Fundación MAPFRE

# PENSION SYSTEMS

MAPFRE Economic Research

# Pension Systems

## An International Comparative Survey

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# MAPFRE Economic Research

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# Introduction

In recent decades societies all over the world have witnessed, to varying degrees of intensity, a demographic pattern characterized by an increase in life expectancy and a decline in fertility and mortality rates. This pattern has significantly altered the population pyramids. In general terms, the expansive pyramids typical of the first half of the last century have given way to constrictive pyramids that reflect the aging of the population. Moreover, the main population projections indicate that by the second half of this century the world will be converging toward the stationary pyramids characteristic of stable and mature populations with low fertility and mortality rates.

This demographic phenomenon has already impacted—and will continue to impact—many areas of economic activity and social organization. Clearly, one of these areas is pension systems. Longevity, together with the materialization of other economic and financial risks, has had a significant effect on pension spending, and there is an evident need to continue adjusting these systems to make them sustainable in the long term and, in so doing, preserve one of the most important pillars of social organization today.

This study aims to contribute to that debate. In addition to presenting a new diagnosis of the pension challenge based on a conceptual framework that emphasizes the risks to which pension systems are currently exposed, it identifies elements that can provide them with long-term sustainability and stability by refining the distribution of the effects produced by the materialization of the inherent risks. To support this analysis, six benchmark models have been selected to cover the spectrum of the different pension plans that currently exist and provide a broad picture from which to draw general conclusions.

Based on this risk-based conceptual framework and analysis of the demographic trends and characteristics of the pension systems in the countries selected, the study identifies the adjustment mechanisms and measures that have produced the best results in the reform of these systems and that could therefore provide a general point of reference in implementing future reforms of pension systems aimed at equipping them with long-term stability and sustainability.

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# Executive Summary

According to United Nations (UN) estimates, life expectancy at birth of the global population has grown steadily in recent decades, rising from 47 years in 1950 to nearly 71 years in 2015. This upward trend in longevity is set to continue in the coming decades. By the end of the century, the average life expectancy of the global population is estimated to reach 90 years in the most developed regions and 82 years in the least developed.

Meanwhile, the UN estimates point to a downward trend in the fertility rate. In 1950 the average fertility rate for the global population was five births per woman, but it was half this figure in 2015 and is estimated to fall to around two births per woman by the end of the century.

These demographic phenomena, combined with drastic declines in mortality rates at young ages, are leading to a gradual aging of the population, with more and more people reaching extreme old age. Advances in the prevention and treatment of diseases, coupled with improved hygienic conditions for birth deliveries, surgeries, food conservation and in daily life in general, are contributing to this process. Biometric actuarial tables usually assume a maximum age limit of 120 years, which has not yet been reached. However, if the observed demographic trends continue, this age limit is likely to be exceeded. Furthermore, research currently underway could give rise to disruptive changes that would push the age at death beyond what is presently conceivable. This is a scenario that we cannot afford to rule out, and in fact it is gaining more and more probability.

These demographic phenomena will impact multiple areas of economic activity and social organization. One of these areas has to do with pension systems. The retirement dependency ratio, which measures the relationship between people considered to be of working age and the population that has reached retirement age, has been rising all over the world in recent decades and the trend is expected to be consolidated in the coming years. This fact is leading to numerous pension system reforms consisting, among other aspects, in the progressive increase in the retirement age and the adoption of active aging measures.

Economic and financial factors are also impacting the medium and long-term financial sustainability of pension systems. Most notably, these factors are the low interest rate environments motivated by the ultra-easy monetary policies applied by the central banks in the world's main economies, and structural elements that are affecting the employment and productivity levels of these economies.

This study presents an international comparative survey of retirement pension systems, using a methodology consisting of pillars or coverage levels and an approach based on the different risks to which pension systems are currently exposed. Although the analysis focuses on the first (mandatory contributory) and second (occupational) pillar, it also includes pillar zero (protection against poverty) and the third pillar (voluntary individual savings). In view of the main demographic trends and the characteristics of the different pension systems, for the purposes of this analysis six benchmark models were selected on the basis that they cover the full spectrum of systems that currently exist, at least as regards the most important features, and therefore provide a broad picture from which to draw general conclusions.

The study analyzes the reforms implemented in the selected systems in recent decades. As a result of the demographic pressure caused by the general increase in life expectancy, accompanied by a significant fall in fertility rates (a phenomenon known as the baby boom), all the reforms carried out in the recent past are designed to reinforce the medium and long-term stability and sustainability of pension systems.

