growth rate of total contributions as the notional interest rate in calculating new pensions and the lowest of either total contribution growth or CPI inflation to index pensions in payment.

Table 2.2. **NDC schemes in OECD countries**

Basic characteristics and risks covered by different NDC schemes

	Notional interest rate applied to the contribution assets *(growth rate of)*	Indexation of pensions in payment	Automatic balancing mechanism	Risks covered for pension finances	
				Changes in labour force size	Changes in life expectancy*
Italy	GDP	CPI		● [a]	●
Latvia	Wage bill	CPI + 75% of real wage bill growth		●	●
Norway	Average wage	Average wage – 0.75% [d]			●
Poland	Wage bill (but no less than price inflation) [b]	CPI + 20% average wage		● [c]	●
Sweden	Average wage	Average wage – 1.6% [d]	●		●
Greece [e] (being phased out)	Total contributions	lowest of total contributions and CPI		●	●

Note: [a] Italy's NDC scheme only partially covers risks posed by a declining labour force and declining productivity. The annuity conversion factor assumes growth of the covered wage bill by 1.5% in real terms, but indexation of pensions in payment is not adjusted to deviations from this 1.5% assumption. Hence, the scheme would be in deficit if growth of the covered wage bill is below 1.5% in real terms. [b] For the funds that were transferred from FDC schemes to the NDC scheme in 2011, the notional rate equals GDP growth, not growth of the wage bill. [c] As the applied rate cannot be below inflation, changes in the size of the labour force are only accounted for to the extent that the growth rate of the wage bill does not fall below inflation. [d] In Norway and Sweden, the subtraction of 0.75% and 1.6% from wage growth, respectively, is actuarially offset by using a discount rate of 0.75% and 1.6%, respectively, applied to *mortality rates* when computing the conversion factor (instead of full indexation and 0% in the generic NDC). [e] Entitlements to Greek auxiliary pensions are built up in the NDC scheme as of 2015 (2014 for new entrants in the labour market), but for new labour market entrants as of 2022 auxiliary pensions will be built up as FDC. Workers younger than 35 will be able to join the FDC scheme voluntarily (Chapter 1). Currently, auxiliary pensions cover 12% of public pension expenditure. * These NDC schemes account for remaining period life expectancy at the time of retirement, not for projected life expectancy, and therefore likely underestimate a retiring cohort's average longevity.

Source: OECD based on information provided by the countries.

All NDC schemes base their annuity conversion on *period* life expectancy, calculated from observed mortality rates, whereas the generic NDC design is based on *cohort* life expectancy, which accounts for expected gains in longevity. As period life expectancy likely entails an underestimation of a retiring cohort's average longevity, annuity conversion factors based on period life expectancy are likely to set benefits at a higher level than what actuarial calculation would warrant.[6] This might generate financial imbalances, which need to be subsequently offset. On the other hand, as period life expectancy is observed, not projected, the adjustment procedure is more transparent and less dependent on assumptions. The choice of assumptions is a potential source of relatively invisible political intervention in the functioning of the AAM.

Yet, even if the generic NDC principles were followed, economic shocks can still result in imbalances in the short term while unanticipated changes in life expectancy might generate structural issues (Valdes-Prieto, 2000[8]). Hence, solvency is not ensured over time and corrective measures are needed. A supplementary automatic balancing mechanism is thus required to ensure long-term financial sustainability of the pension system. Sweden is the only NDC country with such a mechanism (see the section on Balancing mechanisms).

Adjustment of the retirement age to life expectancy

By automatically linking the statutory retirement age to life expectancy, countries can prevent increasing life expectancy from negatively affecting the financial sustainability of DB pensions or the retirement income adequacy of FDC and NDC pensions. Several OECD countries have introduced such a link so that cohorts that can expect to live longer also have to work longer: Denmark, Estonia, Finland, Greece, Italy, the Netherlands and Portugal (Table 2.1, column 3). Such a link has also been in effect in the Slovak Republic from 2017, but it was abolished from 2020.

Countries differ in the exact way they link their statutory retirement age to life expectancy (Table 2.3). The link is fully automatic in all countries except Denmark, where parliamentary approval is required to change the statutory retirement age when applying the link.[7] Denmark, Estonia, Greece and Italy link their statutory retirement age one-to-one to life expectancy, meaning that a one-year increase in life expectancy at 65 (60 for Denmark) leads to a one-year increase in the statutory retirement age. This basically implies that all additional expected life years are supposed to be spent working, while the average length of the retirement period will be constant: this thus leads to a steady decline in the length of the retirement period relative to the period spent working. In Denmark, the link is made by fixing the period people can expect to live in retirement at 14.5 years.

Table 2.3. **The retirement age is linked to life expectancy in seven OECD countries**

Basic characteristics of the link

	Increase in retirement age as proportion of increase in life expectancy	Need for parliamentary approval of retirement-age increase	Link based on life expectancy at age	Years between retirement age revisions	Period between setting new retirement age and it taking effect	Minimum increase per retirement age revision	Maximum increase per retirement age revision	Retirement age goes down with decreasing life expectancy
Denmark	1	●	60	5	15 years	6 months	1 year	
Estonia	1		65	1	2 years	1 month	3 months	●
Finland	2/3		65	1	3 years	1 month	2 months	●
Greece	1		65	3	Max 1 year	No	No	●
Italy	1		65	2	2 years	1 month	3 months	
Netherlands	2/3		65	1	5 years	3 months	3 months	
Portugal	2/3 *		65	1	2 years	1 month	No	●

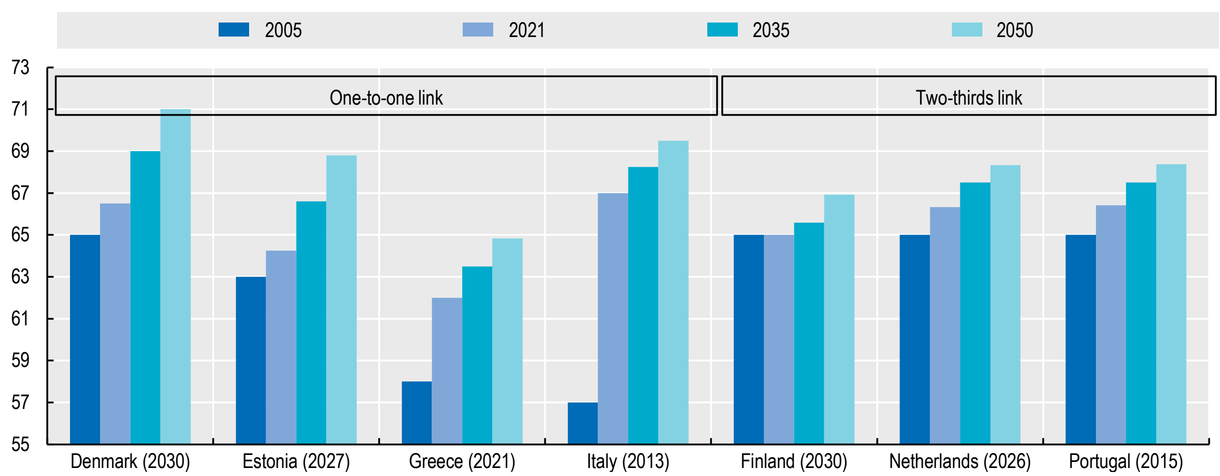
Note: * For someone with more than 40 years of contributions, the normal retirement age increases by only half of life-expectancy gains.
Source: OECD based on information provided by the countries.

In Finland, the Netherlands and Portugal, the statutory retirement age is increased by two-thirds of the increase in life expectancy at 65, and average retired life is extended by one-third. In addition, in Portugal, someone with more than 40 years of contributions can retire without penalty four months earlier for each year over 40 years of contributions. This implies that in fact only half of life-expectancy gains are reflected in the normal retirement age applying to full-career workers. While the Netherlands had legislated a one-to-one link from 2025, in the 2019 Pension Agreement social partners and the government agreed to instead apply a two-thirds adjustment (see the section on Design problems in automatic adjustment mechanisms). Also Sweden is in the process of legislating a two-thirds link between the retirement age and life expectancy (Chapter 1). Among countries with a one-to-one link, taking into account additional increases before the link applies, the normal retirement age – that is, the age at which someone who entered the labour market at 22 can retire after a full career without any reduction to the pension – is expected to rise by 4.5 years in Denmark and Estonia between 2021 and 2050, and by 2.8 and 2.5 years in Greece and Italy, respectively (Figure 2.1).[8] In Finland, the Netherlands and Portugal, where the statutory retirement age increases with two-thirds of the increase in life expectancy, it is expected to increase by around two years.

A two-thirds link roughly keeps the share of adult life that people can expect to spend in retirement constant across cohorts. Indeed, retirement periods are approximately half as long as career lengths. Such a link is equitable as it keeps this ratio between time spent working and in retirement roughly constant across cohorts. If the starting point is a financially balanced pension system – with pension revenues covering pension expenditure – and if fertility rates are close to the population replacement rate of about 2.1, a two-thirds link in a PAYG system basically ensures a stable pension replacement rate across generations financed by a stable contribution rate in a sustainable way. In this case, if the retirement age increases by less than implied by a two-thirds link, then either the contribution rate must rise or pensions must fall in order to maintain the long-term financial balance.

Increasing the statutory retirement age often is politically unpopular and the need for the increase when life expectancy improves must be made clear to the wider population. Unlike discretionary increases in the statutory retirement age, a link to life expectancy makes clear why changes in the statutory retirement age are needed and provides a transparent mechanism to determine the size of the adjustment. Public support for a link may increase if it can widely be perceived as fair, as for example with a link that keeps the share of adult life in retirement constant.

Figure 2.1. **Evolution of normal retirement ages for those retiring between 2005 and 2050 in countries now linking the statutory retirement age to life expectancy**



Note: The normal retirement age is defined as the age at which someone who entered the labour market at 22 can retire after a full career without any reduction to the pension. The year in parentheses is the year from which the link started or will start to apply. The numbers shown also include discretionary increases before the link kicks in. For Denmark, the statutory retirement age projected for 2050 is slightly lower than in the most recent projections from Statistics Denmark, according to which it would be 71.5 years. The data for Estonia in 2005 show the normal retirement age for men; the statutory retirement age for women was at 59 years during the first half of 2005 and at 59 years and 6 months in the second half of that year. The data for Finland show the age from which a person has access both to the earnings-related and the targeted pension scheme. In the earnings-related scheme, the normal retirement age was 63 years in 2005 and is 63 years and 9 months in 2021.

StatLink https://stat.link/wpvui3

While linking the statutory retirement age makes the pension system more robust in the face of increasing life expectancy, a two-thirds link does not protect it against other factors, such as low fertility rates. If the initial situation is financially unbalanced or if sub-replacement fertility is expected, a faster link is needed to ensure financial sustainability in case the retirement age is the only policy lever that is used. Furthermore, an increase in the statutory retirement age, while in general succeeding to prolong working lives, does not necessarily result in the same increase in the labour market exit age, at least in the short-to-medium term (Geppert et al., 2019[9]; Mastrobuoni, 2009[10]).

When the objective is to avoid financial imbalances while maintaining the same replacement rates, the retirement-age link should be combined with a mechanism that proportionally reduces accrual. Otherwise, increasing the retirement age results in additional build-up of pension entitlements leading to higher pension replacement rates at retirement age in PAYG pensions, thereby limiting net savings. Hence, increases in the statutory retirement age might not be sufficient to ensure the financial sustainability of standard DB pension systems based on constant accrual rates. This can be established through a sustainability factor such as the Finnish life expectancy coefficient.

In Estonia, Finland, Greece and Portugal, the link is symmetrical so that the retirement age is supposed to adjust both when life expectancy increases and decreases, whereas in Denmark, Italy and the Netherlands, the link is not activated when life expectancy decreases. These three latter countries have a mechanism that ensures that, after a decline in life expectancy, the statutory retirement age does not increase until life expectancy reached the same level as it was before declining.[9] Although declining life expectancy was often seen as a theoretical scenario before the COVID-19 pandemic, the effect of COVID-related excess mortality through the application of the link will become visible in 2022 only. However, the responsiveness of a link to short-term changes in life expectancy is an issue going well beyond the life expectancy shock due to COVID-19. As mortality rates fluctuate from year to year due to environmental factors even in normal times such as weather conditions and contagious diseases like the flue, changes in life expectancy are not a stable indicator. By linking the statutory retirement age to the moving average of life expectancy over multiple years, changes in the statutory retirement age are more stable and predictable.

Most countries with an automatic link between the statutory retirement age and life expectancy proceed with incremental changes. Estonia, Finland and Portugal assess the link on a yearly basis, Italy every second year. If the mechanism prescribes a change in the statutory retirement age, it takes effect two or three years after. The statutory retirement age changes with one or two months per revision in Finland, and with one to three months in Estonia and Italy. If the increase in life expectancy would result in an increase in statutory retirement age exceeding this maximum, the excess increase in the statutory retirement age is implemented with the next revision. The mechanism in the Netherlands is somewhat different in that the statutory retirement age increases in increments of three months, with the increase taking effect five years after it was triggered. Denmark’s link deviates from all others in a number of ways. In Denmark, revisions only take place every five years, with the increase in the statutory retirement age only taking effect 15 years later. As a result of the longer periods between revisions, the Danish statutory retirement age does not follow the same incremental path as that in other countries, and instead increases in leaps of either half a year or a full year, potentially generating larger differences for close cohorts.[10]

How socio-economic differences in longevity interfere with the link between retirement age and life expectancy deserves some specific attention (Boulhol, Lis and Queisser, 2022[11]). There is substantial inequality in life expectancy between socio-economic groups in all countries (OECD, 2017[12]). Income redistribution from those dying early to those dying late is the core insurance function of pension systems. As low earners have a shorter life expectancy and thus receive benefits over a shorter period, this reduces the progressivity of pension systems. Therefore, even schemes that appear to be distribution-neutral, such as those delivering annuities from pure DC pensions, are in fact regressive as annuities are typically computed from common mortality tables.[11]

Addressing longevity inequality is a challenge for pension policies. Policy makers should take this inequality into account when determining benefit levels for low-income workers as large longevity gaps can justify increasing redistribution in pension systems (Diamond and Orszag, 2004[13]).[12] Bommier et al. (2005[14]) estimated that differential mortality offsets about one-third of the income redistribution built into the French PAYG pension system, while Sánchez-Romero, Lee and Fürnkranz-Prskawetz (2019[15]) suggest it offsets redistribution fully in the United States. OECD (2017[12]) estimates that the average 3-year gap in remaining life expectancy at retirement reduces total pensions received by low earners by 13% relative to those of high earners, on average across countries, on top of the effects from lower earnings.

However, the issue of accounting for life-expectancy inequality in a pension benefit formula is sometimes mixed up with the question of how retirement ages should respond to changes in life expectancy. Raising the retirement age with average mortality tables means that the increase will shorten low earners' average retirement period more due to their lower life expectancy and thus be regressive, although this effect is quantitatively very small (OECD, 2017[12]).[13] This does not mean that applying an automatic link that raises retirement ages in line with increasing life expectancy is regressive. The reason is the following: if nothing is done and pension ages are kept at the same level despite longevity gains, those gains will, based on the same argument, benefit relatively more those with shorter expected lives, when longevity gains are broadly shared across socio-economic groups. Therefore, implementing such a link to accompany health improvements will be neutral in terms of redistribution, i.e. neither progressive nor regressive. However, if life expectancy gaps between socio-economic groups widen, linking the retirement age to life expectancy does raise equity concerns.

The evidence on changes in socio-economic inequality in longevity is mixed, varying across countries and measures, such as those based on education, income or location. Banks et al. (2021[16]) highlight that assessing these changes raises serious methodological issues. Using a wide range of analyses,[14] over the last decades, inequality in longevity is found to have: increased in Finland,[15] Lithuania, Norway and the United States; decreased in Estonia, Greece, Hungary, Italy, Poland and Spain; and been stable in France and Korea. In the Czech Republic, Canada, Denmark, Japan, Portugal, the Slovak Republic, Slovenia, Sweden, Switzerland, Turkey and the United Kingdom the picture is unclear.

Benefits linked to demographics, wage bill or GDP

A wider group of measures automatically corrects benefit levels in order to reduce the impact of demographic changes on pension expenditures. This includes linking benefits to life expectancy, the size of the working population, GDP or the wage bill.

Linking benefits to life expectancy

A sustainability factor adjusting pensions to changes in life expectancy across cohorts improves financial sustainability and may contribute to intergenerational equity by accounting for differences in the length of benefit receipts.[16] As discussed above, such a mechanism applies by design in DC schemes. Moreover, in principle, it provides an incentive for people to postpone the exit from the labour market without increasing the statutory retirement age, as this is the way for them to achieve the same pension level they would have in the absence of the AAM. However, as many people do not delay retirement in response to changing incentives, sustainability factors may still need to be combined with an increase in the statutory retirement age in order to uphold pension adequacy.

The Finnish life expectancy coefficient adjusts new pensions in a similar way as the annuity conversion factor in NDC schemes. It is calculated based on mortality rates as of age 62 (Box 2.1) to account for changes in the present value of the total pension benefits due to changes in longevity. As such, the mechanism ensures that pension wealth, i.e. the total amount of pension benefits received during the retirement period, does not increase as a result of increases in life expectancy. The life expectancy coefficient decreased from 1 in 2009 (the reference year) applying to the 1947 birth cohort to 0.957 in 2021 for the 1957 birth cohort, implying a 4.3% reduction of new pensions through this effect (Table 2.4). In addition, as of 2030, the statutory retirement age will be linked to life expectancy. From that moment onward, the calculation of the coefficient will be based on life expectancy the year before the earliest eligibility age for an old-age pension (for example life expectancy at age 65 years and one month in 2040 based on current projections). The coefficient is projected to be 0.869 in 2066, meaning that the pension of a person entering the labour market at age 22 in 2020 will be reduced by

13.1% through this effect. The Portuguese sustainability factor was introduced in 2007 and subsequently reformed with the introduction of the automatic link between the statutory retirement age and life expectancy in 2013. Its calculation has the big advantage of simplicity: the sustainability factor is equal to the ratio of life expectancy at 65 in 2000 over life expectancy at 65 in the year before the old-age pension becomes accessible, similar to what is used for the NDC schemes in Latvia and Poland. However, both the purpose and the calculation are very different from Finland's life expectancy coefficient and from annuity conversion factors in NDC schemes. The Portuguese sustainability factor now only applies to early pensions taken up before the normal retirement age for people with a contribution record of less than 40 years at age 60. The factor generates substantial pension reductions for early retirement on top of penalties of 0.5% per month of early retirement – the factor alone reduces further pension benefits in case of early retirement by 16.7% in 2021, and the reduction would rise to 30.3% in 2066. Hence, the factor is not designed to adjust pension systems to life expectancy consistent with actuarial principles.

Table 2.4. **Life expectancy coefficients in OECD countries**

Basic characteristics of sustainability factors correcting for life expectancy

	Life expectancy at age	Sustainability factor based on…	Sustainability factor projected value			Mortality period assessed	Corrects also when life expectancy decreases	Frequency of calculation
			Reference year	2021	2066			
Finland	62	Survival rates	2009	0.957	0.869	Last 5 years available	●	Yearly
Portugal *	65	Period life expectancy	2000	0.833	0.697	Last year	●	Yearly

Note: The sustainability factor for 2066 is the factor that applies to the cohort entering the labour market at age 22 in 2020. * The Portuguese sustainability factor only applies in case of early retirement.
Source: OECD pension model; OECD based on information provided by the countries.

Portugal thus stands out among other OECD countries in terms of penalties for early retirement: as the sustainability factor does not currently apply to retirement at the normal retirement age, early retirement triggers sweeping benefit reductions. OECD (2019[17]) highlights that the policy objective pursued by penalising early retirees so strongly is unclear. Retiring early does not seem rational in most cases given these very strong penalties. This suggests that people who retire early despite these rules either do not understand the drastic consequences of their decision or have no other choice, for example due to bad health conditions. Hence, the big difference with Latvia and Poland is that in these two NDC countries the adjustment applies actuarially to all the pensions of a given cohort.

Finland and Portugal also differ in terms of smoothing the adjustments made by the life expectancy coefficient. In Finland, mortality is assessed over a five-year period, compared to a one-year period in Portugal. As a result, the Finnish mechanism provides a smoother correction over cohorts and ensures that cohort differences in pension benefit levels reflect longer life expectancy trends rather than yearly fluctuations in mortality rates (see the section on Adjustment of the retirement age to life expectancy). In theory, both the Finnish and the Portuguese calculation methods also make upward pension adjustments in case of decreases in life expectancy, although this has never happened until 2020.

When benefits are adjusted to remaining life expectancy, either through an annuity conversion factor or a sustainability factor, an additional link between the retirement age and life expectancy can help improve pension adequacy. If the statutory retirement age remains unchanged, sustainability factors and annuity conversion factors will result in an erosion of replacement rates over time with population ageing, unless individuals decide by themselves to claim their pensions at older ages. This is supposed to provide financial incentives to delay retirement. However, beyond the rational choice made by some individuals, many people tend to retire as early as possible even with low pensions as a result of cognitive limitations, underestimation of longevity and low levels of financial literacy (O'Dea and Sturrock, 2018[7]). Through linking the statutory retirement age to life expectancy, this erosion of pension levels at a given age is counteracted by keeping people in the labour market longer. Finland linked the statutory retirement age to life expectancy seven years after it introduced the life expectancy coefficient and Sweden is likely to follow suit with the introduction of a two-thirds link to delay retirement, reducing the erosion of new pensions due to the annuity conversion factor.