The benchmark models selected comprise different characteristics. They include a system with a strong weight of the first pillar of state retirement pensions based on a pay-as-you-go system in which the contributions are used to pay the current pensions, without a clear link between the contribution levels and the benefits received (i.e. the Spanish system); a system derived from one of the first comprehensive reforms of the late 20th century, whose first pillar is based almost exclusively on the system of individual capitalization accounts, and which has been replicated in numerous countries (i.e. the Chilean system); a system in which the first pillar is basically pay-as-you-go but includes a mechanism (notional accounts) to adapt the benefits received to the contributions made throughout the person's working life and with a greater weight of capital funds to supplement the state pension (i.e. the Swedish model); and a group of systems in which the second pillar of pension commitments assumed by companies on behalf of their employees plays a crucial role (i.e. the United States, United Kingdom and Netherlands).

A general analysis of the reforms implemented in these models reveals that the effect of demographic, economic and financial factors on the medium and long-term sustainability of pension systems can be absorbed or corrected through a set of mechanisms and measures. The study identifies eight main mechanisms for analyzing and implementing public policies to address the pension issue: (i) the maintenance of a basic system of social protection; (ii) the increase in the retirement age; (iii) the adjustment of contribution rates; (iv) the adjustment of budgetary transfers for pension payments; (v) the adjustment of replacement rates; (vi) the generation of incentives to encourage companies to create and manage supplementary pension plans; (vii) the introduction of fiscal incentives for medium and long-term voluntary individual savings, again designed to supplement pensions; and (viii) greater transparency to workers regarding the pension they are likely to receive.

In the most stable systems, characterized by the absence of the need for successive reforms, the strengthening of Pillars 2 (pension plans to supplement the employment system) and 3 (incentives for voluntary individual saving in the form of financial products to supplement pensions) always play a crucial role. However, to achieve greater stability that is derived from a better balance between the different pillars (and, consequently, between the risks), it has been necessary to sustain significant contribution percentages over long periods of time.

Profound reforms aimed at substantially altering the weight of the different pillars, in which capitalization occupies a significant part of the contributory component, have only worked when they have been undertaken well in advance because they need to be accompanied by substantial contributions over a long period of time by both companies and employees. This is the case of the Dutch system, which is a paradigm in this respect and whose reform dates back to the 1950s. Since then, the contributions through Pillar 2 supplementary pension systems have led to what is now one of the largest aggregate funds in the world. But even in this case, the estimated impact of improvements in life expectancy has recently led to the introduction of certain adjustments to offset the possible negative effect on the system accounts.

All pension systems are exposed to a series of risks which, if they materialize, will be assumed by the government, the private companies involved in the system, the active workforce, or retired pensioners. This study describes these risks and their possible impact on both pre and post retirement.

One common denominator in the recent reforms analyzed is that they have all implemented measures to spread these risks, to a greater or lesser extent, between the different actors involved by introducing public control mechanisms to prevent poor risk management due to an inefficient system

leading to situations in which people who reach retirement age suffer the consequences in the form of lower replacement rates. The importance of developing these mechanisms cannot be overestimated, and the latest reforms tend to increasingly involve public institutions and assign greater oversight powers to them. The measures analyzed include the following:

- The creation of public compensation mechanisms for employees who have suffered a loss of their rights due to the irregular performance of the entities involved in the company pension plan, as in the case of the United States.

- Requirements to externalize funds intended to cover companies' pension commitments to their employees, as in the case of the Dutch and Spanish systems.

- Assumption by public institutions of some of the elements at greatest risk and with a greater potential impact on retired persons, such as life annuities, so that the coverage of the demographic risks, both idiosyncratic and aggregate or systematic, falls to a public company, as in the Swedish case.

- Public control over the powers and the commissions charged by the entities that manage the capital funds, through the creation of public entities with a stake in the system, as in the cases of the United Kingdom, Sweden and Chile.

The reasoning behind the mechanisms to protect people who reach retirement age from losses in their purchasing power as a result of inflationary processes is diverse, although all the systems analyzed have introduced annual or even more frequent review mechanisms. There is a tendency to introduce mechanisms in which the indices used for the indicators that measure the loss of purchasing power (the consumer price index, changes in salaries, or a combination of both) are coupled with other indicators related to the sustainability of the system.