Box 2.1. **Finland's life expectancy coefficient**

The life expectancy coefficient is calculated for each cohort at the age of 62. In year *y*, the life expectancy coefficient (LEC) of the cohort born in year *y – 62* equals the longevity indicator (LI) of the year 2009 over the longevity indicator in year *y*:

$$LEC_{y-62} = \frac{LI_{2009}}{LI_y}$$

Hence, the life expectancy coefficient decreases as the longevity indicator increases, which is used to correct new pensions calculated from the DB formula. The longevity indicator in year *y* is calculated as follows (Merilä, 2019[18]):

$$LI_y = \sum_{x=62}^{100} 1.02^{-(x+0.5-62)} \cdot \frac{L_{x,y}}{l_{62,y}}$$

in which x is age, ranging from 62 to 100. $L_{x,y}$ equals the average of the number of persons alive at age *x* ($l_{x,y}$) and at age *x+1* ($l_{x+1,y}$) in year *y*. These numbers are based on mortality rates over a 5-year period in order to provide smoothing: it is established by multiplying $l_{x,y}$ with the mortality rate at age *x* over the 5-year period. The calculation assumes an annual mortality rate at age 100 of 1, and a 2% discount rate.

The longevity indicator is thus related to mortality rates in old age (remaining life expectancy). It is similar to the conversion factor in an NDC scheme where 2% would be equal to the notional interest rate minus the indexation rate of pensions in payment: in NDC schemes, the pension benefit in year *y* for an individual retiring at age *x* is computed by dividing the accumulated notional account by the conversion factor, $A_{y,x}$, which is:

$$A_{y,x} \equiv \sum_{i=x}^{\propto} \frac{s_{y,i}\,(1+z_i)^{i-x}}{(1+r_i)^{i-x}} \approx \sum_{i=x}^{\propto} \frac{s_{y,i}}{(1+r_i-z_i)^{i-x}}$$

where *s* denotes survival rates, *z* the pension indexation rates and *r* the nominal discount rates. In a generic NDC scheme, *r* is the notional interest rate, itself equal to the growth rate of the contribution base (close to the wage bill). When *z* and *r* are equal, the conversion factor simplifies into remaining life expectancy at age *x* in year *y*. The Latvian and Polish NDC schemes indeed use remaining (period) life expectancy as the conversion factor even though the indexation of pensions in payment is equal to price inflation plus 50% of the real growth rate of the wage bill in Latvia and to price inflation plus at least 20% real average-earnings growth in Poland. In Finland, pensions in payment are indexed to 80% prices and 20% wages, implying that the wage bill growth ("notional interest rate") is equal to 2% plus this indexation rate only if one assumes that 2% is equal to 80% of annual real-wage growth rate plus the annual employment growth rate.

Linking benefits to the size of the working population, GDP or the wage bill

Several countries link the benefit levels to the size of the working population in a variety of ways. These mechanisms affect pensions in payment, and in some countries also new pensions (Table 2.5). Indexation of pensions, even partially, to the real growth of GDP or the total wage bill implicitly adjusts for trends in the size of the working population: pensions are not only adjusted to the average wage, but also to the number of contributors – indexation based on GDP growth is similar to indexation to wage bill growth when assuming a constant labour share in GDP. This thus accounts for the impact of demographic changes affecting the size of the workforce. Perhaps more importantly, indexing to a proxy for the contribution base (wage bill or GDP) in a PAYG system makes good economic sense as it closely relates to the internal rate of return of what the scheme can ensure on paid contributions (see above). All these measures have in common that they seek to improve financial balance in the pension scheme. Estonia, Greece, Japan and Lithuania have such a mechanism in place. Germany also accounts for shifts in the population structure; its mechanism functions as a balancing mechanism and is thus described in greater detail in the corresponding section below.

The Estonian pension system includes an adjustment of pensions to the evolution of the wage bill (more precisely, the contribution base) through the value of the pension point within their points system. This mechanism affects both new pensions and pensions in payment as both the base amount of the pension and the value of the point (called “year of pensionable service”) are indexed for 20% to the CPI and for 80% to total contributions in the last year over total contributions the year before.

Similarly, in Lithuania, both the value of the pension point and of the basic pension are linked to changes in the wage bill, albeit over a seven-year period: for a given year, the average wage bill growth comprises the average for the last three years as well as projections of wage bill growth in the current and next three years. Lithuania also ensures a certain level of pension adequacy by not adjusting pension benefits and entitlements if the wage bill falls in nominal terms. While the long reference period provides smoothing, it also creates a need for supplementary corrections in case the seven-year moving average deviates too much from economic conditions in the current year. This need is addressed through a reserve fund mitigating the impact of short-term economic shocks (see the section on Are there alternatives to automatic adjustment mechanisms?) and by applying the indexation only if total pension expenditures are projected to fall short of total contributions during both the current and the next year; and if total contributions exceed expenditures in the current year, a maximum of 75% of the surplus can be used for indexation. The seven-year smoothing procedure does not contain a mechanism to correct indexation if the projections on which indexation was based in previous years turn out to be incorrect. The lack of such a correction mechanism makes the AAM vulnerable to manipulation by changing projection methods or assumptions.

Japan’s system of ‘macroeconomic indexation’ applies a correction both to price indexation of pensions in payment and, for new pensions, to the uprating of past wages based on the average wage. Both are adjusted by changes in the number of contributors to public pensions. The change in the total number of active participants is calculated as an average over the three-year period between four and two years prior. Macroeconomic indexation also adjusts in principle for the rate of growth of life expectancy at 65, although this factor is fixed at 0.3% since its introduction in 2004 based on long-term projections to avoid short-term fluctuations (Sakamoto, 2005[19]). If the sum of the growth rate of the number of active participants and -0.3% is negative, it is added both to the growth of average wages in the uprating of past wages to calculate pension entitlements and to CPI growth in the indexation of pensions in payment. However, by fixing the factor at 0.3%, it no longer accounts for uncertainties in the development of life expectancy, placing the measure in the realm of long-term planning (see below) rather than AAMs. Indeed, the fixed factor was significantly lower than increases in life expectancy between 2004 and 2019 especially for males.[17]

Adjustments in both Estonia and Japan contain little smoothing as both countries assess change over a period of one year and three years, respectively. Yet, the pension systems in both countries include a mechanism to limit the size of the adjustment. In Estonia, as in Lithuania, negative indexation is not possible. Japanese pensions are indexed to inflation with no additional correction at times of negative inflation (and partial correction in case of small positive inflation) as the adjustment itself cannot result in a nominal decrease in pensions. The same applies to uprating in case of negative wage growth. Indexation has been negative in several years since 2004, particularly in 2013 and 2014, when pensions were reduced to account for previous periods of negative inflation. Due to a

Table 2.5. **Adjustment of pension benefits to size of the working population, GDP or the wage bill in OECD countries**

Basic characteristics of adjustments to evolutions in size of the working population, GDP or the wage bill

	Affects new pensions	Affects pensions in payment	Based on change in…	Extent of indexation	Period assessed	Mechanism to protect adequacy
Estonia	●	●	Total contributions	80% (+ 20% CPI)	1 year	No negative indexation
Greece		●	GDP (nominal)	50% [a] (+50% CPI)	1 year	
Japan [b]	●	●	Total number of active participants across schemes [c]	added to both wage growth (uprating of past wages) and CPI growth (indexation of pensions in payment)	3 years	Replacement rate for standard pension not below 50%
Lithuania	●	●	Total wage bill	100%	7 years	No negative indexation
Portugal		●	Real GDP	Ranging between CPI – 0.75% and CPI + up to 20% real-GDP growth [c]	2 years	

Note: [a] Pensions are indexed to the lowest of two options: either full CPI or 50% CPI and 50% GDP. Hence, partial indexation by GDP only applies if real GDP falls. [b] Increases in life expectancy are also accounted for in indexation of new pensions and pensions in payment in Japan, but it is proxied by a fixed rate based on long-term projections in life expectancy. Japan opted for this fixed rate to avoid fluctuations in pensions due to circumstances such as pandemics. [c] If the sum of the change in the number of active participants and -0.3% is negative, it is added both to the growth of average wages in the uprating of past wages to calculate pension entitlements in build-up and to CPI growth in the indexation of pensions in payment. [c] In Portugal, indexation varies depending on the level of the pension itself and growth in real GDP.
Source: OECD based on information provided by the countries.

combination of factors, the correction mechanism from “macroeconomic indexation” was applied for the first time in 2015. In 2018, a catch-up system was introduced, which carries over downward benefit revisions in years of negative inflation to later years. The Japanese AAM also contains a safeguard limiting its application that should prevent that pensions become inadequate due to the adjustment to the size of the contributing population: if the actuarial review conducted every five years projects that the replacement rate of a “standard pension”[18] will fall below 50% before the next review, adjustments can be suspended.

Replacement rates from the points scheme in Estonia and Lithuania will likely be eroded significantly over the next decades due to the impact of demographic changes on the indexation of the point value. Indeed, the size of the working-age population is projected to fall sharply by about 30% in Estonia and 40% in Lithuania by 2060 (Chapter 5). This means that in both countries the value of total contributions or the wage bill will grow significantly less than wages, lowering replacement rates.

Greece adjusts pensions in payment by 50% of CPI and 50% of nominal GDP growth. Indexation cannot exceed CPI growth, hence, partial indexation to GDP growth only applies if real GDP falls.[19] In Portugal, indexation of pensions in payment depends on average growth in real GDP over the last two years and the pension level itself, with more favourable indexation of the lowest pensions. The lowest indexation applies to the highest pensions when real-GDP growth is below 2%, in which case pensions in payment are indexed to CPI inflation minus 0.75%; the most favourable indexation applies to the lowest pensions when real-GDP growth exceeds 3%, in which case pensions in payment are indexed to CPI plus 20% of real-GDP growth.

Balancing mechanisms

AAMs are designed to adjust pensions to demographic or economic changes, in particular to improve financial sustainability. Automatic balancing mechanisms (ABMs) are AAMs with a specific objective: they are designed not just to improve financial sustainability, but to ensure a balanced budget of the pension scheme (Gannon, Legros and Touzé, 2015[20]). ABMs can be designed to ensure long-term financial equilibrium or to avoid short-to-medium term imbalances. They can contain a variety of adjustments to both pension benefits and contributions triggered by current or projected imbalances in the pension system. Table 2.6 summarises the main characteristics of the ABMs which exist in seven OECD countries: Canada, Finland, Germany, the Netherlands, Sweden and the United States as well as Luxembourg to some extent.