Contribution percentages are an important aspect to mention in this context. Of the six models analyzed, four of them have aggregate contributions for the first two pillars above the average of OECD (Organization for Economic Cooperation and Development) countries, at around 18 percent. The system with the smallest contributions is the Chilean one, at 10 percent, although there is a reform underway to raise this percentage.

Another aspect to note is that fiscal incentives have a great impact on all the pension systems analyzed, especially as regards the voluntary individual savings components in Pillars 2 and 3. Depending on the benchmark model, there are fiscal incentives on direct tax (income tax) aimed at stimulating medium and long-term saving when this forms part of company supplementary pensions, or (in Pillar 3 methods) when it is channeled through financial products designed to supplement the pensions received in Pillar 1 and Pillar 2 plans. These contributions are usually deductible at the time they are made—and taxed when the profit derived from them is received during retirement—and are subject to lower marginal rates, with certain limits on the annual deductible contributions, or in other cases through exemption on earnings.

Meanwhile, the unfavorable demographic trend (a structural element common to all the systems analyzed) is further compounded by the effect that economic crises can have on pension systems. Of particular importance in this respect are economic and employment policies to prevent situations of structural unemployment, which greatly compromise the sustainability of pension systems in an environment marked by a sharp upward trend in dependency rates. In some economies, factors such as lower levels of labor market inclusion among women and certain age brackets and low incomes can have additional harmful effects on the respective systems for these groups. The public policies analyzed always attempt, with varying degrees of success, to offset these problems.

Lastly, it is important to note that the measures and mechanisms aimed at addressing the challenges of sustainability derived from the demographic, economic and financial risks to which pension systems are exposed can only be contemplated within a medium and long-term horizon. Consequently, any system in which a reform is undertaken with a view to generating definitive effects in the short term is bound to fail to resolve the problems and, ultimately, is destined to fall prey to the same pressures, thereby increasing the probability of having to address an even greater economic and social shock.

The conclusion that may be drawn from this analysis of the selected benchmark models is that in view of the pressure of the demographic, economic and financial risks which, to varying degrees, affect all pension systems worldwide, the path that offers the greatest likelihood of providing sustainability and stability in the medium and long terms necessarily involves achieving a better balance between the different pillars, as a mechanism for redistributing the risks to which those systems are exposed and, in the final instance, improving the capacity to absorb the economic effects derived from their potential materialization. It is also important to note that the materialization of these risks does not affect the different pillars in the same way, so improving their distribution will moderate their impact should they materialize.

From an instrumental point of view, a better balance between pillars (and, consequently, between risks) can only be achieved in a scenario of medium and long-term implementations, which can be summarized in the following general principles:

- Maintenance and reinforcement of a basic system of social protection (Pillar 0); i.e. a minimum non-contributory solidarity pension to support the strata of workers who were unable to complete their working life and therefore do not qualify for a contributory pension.

- Creation of a first contributory pillar that combines intergenerational solidarity with the effort of individual saving, aligning benefits more closely with individual contributions.

- Generation of incentives for companies to create and manage (directly or indirectly through professional fund managers) supplementary pension plans of the contributory variety (especially defined contributions) to complement Pillar 1 contributory pensions.

- Incentives for medium and long-term voluntary individual saving which workers can channel through professional managers with financial products designed to generate an income during retirement, thus supplementing the pensions from Pillars 1 and 2.

Adjusting pension systems is possibly the economic and social challenge most widely diagnosed by governments, experts and society in general. It is the collective challenge about which there is the greatest consensus regarding the urgent need to take measures, and it is the challenge for which the most efficient solutions depend on key aspects that not only affect the macroeconomic foundations of countries but their social stability as well. Even so, the characteristics of this challenge mean that the solutions are very complex.

The existing pension systems need to be reformed and adjusted to guarantee their sustainability and stability in the long term. But it is not only a question of correcting the financing problems derived from the materialization of demographic, economic and financial risks. In certain cases, it is also a matter of addressing the unintended consequences derived from the very measures that have been implemented to correct those problems.

The best course of action would therefore seem to be to create a more structural foundation for the pension systems of the

future. The risk-based approach for pension systems, as proposed in this study, indicates that the transition to a new formulation to provide long-term sustainability and stability should focus on improving the balance between pillars in order to limit and mitigate the risks inherent to their operation.