The ABM for the main component (base) of the Canada Pension Plan (CPP) is an automatic backstop mechanism in the sense that the mechanism is automatically activated in the absence of a political agreement. Every three years, the Chief Actuary calculates the minimum contribution rate required to finance pensions over the following 75 years.[20] If the calculated minimum contribution rate exceeds the legislated contribution rate and the finance ministers of the federal and provincial levels cannot agree on how to restore long-term financial sustainability, then a safety mechanism (known as the insufficient rates provisions or the self-sustaining default provisions) is activated. In that case, indexation of pensions in payment is frozen and contribution rates are increased by 50% of the difference between the legislated and the calculated minimum contribution rate for a three-year period, until the next report of the Chief Actuary. Hence, in case of a forecasted deficit in the pension scheme the procedure first induces a political debate, and it only triggers the adjustment mechanism if policy makers fail to converge on a solution. The mechanism thus acts as a safety valve avoiding that financial pressure on the pension system increases over time when policy makers cannot agree on a course of action. The recently introduced CPP enhancement, which unlike the base CPP is meant to be fully funded, also has a distinct but similar backstop mechanism.

Finland has a balancing mechanism adjusting only contribution rates. Reserve funds for private sector employees should at least equal 20% of expected PAYG pension expenditure in the coming year. If the reserve fund size is projected to fall below this standard, then the contribution rate is automatically increased to the level required to meet the 20% threshold. However, as reserve funds currently hold 65% of annual PAYG expenditure, more than three times the minimum required amount of assets, it is unlikely that the mechanism will be triggered in the foreseeable future.

Germany’s pension system contains a sustainability factor adjusting the pension point value on the one hand and an adjustment of the contribution rate on the other hand that, together, function as a balancing mechanism. Unlike in the Canadian and Swedish mechanisms, future revenues and expenditures are not taken into account. However, it balances current revenues and expenditures, and by doing that successively every year, long-term solvency would be achieved by default.

Since 2005, the German pension point value is adjusted to three components accounting for the change in average earnings, the change in the contribution rate, and a sustainability factor (Box 2.2). The sustainability factor links pensions to the demographic ratio of contributors over pensioners, which is critical for PAYG pensions: in a pure PAYG pension (i.e. fully financed by current contributions), this ratio multiplied by the contribution rate is mathematically equal to the average replacement ratio, defined as the average pension divided by the average wage. By adjusting the pension point value, both pensions in payment and accruing pension entitlements are adjusted.

Through the so-called alpha coefficient, the costs of balancing are divided between contributors and pensioners: with the alpha-level currently at 0.25, the sustainability factor actually adjusts the pension point value to 25% of the change in the ratio of pensioners to contributors between last year and the year before.[21] Were the alpha level set at 1, then the balancing would happen entirely through adjusting pensions and the contribution rate would be kept constant.

A nominal decline in the pension point value is not possible. Until 2019, non-implemented negative indexation has been compensated by the ‘catch-up factor’ that reduces subsequent positive

Box 2.2. **The mechanics of the German points system**

For every year of work, a person earns points based on her individual gross annual earnings. One point is granted to an individual whose earnings equal the average earnings in Germany in the same year. Higher individual earnings up to a ceiling generate proportionally more points, based on the principle of equivalence between contributions and benefits (*Äquivalenzprinzip*).

The pension point value (PPV) is set every year on 1 July following the below formula. Demographic and economic changes are accounted for through three parts: growth in gross average earnings, growth in the contribution rate, and a sustainability factor, where PCR is the pensioners-to-contributors ratio (see below).

$$PPV_t = PPV_{t-1} \cdot \frac{average\ earnings_{t-1}}{average\ earnings_{t-2}} \cdot \frac{100 - \ contribution\ rate_{t-1}}{100 - \ contribution\ rate_{t-2}} \cdot \overbrace{\left(1 - 0.25 \cdot \frac{PCR_{t-1} - PCR_{t-2}}{PCR_{t-2}}\right)}^{Sustainability\ factor}$$

In addition, an increase (decline) in the contribution rate has to be legislated once the account balance managed by the public pension authority drops below (exceeds) a certain level. The contribution-rate component of the formula implies that the benefit level declines when the contribution rate increases and vice versa. This makes current contributors and pensioners suffer or benefit jointly from current financial developments, for example driven by a deteriorating or an improving labour market. Since the introduction of tax subsidies for voluntary private pensions (Riester pensions) in 2001, the contribution-rate factor includes the maximum voluntary contribution rate that is subsidised, which is currently equal to 4%.

The last factor was introduced in 2004 to help deal with financial sustainability. It is determined by changes in the ratio of pensioners to contributors. An increase in the pensioners-to-contributors ratio means that the point value is not fully indexed to earnings growth. An increase of 1% in the relative number of pensioners decreases the adjustment of the point value by 0.25%. The 0.25 factor was determined to fulfil the objective of ensuring that the contribution rate remains below 22% by 2030 and that the replacement rate for an average-wage worker with a 45-year career remains above 43%. Overall, the sustainability factor is meant to capture the demographic and labour market developments that affect the financial sustainability of the system.

A law passed at the end of 2018 introduces a floor in the pension point value such that the net replacement rate of an average-wage worker with a 45-year career is at least 48% until 2025. That law also imposes a ceiling of 20% on the contribution rate until 2025 (*Doppelte Haltelinie*). From 2026, when population ageing is expected to have its largest impact as the demographic old-age to working-age ratio is projected to increase sharply between around 2025 and 2035, the pension adjustment formula will be in force again if no renewal of the replacement rate floor and contribution rate ceiling is legislated.

A decline in the real value of the pension point is allowed and also intended if, for example, demographic change deteriorates the ratio of contributors to pensioners. Nominal declines of the pension point value are ruled out by a restrictive clause. That clause was activated in 2005, 2006 and 2010, when the adjustment was calculated to be lower than one. Non-implemented negative indexation had to be offset in following years by a lower indexation than implied by the formula, which happened until 2013. However, this ‘catch-up factor’ was suspended in 2019 until 2025 to ensure the 48% replacement rate throughout the period (*Haltelinie*).

Source: Updated based on Boulhol, 2019 ([28]).

indexation. In 2018, the catch-up factor was suspended until 2025, leading to an asymmetric indexation mechanism.[22] The asymmetry can result in a higher level of the pension point value, and thus total spending, if the average wage falls and subsequently increases to the previous level (Börsch-Supan and Rausch, 2020[21]).

The second part of the balancing mechanism entails adjusting the contribution rate, which does not affect the number of points being acquired in contrast to the main occupational scheme in France (Agirc-Arrco). The contribution rate must be increased in Germany if the pension account balance deteriorates beyond a certain threshold, which in turn automatically lowers the point value (Box 2.2), thereby sharing the burden of the adjustment between current workers and current pensioners. If at the start of the year, the contribution rate is projected to result in the public pension reserves (totalling about 1% of GDP) falling below 0.2 times or growing above 1.5 times average monthly pension expenditure by the end of the year, the contribution rate has to be adjusted in such a way that the reserve fund is forecasted to remain within these limits (see the section on Are there alternatives to automatic adjustment mechanisms?). However, this adjustment of the contribution rate can be circumvented by directly financing the pension system from the State budget through legislative action. At the same time, the contribution rate component in the formula reduces the pension point value if the contribution rate is increased.

To avoid that the balancing mechanism creates too high a burden on the contributing population while ensuring a certain level of pension adequacy in the short term, there is a ceiling for the contribution rate and a floor for the pension point value until 2025 (Box 2.2). There currently are no limits to the impact the balancing mechanism can have on pension levels or contribution rates after 2025, although in 2020 the commission tasked with developing a proposal on what should happen after 2025 proposed to maintain both a ceiling to the contribution rate and a floor to the pension point value.[23]

In the Netherlands, an ABM currently is in place for funded DB schemes. The uprating of pension entitlements and indexation of pensions in payment are directly linked to funding ratios, that is, the ratio of the funds' current value over its future estimated liabilities. In case of persistent underfunding, indexation can be suspended or pension benefit levels reduced. A pension fund can index pension benefits and uprate pension entitlements by the full growth of CPI only if it has a funding ratio above a certain threshold that varies across pension funds, and it can uprate and index to less than CPI growth if the ratio is above 110%. Funding ratios below 110% lead to a freeze in pension benefits and pension entitlements. Funding ratios below 104.2% for more than five years lead to cuts in entitlements and benefits. The funding ratio in that case should be brought back to 104.2%, with associated cuts being spread over up to 10 years. The mechanism triggered cuts in entitlements and benefits in several pension funds in the wake of the 2008 financial crisis as funding ratios needed to be increased while interest rates remained low and life expectancy increased. The resulting public dissatisfaction with the system led to a decision to partially suspend the ABM and to a more structural reform (Chapter 1 and the section Design problems in automatic adjustment mechanisms).

Sweden supplements its NDC scheme with an ABM, in particular as its NDC scheme does not adjust for the size of the working population; indeed, the notional interest rate is only set to equal the average-wage growth by default. The Swedish Pensions Agency calculates a balance ratio dividing the sum of estimated contribution assets and the market value of the reserve fund by pension liabilities (accrued notional pension entitlements and pensions in payment). If a deficit is identified a brake is activated, reducing the notional interest rate below the wage growth rate in order to help restore solvency by both limiting accumulation in notional accounts and reducing indexation of pensions in payment. In the aftermath of the 2008 financial crisis, the mechanism resulted in a decline in the value of pensions both in nominal and in real terms, mainly as a result of the fall in the value of financial assets in the reserve fund (Sundén, 2009[22]). Following this experience, smoothing was introduced in the ABM. Since 2017, the potential reduction of the notional interest rate and the pension indexation rate triggered by the balancing mechanism is spread over a three-year period. For instance, if wages grow by 2% per year and the balancing mechanism requires a downward correction of 1%, then the interest rate on pension accounts and indexation of pensions in payment will equal 1.66% for three consecutive years. This smoothing offers more income stability to pensioners (del Carmen Boado-Penas, Naka and Settergren, 2020[23]; Bosworth and Weaver, 2011[2]). Once rebalancing is achieved, any surplus can be used to boost the interest and indexation rates during a catch-up phase to the level they would have been if no negative correction had occurred. The mechanism provides a catch-up but does not distribute surpluses in the financial balance (Barr and Diamond, 2011[24]).

The United States has a 'fiscal cliff' balancing mechanism (Gannon, Legros and Touzé, 2020[25]). As the Social Security pension scheme is not allowed to borrow, it is obliged to cut benefits when its reserve fund is fully depleted so that total benefits can be covered by total contributions.[24]

This is currently estimated to happen in 2033, the date after which pension benefits are expected to make a sudden drop of 24% (Board of Trustees, 2021[26]). The ABM used in the US Social Security is not unlike Canada's automatic backstop mechanism as it is meant to act as a disciplining device to trigger policy action to prevent its activation. However, the Canadian system makes the conditionality on political disagreement explicit, which is not the case in the United States where in addition the impact of a non-agreement is much more abrupt.

Table 2.6. **Automatic balancing mechanisms in OECD countries**

Basic characteristics of automatic balancing mechanisms

	Affects new pensions	Affects pensions in payment	Affects contributions	Based on change in…	Period assessed	Mechanism to protect adequacy	Fully automatic
Canada		●	●	Estimated minimum contribution rate	75 years	No negative indexation	Backstop
Finland			●	Ratio of reserve fund size to expected pension expenditure	1 year	No	●
Germany	●	●	●	Equivalised pensioners to contributors ratio	1 year	No negative indexation	●
Netherlands	●	●		Funding ratio (fund value over liabilities)	1 year	No	●
Sweden	●	●		Balance ratio of notional assets over liabilities	Long term	No	●
United States	●	●		Ratio of total assets plus income over scheduled benefits	1 year	No	●
Luxembourg	●	●	●	Ratio of reserve fund size to expected pension expenditure	10 years	No	Semi-auto matic

Source: OECD based on information provided by the countries.

Luxembourg has a semi-automatic balancing mechanism, forcing the government to take action. The total pension contribution rate for old-age, disability and survivors' benefits is fixed in the law for a 10-year period based on projections by the General Inspectorate of Social Security (IGSS). It is fixed in such a way that the public pension reserve fund is projected to be at least 1.5 times annual pension expenditure at all times over the 10-year period. The IGSS also performs a mid-term evaluation to see if the contribution rate needs to be adjusted.[25] Hence, the semi-automatic balancing mechanism primarily adjusts contribution rates, although indexation of benefits in payment is also adjusted in case contributions fall short of covering expenditures nonetheless. As long as contributions cover expenditures, CPI indexation is supplemented by the growth of real average wages. However, once current contributions no longer suffice to cover expenditures, the law determines that the government must make a proposal to parliament to reduce indexation (i.e. move from full wage indexation to indexation between prices and prices plus 50% of real wage growth). The semi-automatic adjustment of the contribution rate has not been brought to the test yet, as the first revision of the contribution rate under the current mechanism is due in 2022; pension expenditures are expected to exceed total contributions in 2027 if the contribution rate is not changed (Inspection générale de la sécurité sociale, 2021[27]). As pension expenditures are projected to almost double from 9.2% of GDP in 2019 to 18.0% of GDP in 2070 (Chapter 7), the pension contribution rate would almost have to double if the semi-automatic adjustment mechanism was to be applied. Given the current contribution rate of 24%, the semi-automatic link will thus not ensure the financial balance over the long term.

Limitations of automatic adjustment mechanisms

AAMs should be designed to meet clear objectives given the specific context of each country. Whether to adjust contributions, benefits or retirement ages depends on their initial levels, demographic evolutions and people's preferences, and is therefore ideally subject to democratic debate. AAMs are likely to be reformed, replaced or removed if they do not fit well with the context they are implemented in.

This section presents instances where AAMs were changed or cancelled, and discusses whether there are alternatives to deal with the challenges faced by pension systems as populations age. The first part discusses political pitfalls in the implementation of AAMs and the second part presents problems in the design of AAMs that led to their reversal. While political and design elements are often intertwined and both at play to some extent in reversals, as the case of Spain illustrates, some appear to be more politically motivated than others. The final part presents other policy tools to make pension systems more sustainable and argues why they are not full alternatives to AAMs. The section shows that for AAMs to succeed in pursuing financial or social sustainability and providing trust in the pension system, both a careful AAM design and an inclusive political process to implement it are essential.

Political pitfalls of implementation

Populations may differ in their preference for certain policies, as well as how they value time and income (Börsch-Supan, 2007[29]). Depending on the initial pension parameter levels, the same AAM may not be as acceptable to people in different countries. In some cases, for example if pension benefit levels are relatively high or contribution rates relatively low, adjusting pension benefits or, at least temporarily, contribution rates to life expectancy may be preferable to adjusting the retirement age. Even if countries face the same challenges, the political feasibility of specific AAMs to overcome these challenges may differ and opposition against their introduction may be fiercer in some countries than in others. Therefore, it is necessary for policy makers to convince the wider population of the need for AAMs by highlighting the cost and consequences of inaction, and to argue how the proposed AAMs solve this problem while accounting for people's preferences.

AAMs require a continuous application to reach their objectives of financial or social sustainability and trust in the pension system, and are hence best introduced through wide political support. AAMs that are decided by simple majority may not be upheld when coalitions change. For example, even with standard pension indexation, discretionary changes or repeated deviations from the indexation rule – which might be needed in the absence of a well-designed balancing mechanism – highlight time inconsistency in policy decisions, which in the end hurts transparency, equity and confidence in the pension system.

Germany's demographic factor, legislated in 1997, which adjusted benefits to half of the growth in life expectancy at age 60, was withdrawn when a new government came to power a year later. In 2004, the sustainability factor was introduced, linking pensions to the ratio of pension recipients to contributors. In order to ensure sufficient trade union and political support, the application of the mechanism is subject to some constraints such as a minimum net replacement rate (Bosworth and Weaver, 2011[2]). In contrast, Sweden's NDC scheme with the ABM discussed in the preceding section was developed through political collaboration beyond the governing coalition. While the 2008 global financial crisis provided a stress test for the ABM, the broad principles of the ABM have remained largely unchallenged even though this experience shows that in periods of large volatility interventions by politicians are still needed (Weaver and Willén, 2014[30]). The Swedish ABM is thus more likely to succeed in fulfilling its long-term objectives due to its design and political sustainability, strengthened by the extensive process of consensus-building among all political parties prior to the pension reform.

The short-lived link between the retirement age and life expectancy in the Slovak Republic is also the consequence of a lack of wide political agreement, although the experience is somewhat different. Here, the main party in the government, which had approved the introduction of the one-to-one link between statutory retirement age and life expectancy in 2012, subsequently decided under political pressure to cap the increase in 2019 at the age of 64 (to be reached in 2030) and to abolish the link.[26] The link was only in effect for three years between 2017 and 2020. The cap on the retirement age was removed again in December 2020, and the Ministry of Labour, Social Affairs and Family prepared a proposal to re-establish a link between the retirement age and life expectancy.

On top of changing the AAM itself, policy makers may seek to intervene in the calculation of the indicator the AAM is based on to modify the outcomes of the adjustment mechanism. Particularly projection-based indicators may be prone to such interventions, as they are based on a series of assumptions. Policy makers can then affect the indicator through challenging or changing the assumptions the indicator is based on. For instance, the activation of the Canadian balancing mechanism is rather sensitive to the assumptions made by the Chief Actuary (Baldwin, 2020[31]), and there is some controversy surrounding the dismissal of the Chief Actuary in 1998 in this regard. According to Bosworth and Weaver (2011[2]), the dismissed Chief Actuary would have claimed to have been pressured into adjusting assumptions when initial calculations showed that the contribution rate at the time fell just short of being financially sustainable. This case illustrates not only the importance of political independence of the body that calculates the indicators for AAMs, but also the need for transparency in how the indicator is calculated. By clearly stating the methodology used in the calculations, transparency and trust in the pension system are improved as changes in the methodology would require clear explanations.

Design problems in automatic adjustment mechanisms

Some might be tempted to consider that because an AAM is in place all pension problems are solved and the system can run on auto-pilot. However, not all AAMs are well designed, and badly designed AAMs may generate opposition resulting in their cancellation or reform. Moreover, not all AAMs are equally suitable to tackle the specific challenges a country faces, and supplementary reforms might be required in order for the mechanism to fulfil its objectives.

The capacity of AAMs to account for demographic and/or economic changes largely depends on the indicator used. The accuracy of the indicator determines the extent to which the mechanism will correctly adjust to changes. For instance, an annuity conversion factor, a life expectancy coefficient or a link with the statutory retirement age only really adjust to changes in ex post longevity if the ex post observed longevity corresponds to the (ex ante) life expectancy estimate (at retirement). Even projection-based automatic balancing mechanisms cannot avoid imbalances if the projections of changes in life expectancy differ from ex post longevity changes. However, unless the projections prove to be totally wrong, the AAM is likely to substantially reduce the size of the imbalances compared to a scenario without any AAM.

AAMs designed to mask cuts in pension benefits in real terms are more likely to fail as they may result in increasing pressure on policy makers to soften the impact of the AAM or even abandon it altogether. Spain introduced the Revalorisation Pension Index (IRP) without wide political consensus in 2013, a mechanism indexing all pensions to account for the difference between the growth rate of total contributions and that of total expenditures, albeit with a minimum nominal indexation of 0.25% per year. Every year between 2014 and 2017, pensions were indexed at the floor of 0.25%, and, based on projections, the floor was likely to be persistently applied in the future given expected difficulties in financing public pensions in Spain. After protests of pensioners against this index resulting in a loss of purchasing power in 2017 and 2018 and as a new government came into power that same year (Montserrat Codorniu and Rodríguez Cabrero, 2018[32]), the parliament deviated from this mechanism and instead indexed pensions to the CPI, resulting in significantly higher indexation rates. In 2019, the IRP was suspended. This example illustrates not only the need for political consensus, but also that the introduction of an AAM leading to a steady decline in pensions in real terms during retirement is questionable as retirees have little possibility to adjust their income, for example by working more. This also implies that corrective measures – through AAM or more generally – need to be implemented soon enough, as modifying pension calculations for current retirees is very difficult. Otherwise, when pension promises that were made are not financially sustainable, the burden of adjustment is unlikely to be well shared across generations or, even worse, macroeconomic stability may ultimately be threatened.

The protests against the Spanish IRP and its subsequent suspension ultimately spilled over to the sustainability factor that was legislated in 2013 to adjust new pension benefits at retirement to increases in life expectancy. The sustainability factor was supposed to take effect as of 2019, but its implementation was suspended until 2023. As of yet, the design of a mechanism that is supposed to replace both the IRP and the sustainability factor is unclear (Chapter 1).