In view of the uncertainty about the potential impact of longevity, based on the projected demographic patterns, societies and their governments need to create a space for devising and implementing measures which will only mature in the medium and long term and which must therefore be adopted as soon as possible. In the final instance, societies cannot afford to ignore the fact that retirement is increasingly nearly as long as working life. This is financially unsustainable, but above all it is incompatible with the aspiration of the economic and social development of nations.

# 1. Introduction and Conceptual Framework

## 1.1. The pension system challenge

Since the postwar period, societies in different parts of the world have been witnessing, with varying degrees of intensity, an increasingly convergent global demographic pattern: an increase in life expectancy, accompanied by declines in the fertility and mortality rates. This has significantly altered their population pyramids, which in general terms evolved from expansive at the beginning of the 20th century to constrictive by the end of that century, and currently suggest (based on most population projections) a common tendency to converge toward stationary pyramids in the second half of the 21 stcentury.

The increase in longevity, in line with the parameters predicted by both traditional demographic approaches and more disruptive ones (which anticipate significant increases in longevity in the near future), will have profound implications for societies across most of the planet. However, while there is great uncertainty about the specific impacts that the increase in longevity may have during the present century, there is no doubt that the higher life expectancy will affect virtually every area of society. From the economic point of view, increased life expectancy will impact the structure of the labor market and salary growth, especially in light of its convergence with the technological revolution associated with the digital age and production processes. And from the social point of view, greater longevity will substantially alter the patterns of organization and coexistence.

One of the areas that will clearly be impacted by the greater longevity of the population is pension systems. Higher life expectancy, coupled with the potential materialization of other risks of an economic and financial nature, will affect pension spending and it will therefore be necessary to adjust these systems to make them sustainable in the long term.

In addition to demographic pressures associated with population phenomena (a permanent structural factor), there are other elements that reinforce the urgency of addressing the long-term sustainability of pension systems. The slowdown in economic activity caused by the economic and financial crisis of 2008-2009 (a temporary structural factor), coupled with the presence of occasional volatility, has had a major impact on employment and income levels in many societies. Meanwhile, the low interest rate environment (a temporary structural factor) that has been characterizing most of the world's main economies for several years has proved to be a useful monetary policy for stimulating the growth of economic activity and employment but it has also had unintended consequences for the rhythm of the accumulation of savings and funds used to pay pensions. The result of this combination of factors has been a tendency to undermine the technical and financial foundations of pension systems, which in many cases, and in line with their current parameters, may seriously compromise their medium and long-term sustainability.

The scope of this study is limited to retirement pensions and adopts a conceptual framework based on pillars or coverage levels, to emphasize the different risks to which they are each exposed, as well as the mechanisms used to manage or transfer them, depending on whether they are ultimately supported by the state, by private management entities involved in the process, by the active workforce or by retired pensioners. Of the five levels of coverage defined conceptually in the following section, the analysis in this study mainly focuses on Pillar 1 (mandatory contributory) and Pillar 2 (occupational). However, it also makes reference to Pillar 0 (basic protection against poverty) and Pillar 3 (voluntary individual).

In view of the main demographic trends and the characteristics of the different pension systems, for the purposes of the analysis in this study six benchmark models were selected on the basis that they cover the full spectrum of systems that currently exist, at least as regards the most important features, and provide a sufficiently broad picture from which to draw general conclusions.

These benchmark models include a system with a strong weight of the first pillar of state retirement pensions based on a pay-as-you-go system in which the contributions are used to pay the current pensions, without a clear link between the contribution levels and the benefits received (i.e. the Spanish system); a system whose first pillar is based entirely on the system of individual capitalization accounts and does not include any pay-as-you-go component (i.e. the Chilean system); a system in which the first pillar is basically pay-as-you-go but includes a mechanism (notional accounts) to adapt the benefits received to the contributions made throughout the person's working life and with a greater weight of capitalization funds to supplement the state pension (i.e. the Swedish model); and a group of systems in which the second pillar of pension commitments assumed by companies on behalf of their employees plays a crucial role (i.e. the United States, United Kingdom and Netherlands).

Accordingly, based on the analysis of the demographic trends and characteristics of the pension systems in these countries, and the reforms implemented to adjust them in the recent past, and using the conceptual framework of pillars or coverage levels and the risks to which they are exposed, the study identifies the adjustment mechanisms and measures that have produced the best results in the reform of the pension systems analyzed and that could therefore provide a general point of reference in implementing future reforms at the international level.