When AAMs trigger a decline of real pension benefit levels, policy makers may also seek to counteract this negative indexation. In Sweden, the 2008 global financial crisis provided a stress test for the ABM, as the rule would have generated a decline in the value of pensions (see the section on Balancing mechanisms), The rule was therefore altered through a small smoothing adjustment. In addition, the government attempted to counteract the impact of negative indexation by reducing taxation of pension incomes. In doing so, a deficit in the pension system was avoided by transferring the cost to the general budget, which is what NDC schemes aim to avoid.[27]

Large adjustments triggered by AAMs may generate political pressure not to apply them. Initially, Italy's conversion factor adjusting NDC benefits to life expectancy was updated every 10 years and the adjustment required political approval. However, given the size of the adjustment to be applied when the coefficient was to be updated for the first time in 2005, the government backtracked and suspended the adjustment until 2010 (Turner, 2009[33]; Guardiancich et al., 2019[34]). More frequent adjustments diminish the need for substantial corrections, and therefore generate less pressure to intervene in the mechanism's working.

The Netherlands provides another example where substantial and sustained reductions in indexation have led to public dissatisfaction with the AAM. The balancing mechanism forced several pension funds to make nominal reductions in pensions in the aftermath of the 2008 financial crisis and pension providers felt resentment over the last decade when the mechanism did not allow them to share high investment returns with pensioners through increased indexation, instead having to use the money to build up reserves to increase their funding ratio. This led to the 2019 Pension Agreement between the Dutch Government, trade unions and employers' organisations prescribing that funded DB occupational pension schemes will be replaced by FDC pension schemes. The transition is yet to be legislated, but it is expected that funds can transition to FDC as of 2023 and that all funds will have to have transitioned before 2027 (Chapter 1).

The Dutch balancing mechanism will be partially suspended until funds make the transition from funded DB to FDC: pension funds will not be forced to reduce pensions if their funding ratio is above 90%, instead of the legislated 104.2%. The social partners have to determine the minimum funding ratio required for a pension fund to transition to FDC, but it cannot be below 90%. Until the social partners reach an agreement, pension funds have to employ a funding ratio target of at least 95%. If the mechanism had not been suspended, many pension funds would have had to reduce pensions in nominal terms.[28]

Not only AAMs reducing pension benefits in real terms are vulnerable to being reformed, also one-to-one links of the statutory retirement age to life expectancy may not be politically sustainable. They might be used in the medium term in countries that need to restore financial sustainability, but over the long term the steady reduction they imply in the share of life spent in retirement relative to the length of the working period is difficult to justify. The Slovak Republic withdrew its one-to-one link, although new attempts are being made to re-establish a link as described in the previous section. The Netherlands replaced its one-to-one link with a two-thirds link as part of the implementation of the Pension Agreement. Denmark has no concrete plans to deviate from its current one-to-one link, but a committee has been set up to look into the effects of easing the link after 2040. The committee will present its recommendations in early 2022.

Finally, the design of an AAM should take into account the administrative capacity of the country: sufficient administrative capacity is needed for a successful implementation of AAMs as it may require specific knowledge and expertise as well as data collection (Guardiancich et al., 2019[34]). The required capacity varies according to the chosen measure, with some AAMs such as adjustments of the statutory retirement age to observed changes in period life expectancy being relatively easy to implement whereas measures based on forward-looking indicators require some forecasting capacity.

Are there alternatives to automatic adjustment mechanisms?

AAMs are not the only measures available to tackle the challenges population ageing poses to pension systems, as this can also be done through discretionary adjustments. However, to reach long-term financial sustainability through discretionary measures while maintaining citizens' trust in the pension system requires forward-looking policy makers and a stable political environment. Beyond AAMs, two policy tools are of particular importance to assist policy makers in making pension systems more robust in the face of a changing demographic environment: long-term planning and reserve funds. In this section, both policy tools are presented and their main advantages and drawbacks discussed.

Long-term planning entails legislating a schedule of adjustments in pension system parameters over a relatively long period, usually based on long-term projections. Hence, changes in parameters can be legislated to take effect only decades later. In contrast to AAMs that link pension parameters to a specific indicator, under long-term planning the parameter path is fixed. It essentially is a form of extreme smoothing. Both the Czech Republic and the Slovak Republic, for instance, are increasing their statutory retirement ages until 2030 according to a fixed timetable that is set based on assumptions about the evolution of life expectancy. However, the pre-determined changes in parameters are also the Achilles' heel of long-term planning, as the projections they are based on have to be correct: political intervention remains required at the end of the planning period or when economic and demographic changes deviate from the forecasted evolution, hence to a much larger extent than with AAMs.

One of the advantages of long-term planning is that it can give people sufficient time to adjust their lives accordingly (Goss, 2010[35]). However, fixing parameters in the long term may give people a false sense of security, as there is no guarantee that circumstances evolve as predicted and, therefore, that the scheduled change in parameters is respected. Hence, to present long-term planning as generating certainty for people regarding retirement benefits is misguided: the sense of certainty it may project comes from its lack of adjustment to changing circumstances, which actually might become a source of financial unsustainability.

While long-term planning could offer an alternative to AAMs in theory, the lack of flexibility to adjust to changing circumstances entails a strong reliance on policy makers in the future to make changes in pension parameters, especially if previous estimations have turned out to be too optimistic.

The example of the United States makes this abundantly clear, as the fiscal cliff moved forward from 2057 at the time when the long-term plan was developed to 2033 in the most recent estimate (Board of Trustees, 2021[26]). The Canadian procedure in case of a forecasted deficit combining long-term planning with an automatic backstop mechanism, in case policy makers cannot find an alternative way to restore long-term financial sustainability, can be a way to overcome this issue. Moreover, by starting the procedure at the time the deficit is projected rather than when it materialises is likely to result in much less harsh corrections which, as discussed above, is important to uphold the mechanism.

Long-term planning, like AAMs, is vulnerable to reversal. In 2011, the Czech Republic decided that, once the statutory retirement age reached 65 in 2030, it would increase by two months per year indefinitely. The policy entailed a faster future increase in the retirement age than the expected increase in any country where the retirement age is linked to life expectancy. In 2016, merely five years after its introduction and before the policy would take effect, the increase in the retirement age was capped at 65 (OECD, 2020[36]).

Public pension reserve funds can also contribute to making pension systems more robust, and are often an important component of long-term planning efforts. These funds hold reserves established by governments or social security institutions to support public pension systems. The United States was the first country to create a reserve fund, with the Old-Age and Survivor Insurance Trust Fund having been established in 1937. Reserve funds were particularly established in the 1990s and early 2000s, as concerns rose over the financial sustainability of pension systems in the face of population ageing, particularly in relation to the forthcoming retirement of the baby-boom generation. The size of these funds varies between countries, with funds exceeding one-quarter of annual GDP in Canada, Finland, Japan, Korea, Luxembourg and Sweden (Chapter 9).

Reserve funds serve three main purposes. First, they can be used as a buffer to smooth the impact of short-term economic or demographic fluctuations on pension finances. Second, they can partially prefund pensions to account for demographic changes, either through a generation-specific reserve fund that is fully depleted after retirement of the larger generation or through a system of permanent prefunding. Reserve funds created to cushion the temporary, medium-term financial impact of a large generation such as the baby-boom generation reaching retirement are built up while these large cohorts are of active age and then depleted when they are in retirement. In a PAYG scheme, they can prevent that larger retiring generations result in either an increased burden on subsequent generations through higher contributions (or additional financing from the state budget) or in reduced pensions (OECD, 2012[37]). In a system of permanent prefunding, on the other hand, each generation partially funds its own retirement. This is the case in Canada and Finland, where the size of the buffer fund is taken into account in their respective ABMs. Third, reserve funds can provide a permanent diversification of pension financing through financial returns on investment, which is otherwise financed on a PAYG basis. Beyond these, reserve funds can be an important component of the balancing mechanism, as in Sweden for example.

Only the second objective clearly, but partly, connects to those pursued by AAMs, and might then be seen as operating for a couple of decades as an alternative to AAMs on the condition that pension assets have been accumulated over a sufficiently long phase while the baby-boom generation was in the labour market. Even in that case, reserve funds created for that purpose are supposed to be depleted in the long term, making them useful to partially prefund the retirement of the baby-boom generations, but unsuited to manage long-term ageing trends unlike AAMs. Moreover, the success of reserve funds in prefunding the retirement costs of numerous generations depends on the accuracy of long-term demographic projections and consistency in the regulatory framework over time, much like in the case of long-term planning. As with long-term planning, reserve funds are vulnerable to reversals, with several funds being depleted earlier than initially intended or used for other purposes when the government faces an urgent funding need. For example, when the 2008 financial crisis hit, Ireland first used its reserve fund to support its banking sector and subsequently for strategic investment in the domestic economy (Casey, 2014[38]). In 2014, the reserve fund was abolished and its remaining assets transferred to the newly established Ireland Strategic Investment Fund, as economic growth and employment were considered a greater priority at the time than long-term sustainability of public pension provision.

Automatic adjustment mechanisms: Where to go and how to get there

Pension expenditures have been increasing and the level of pension benefits might be under pressure in many OECD countries due to demographic changes driven by improvements in longevity, the retirement of the baby-boom generation and low fertility rates. Given the high cost of inaction, policy makers thus have the choice to take measures mitigating the effects of population ageing on pension parameters or increasing pension system revenues in an automatic or a discretionary way. This section first argues why automatic adjustments are the best way to tackle these challenges, at least when pension systems are initially on a solid footing, and sets out a number of principles on the design of automatic adjustment mechanisms (AAMs) to improve financial and social sustainability of pension systems. Subsequently, some guidelines regarding the process for the development and implementation of AAMs are presented to improve their political sustainability.

Why automatic adjustment mechanisms are needed

Automatic adjustment mechanisms are often claimed to be the most important innovation of pension policy over the last decades. Indeed, they reduce uncertainty surrounding future changes in the pension system in response to demographic and economic developments. While there is no doubt that population ageing is happening, the exact extent of future demographic shifts remains subject to large uncertainty. Yet, even though it is difficult to forecast precisely the development of mortality, fertility and employment, the consequences of changes in these indicators for pensions are easier to predict. This predictability makes it possible to design and implement AAMs that can substantially reduce the impact of demographic changes on financial sustainability.

Political choices are essential in implementing AAMs, as there unavoidably is a trade-off between financial sustainability and pension adequacy, although some mechanisms, such as adjustments of contribution rates or statutory retirement ages can limit this trade-off. Well-defined AAMs thus raise the credibility of the pension system and the promises it makes, and of public finance management more broadly (OECD, 2012[37]), which can ultimately also increase trust in the pension system. In theory, these outcomes could also be reached through a combination of close monitoring of the pension system, long-term planning and recurrent discretionary reforms. Pensions can for instance be balanced without an automatic balancing mechanism through reserve funds or transfers from the state budget. However, the political reality of pension reforms, with many stakeholders and high political costs, makes relying on such continuous efforts of both current and future governments a risky strategy. Hence, discretionary reforms may provide solutions in the short to medium term, but are unreliable to provide long-term financial sustainability. AAMs, on the other hand, can reverse the political process: rather than having to argue for measures improving financial sustainability, policy makers instead would have to legitimise any decisions reducing sustainability.

It is crucial to distinguish AAMs that accompany long-term trends from those that are used to correct imbalances due to entitlements that already accrued. AAMs should ideally be used to prevent the deterioration of financial sustainability, as mechanisms implemented or activated only when the pension system faces financial problems are likely to result in harsh adjustments in benefit levels. Hence, mechanisms preventing insolvency are preferable to those that are triggered in case of insolvency. Preventive AAMs provide frequent small adjustments depending on demographic or economic evolutions, smoothing corrections over time. To that end, AAMs should be introduced and activated well before sharp corrections are required, and the period in between assessments should be limited to avoid the need for sharp corrections.

However, AAMs have also been used to restore financial sustainability. AAMs triggered only in the face of insolvency are likely to be painful and therefore to generate political pressure to circumvent their impacts. This is the case with the suspension of the AAMs in Spain (Chapter 1). If the pension system is not financially sustainable given already accrued entitlements, necessary changes are immediate and not conditional on the developments of some future indicators. In that case, measures should be taken in any case, and the long-term planning of predetermined measures is probably better suited than AAMs. For example, if pension promises are made in such a way that less than price indexation is needed to help improve financial sustainability – something that must be avoided in the first place – then it is probably too late to introduce an AAM. In short, AAMs are meant to adjust for future trends and are not a substitute for bold discretionary measures in a financially unbalanced pension scheme. Countries in that situation should ideally have a wider reform plan consisting of discretionary steps that restore financial balance – there is little reason to condition those steps to some indicators – and of a set of AAMs that can in particular deal with ageing trends.

What should automatic adjustment mechanisms look like

For AAMs to be successful over the longer term, they should fulfil some basic characteristics. One such characteristic is that every AAM should be designed to pursue one specific objective. Different instruments are needed to deal with different sources of imbalance, and a combination of AAMs is necessary to protect pension schemes against the various challenges posed by population ageing. To fulfil different objectives, various pension parameters can be adjusted. It is important to strike the right balance between adjustments to the three main parameters – retirement age, contribution rate and pension level – depending on their initial levels and on social preferences. The choice of pension system parameters to adjust through AAMs as well as through discretionary measures has distributional consequences. Even financial sustainability alone requires that different AAMs are in place. First, an adjustment to longevity trends is needed. However, as adjusting retirement ages or benefit levels to life expectancy might not be sufficient to deal with the overall shifts in the population structure, accounting for changes in the size of the contribution base through another AAM is also needed. For instance, the recent review of the Finnish pension system indicates that, although this is not an urgent problem, the current adjustments to life expectancy are insufficient to ensure long-term financial sustainability, among others due to a sustained low fertility rate (Andersen, 2021[39]). In addition, even if they are well designed, these AAMs cannot guarantee financial solvency, and a balancing mechanism ensuring that total contributions equal total benefits over time should complement them.

One serious difficulty comes from the possible inconsistency of different goals given ageing prospects. For example, in a PAYG pension scheme, financial balance is ensured when total contributions finance total pensions, either every year or on average over time. This means that the contribution rate should be equal to the average benefit ratio (i.e. the average pension divided by the average wage) multiplied by the pensioners-to-contributors ratio. If one goal is to stabilise pension benefit ratios without changing the contribution rates, then the AAM should adjust the retirement age to stabilise the pensioners-to-contributors ratio. If another goal is to ensure that the length of retirement remains at roughly half the working period, which is generally considered to be fair across generations, then the retirement age should be linked to about two-thirds of longevity gains. However, increasing the retirement age will not suffice to prevent the decline in the relative size of the labour force in many countries (Boulhol and Geppert, 2018[40]). This difficulty exists whether pension parameters are adjusted automatically or discretionarily.

Given distributional implications and the need to find a compromise between different goals, the choice of which parameters to adjust should be the topic of political debate. If the choice were made to act on the contribution rate of a PAYG pension scheme to stabilise replacement rates or the average benefit ratio, then the contribution rate would have to be linked one-to-one to the pensioners-to-contributors ratio. The problem is that the demographic old-age to working-age ratio is projected to double by around 2060 on average in the OECD (Chapter 5). This implies that the contribution rate would have to double if the total employment rate does not change, which is not realistic. Thus, while contribution rates may be adjusted to help deal with ageing, this would only be one (small) part of the equation: to preserve pension levels, the adjustment must involve limiting the increase in the pensioners-to-contributors ratio, by raising employment, in particular at older ages and especially by raising the retirement age to accompany improvements in life expectancy. Only four OECD countries have automatic adjustments of contribution rates, and in three of them there is a political option to avoid or limit the automatic adjustment of contribution rates: the backstop mechanism in Canada, the semi-automatic balancing mechanism in Luxembourg and the adjustment of the contribution rate in Germany that is limited by transfers from the State budget to the pension system. In the fourth country, Finland, the automatic balancing mechanism is not expected to be triggered in the foreseeable future (see above).

Linking the statutory retirement age to life expectancy is a good way to improve financial sustainability without reducing pension adequacy. It is therefore a key policy if the objective is to maintain replacement rates. In generic DB schemes, replacement rates are equal to the number of years spent working multiplied by the accrual rates. However, a retirement age link without adjustment of accrual rates also results in higher pension entitlements when life expectancy increases as career length is increased. If there is no fiscal space to raise pension spending, accrual rates should be negatively linked to the retirement age and therefore to life expectancy, hence stabilising replacement rates. This is similar to what Finland does by linking the retirement age to life expectancy improvements and through the life expectancy coefficient. Also in France, although there is no link, the gradual increase in the contribution period to get a full pension in its core DB scheme (*régime général*), decided to cope with increasing longevity, is being implemented without modifying the replacement rate.

The pace of the link could vary depending on people’s preferences and the initial retirement age, pension contribution rates and benefit levels. One alternative implemented in Denmark, Estonia, Greece and Italy is a one-to-one link between statutory retirement age and life expectancy. While such a fast link may be beneficial from a perspective of financial sustainability, the political sustainability of such a link might be weak over the long term, as suggested by policy reversals in the Slovak Republic and the Netherlands. When introducing life expectancy links, it is also important to monitor changes in social inequalities in life expectancy. While there currently is no clear pattern in the development of inequalities in life expectancy across countries, a link would disproportionately affect low-income groups if these inequalities were to continuously grow over time, as has been the case in some countries.

An automatic increase in the statutory retirement age when life expectancy increases, does not necessarily translate one-to-one into increases in effective retirement ages in the medium term (Geppert et al., 2019[9]). To strengthen the effectiveness of retirement age links to boost employment in old age, these links should ideally be accompanied by labour market policies that facilitate older people to remain in the labour market longer. While these policies are beyond the scope of *Pensions at a Glance*, the OECD publication *Working Better with Age* provides a synthesis of the main challenges and policy recommendations together with a set of international best practices to foster employability, labour demand and incentives to work at an older age (OECD, 2019[41]).

Automatically adjusting benefit levels of new pensions or pensions in payment might still be needed. Adjustment of new pensions is particularly suitable to account for changes in remaining life expectancy at retirement, as these changes are specific to the cohort retiring. This is in line with adjustments made by annuity conversion factors in NDC schemes and in Finland through the life expectancy coefficient in its DB scheme. Over time, however, adjustments to new pensions may become socially unsustainable if people do not work longer. Therefore they might be best combined with an automatic adjustment of the retirement age. Introducing an adjustment affecting new pensioners does have distributional consequences as it does not affect already retired generations.

Estonia, Japan and Lithuania adjust both new pensions and pensions in payment to changes in total contributions or a proxy thereof. These mechanisms will significantly erode pension replacement rates over time given the large projected decline in the size of the working population in these countries, although in Japan the adjustment mechanism can be suspended to protect a certain level of pension adequacy.[29] Most balancing mechanisms in place in OECD countries adjust both new pensions and pensions in payment as well, which is an effective way to restore financial balance in a short time. However, making demographic changes part of pension indexation has its limits, especially in countries that have already opted for price indexation as they have basically no room to further reduce indexation in order to generate savings: sharp or sustained decreases of pensions in payment in real terms will likely lead to strong discontent against the AAM and increase pressure on policy makers to adjust, suspend or remove it, defeating the main *raison d'être* of AAMs.

Even if different AAMs adjust to changes in life expectancy and in the wage bill, financial sustainability is substantially strengthened when including a well-designed automatic balancing mechanism (ABM). ABMs specifically aim at ensuring a balanced budget over time and therefore are the final cornerstone of any sustainable pension scheme. By adjusting both new pensions and pensions in payment, balancing mechanisms distribute the burden of restoring balance across generations. While ABMs can ensure a balanced budget in absence of other AAMs such as a link between retirement age and life expectancy, as a standalone policy they might trigger sharp or sustained corrections in benefit levels that could undermine public and political support for the mechanism. This means that an ABM should rather complement some main AAMs, as in Sweden for example. Although the balancing mechanism in Canada does not complement other AAMs, it provides another good example of this principle of reliance on ABMs as a last resort. Here, priority is given to political solutions, but the backstop mechanism automatically restores financial balance if policy makers cannot agree on a set of adjustments sufficient to restore it.

How to get there

Automatic adjustment mechanisms may offer a technical solution to deal with long-term trends affecting pension systems, but that does not mean that they bypass political processes. AAMs raise questions of how the costs of population ageing are distributed across generations. Setting objectives and deciding on which pension parameters to adjust are therefore fundamentally political decisions, and the introduction of an AAM follows standard law-making procedures. While *not* intervening might appear to be neutral policy, it is what changes redistribution between generations in the face of changing circumstances. As life expectancy increases, a fixed statutory retirement age with unadjusted benefits amounts to redistributing more (and unfinanced) pension income to retirees at the expense of those – most likely future generations – that will have to pay the bill. Hence, the view of AAMs as 'confiscating democracy' or as 'depoliticising' pension policy is mistaken.

AAMs should be politically sustainable in order to fulfil their long-term goals of financial and social sustainability and trust in the pension system: people should be able to rely on the mechanisms remaining in place over a long time. Hence, a government seeking to introduce an AAM should look for a wide parliamentary majority as well as broad public support to ensure that the mechanism survives government or coalition changes and is not subject to attacks from various stakeholders.

That does not mean that politics should no longer matter once AAMs are in place. Policy makers maintain full control over the development of the pension system and can intervene if they deem the triggered adjustments undesirable. This applies in particular when AAMs produce unexpected consequences, for instance during unusually large economic shocks, and it must be possible to change AAMs when preferences in society change. However, AAMs make the trade-off between the short-term and long-term consequences of interventions in the pension system transparent. Furthermore, AAMs can be designed to favour political solutions to sustainability questions as long as they fulfil the predefined objective, as is the case for Canada’s automatic backstop mechanism.

Several aspects of AAM design and implementation contribute to political sustainability beyond avoiding real reductions in pensions in payment or long periods between adjustments. Political independence of the body responsible to calculate the indicator and transparency in how it is measured is vital, and all the more so for projection-based indicators. As forecasting is a complex and therefore less transparent exercise, projection-based indicators are more vulnerable to political manipulation through challenging or adjusting forecasting methods or assumptions to change outcomes. Furthermore, the procedure to implement adjustments when the indicator changes or crosses a critical value should be clear.

Finally, clear communication about why AAMs are necessary and what they exactly do is paramount for their political sustainability. The general public should be well informed about the consequences of procrastination when facing these large expected demographic changes. As with all pension reforms, the introduction of AAMs is likely to spark intense political debate as different stakeholders assess whether they stand to gain or lose from them. Hence, the implementation of AAMs is more likely to succeed if they can be perceived by different stakeholders as providing a fair solution across generations.

In the communication on AAMs, it is important to distinguish between the parametric change triggered by AAMs and the automaticity of the trigger. Public resistance against the introduction of AAMs is often not as focused on the automaticity of the change, which is the core component distinguishing AAMs from discretionary adjustments, but on the triggered change in pension parameters itself. For instance, opposition is likely to challenge increasing the statutory retirement age, and not as much the automatic link with life expectancy that triggers this increase. Indeed, any discretionary reforms aiming to improve financial sustainability through adjusting statutory retirement ages or pension benefits will face the same critique. It is therefore important to point out the cost of inaction as well as the difference between AAMs and discretionary reforms following preset timetables. AAMs are conditional and can be designed to maintain the status quo: the statutory retirement age will only increase if life expectancy increases, so as to ensure for example that the ratio of time spent in the labour market over time spent in retirement remains stable over generations. Hence, AAMs by definition offer a clear justification for why pension parameters are adjusted. Reforms following preset timetables cannot promise a solution to the problem of pension financing, nor ensure that adjustments are not sharper than needed to reach financial balance.

Notes

1. Upon parliamentary approval, the triple lock will be suspended for one year in 2022 to avoid that the increase in wages in 2021 compared to 2020, when many workers had a lower income due to COVID-19, causes an 8% hike in pension levels.
2. When pension entitlements are annuitised, longer lives mean more expensive annuities, and therefore lower monthly benefits even if individual longevity risks are still shared among all recipients. As the annuity is set based on life expectancy at retirement, the risk of life expectancy of a cohort growing faster than

predicted after retirement is borne by the pension provider. In the case of lump-sum payments all individual longevity risk is borne by the individual. With longer lives, these lump sums have to finance consumption over a period that is longer on average and uncertain individually.

3. In this generic form, accounts accumulated by people who die before retiring are typically not inherited, thereby increasing the internal rate of return beyond the growth of the contribution base.
4. Moreover, some NDC schemes include survivors' pensions financed by NDC contributions. The generic NDC scheme does not include survivors' benefits, although they can be added. Of all NDC countries, only Italy and Greece have a survivors' pension inside the NDC scheme, while Poland has a survivors' pension outside it (OECD, 2018[44]). In absence of a survivors' pension inside the scheme, NDC schemes generate a 'survivor dividend': the notional accounts of people who pass away before retirement are not accounted for in benefit calculation.
5. Upon the introduction of NDC in 2015, all auxiliary pensions including those in payment were supposed to be transferred to the new NDC scheme, but the Constitutional Court ruled against this. Auxiliary pensions currently make up 12% of total public pension expenditure in Greece.
6. The 'survivor dividend', that is, the notional accumulated capital of people in a cohort who pass away before retirement, would be sufficient to cover the higher pension expenditure due to underestimation of a cohort's longevity gains resulting from the use of period life expectancy (Arnold, Boado-Penas and Godínez-Olivares, 2016[42]).
7. The Czech Republic has a long-term planning policy that somewhat resembles a semi-automatic adjustment of the statutory retirement age to life expectancy. Life expectancy is calculated for every cohort between ages 25 and 54. If for at least one cohort, life expectancy at the statutory retirement age would either be below 24% of total life expectancy or above 26% of total life expectancy, then the report also publishes what the statutory retirement age should be for each cohort for it to fall between these limits. However, even if a clear target is set, there is no formal procedure or mechanism linking this report to effective changes in the statutory retirement age.
8. The increase in statutory retirement age between 2021 and 2050 is faster in Denmark and Estonia than in other countries with a one-to-one link to life expectancy. For Denmark, this is the result of the maximum period people on average can expect to be in retirement having been set at 14.5 years, which is less than what it is expected to be upon introduction of the mechanism, making the retirement age rise faster than life expectancy with the first applications of the link. In Estonia, this is the result of the gradual statutory retirement age increase before the link is applied.
9. For example, Denmark sets a maximum period people can expect to live in retirement, which is at 14.5 years. In Italy, where life expectancy over the last two years is compared to that over the two years prior and the retirement age follows the change in life expectancy between both periods, the statutory retirement age only starts to increase again once life expectancy reaches the level it was at before declining.
10. A longer period between announcement of a change in the statutory retirement age and its implementation is supposed to allow people to better plan their careers as well as their retirement. Moreover, the period has to be longer in Denmark than in other countries with a link as the eligibility ages of various early retirement schemes are linked to the statutory retirement age, the earliest of which being accessible as of six years before the statutory retirement age.
11. Chile, Indonesia and Mexico use gender-specific tables, which lower pensions for women, something that is not allowed in the European Union.
12. By contrast, letting different groups retire at different ages would raise a host of other issues, such as how these groups would be defined and delineated, whether individual health status and behaviours should be taken into account, how retirement ages should be adapted to changing longevity in a group, etc. Many countries in the past allowed for different retirement ages according to occupational risks and these were increasingly closed and replaced by disability pension schemes that grant benefits based on individual health status.
13. The issue is more serious in the US given the very large increase in life-expectancy inequality (Auerbach et al., 2017[46]) but the US is clearly an outlier (Banks et al., 2021[16]).
14. These include Mackenbach et al. (2016[47]), Eurostat (2020[48]) and some country-specific studies: Auerbach et al. (2017[46]), Baker, Currie and Schwandt (2019[49]), Blanpain (2020[50]), Brønnum-Hansen and Baadsgaard (2012[51]), Chetty et al. (2016[52]), Finansministeriet (2017[60]), Khang et al. (2019[53]), Insee (2016[54]), Marshall-Catlin, Bushnik and Tjepkema (2019[55]), van Raalte, Sasson and Martikainen (2018[59]) and studies referenced in GAO (2016[57]).
15. In Finland, inequality in life expectancy increased between the mid-1990s and the late 2000s, but has since remained roughly constant.

16. The longevity measure (such as life expectancy or mortality rates) used to calculate the sustainability factor typically refers to a given age and a given year, and the correction applies to the initial pensions of all people within the same cohort.

17. The annual growth in life expectancy was 0.6% on average over the period (Ministry of Health, Labour and Welfare, 2020[61]). In addition, if the actuarial review conducted every 5 years by the Ministry of Health, Labour and Welfare shows that pension finances can be balanced without the adjustment measures, macroeconomic indexation will be terminated.

18. A “standard pension” is ‘the amount of pension benefits received by a household consisting of a husband who works as a salaried worker earning the average wage for 40 years and a wife who is a covered person in the 3rd category for 40 years’ (Ministry of Health, Labour and Welfare, 2014, p. 13[45]). The 50% minimum replacement rate refers to the pension this household would receive upon retirement relative to the average net income of men of active age. In 2019, the replacement rate for a “standard pension” was equal to 61.7% according to the Japanese Ministry of Health, Labour and Welfare (2019[58]).

19. Portugal also takes into account GDP growth in the indexation rule but unrelated to ageing prospects. Average annual GDP growth over the last two years is partially taken into account in indexation. If real-GDP growth is above 3%, pensions in payment are indexed by 12.5% of real-GDP growth on top of CPI. Adjustment to GDP does not apply to higher pensions, i.e. pensions above six times the Social Support Index (IAS, currently at EUR 438.81).

20. In every third report (i.e. every nine years), the Canadian Chief Actuary also reports on the CPP Actuarial Factors that adjust benefits to individuals’ retirement timing and provides recommendations for adjustments.

21. Moreover, in the calculation of the sustainability factor, the number of both contributors and pensioners is standardised in a way to avoid that the ratio is disproportionately impacted by changes in the amount of people with very low contributions or pensions. The equivalent number of contributors is calculated by dividing total contributions (including those of employees and the unemployed) by contributions that would have been paid by one person earning the average wage (the unemployed are included in calculating the equivalent number of contributors so as to avoid that pensions are affected by economic cycles (Vidal-Meliá, Boado-Penas and Settergren, 2009[1])); the equivalent number of pensioners is calculated by dividing the total pension points of pensioners by the number of points an individual has collected after a 45-year career at average wages (i.e. the ‘standard pension’).

22. The suspension seems to have been decided officially to avoid that the pension of an average wage worker with a 45-year career would fall below 48%.

23. The commission proposed to maintain both a floor in the replacement rate and a ceiling of the contribution rate, but to revise their levels every seven years. It proposed a ‘corridor’ within which the replacement rate floor could be set of 44-49% and another ‘corridor’ for the contribution-rate ceiling of 20-24%.

24. Also the German pension insurance scheme is not allowed to be in debt (Baksa, Munkacsi and Nerlich, 2020[56]).

25. If the contribution rate were to be increased beyond its current level of 24%, then the end-of-year allowance paid to pensioners would be suspended, corresponding to a 1.8% reduction of gross pension after a full career at average wages. This suspension is automatic.

26. Moreover, it decided to prolong the period between announcing an increase in statutory retirement age and the increase taking effect from one to five years (Ministry of Finance of the Slovak Republic, 2020[43]).

27. Even if Norway’s indexation rule only involves indexation to average wages and therefore falls outside the scope of this chapter, it is worth noting that it similarly led to a decline of real pension benefit levels between 2015 and 2018 – although for some groups this loss was offset by changes in taxation and minimum and basic pension benefits. In 2021, the subtraction of 0.75% from average wage growth was not applied, and the government is working on a proposal to change the indexation of pensions in payment to the average of wage and price growth as of 2022 (Chapter 1).

28. Moreover, the Agreement also established a temporary early retirement scheme for people in occupations deemed arduous by the social partners, allowing early retirement without penalty three years before the statutory retirement age. As the social partners could not agree on a list of arduous occupations centrally, the social partners at the sectoral level can now propose a list of occupations they consider arduous within the sector. The early retirement scheme is temporary, and will terminate once occupational pension schemes are transformed into FDC schemes.

29. Estonia's one-to-one link of the statutory retirement age to life expectancy will only partially mitigate this effect.

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