## 1.2 Pillars for analyzing pension systems

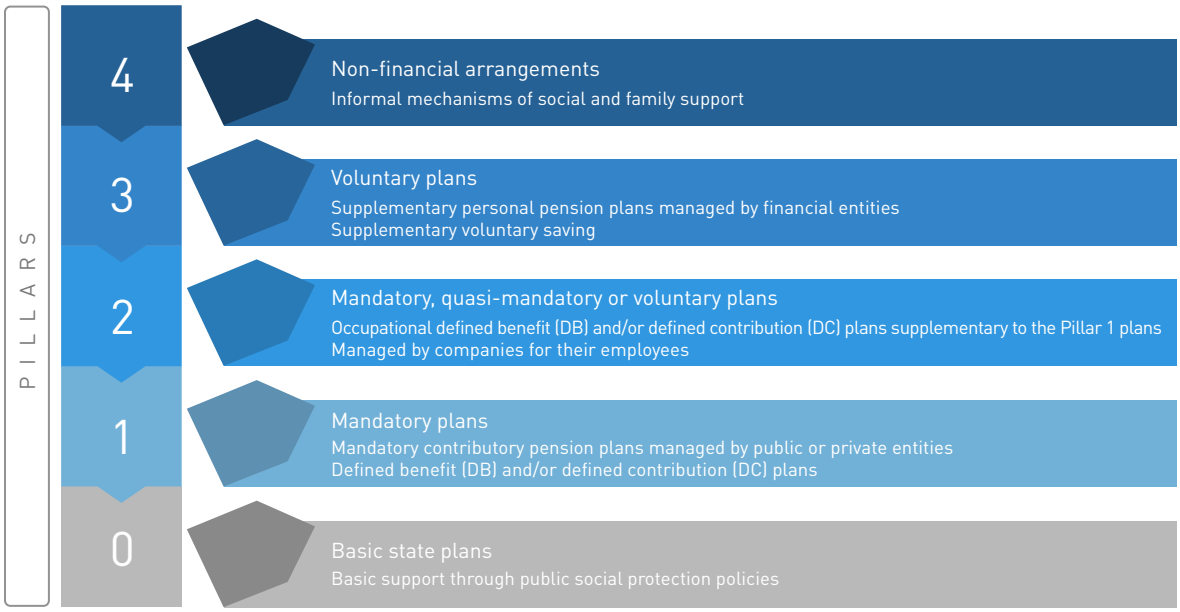
The pension systems in this study are classified and analyzed according to a pillar scheme. This scheme (illustrated in Chart 1.2-a) comprises five elements which, taken together, characterize the different sources of income that an individual may receive during their retirement.

### Pillar 0
### Basic non-contributory state plans

In the first place, the so-called **Pillar 0** refers to basic social protection provided through public policies in the form of basic non-contributory incomes or pensions. The main objective of the benefits received at this level of protection is to avoid elderly people who have been unable to complete their working life falling into poverty when they reach retirement age, thus ensuring that they can meet their basic needs.

The amount is usually similar for all beneficiaries and does not depend on any social security contributions they may have made, irrespective of the fact that these pensions are paid from the contributions currently being made by the working population or from the country's government budgets. In certain cases, this support is received when the amount contributed by the beneficiary is insufficient to qualify for a minimum benefit, and it is usually indexed to their financial situation and certain minimum residence requirements in the country in which it is granted.

Chart 1.2-a
Conceptual framework: pillars for the analysis of pension systems




Source: MAPFRE Economic Research

## illar 1: Mandatory contributory plans

**Pillar 1** comprises the mandatory contributory pension plans that are managed by public and private entities, usually linked to social security systems. This first pillar includes defined benefit plans as well as defined contribution plans. Its main objective is to guarantee a certain level of well-being for people who reach retirement age, measured in terms of the income they have received during their working life (replacement rate).

These plans are characterized by their mandatory and contributory nature, with intervention and inspection by the public authorities. The degree of public intervention may be total or partial, depending on the level of participation by private financial entities (specifically in defined contribution plans) and the specific design of the plan. This pillar therefore includes traditional pay-as-you-go systems, pay-as-you-go systems managed through notional accounts, individual capitalization account systems, and mixed pay-as-you-go and capitalization systems.

## Pillar 2: Occupational plans

**Pillar 2** refers to contributory occupational pension plans which may be mandatory, quasi-mandatory or voluntary, which are promoted by companies on behalf of their employees, and which may be of the defined benefit or defined contribution type. This level of protection is associated with labor relations in both the private and public sectors.

The plans are usually mandatory in the companies that provide them, either by law, as part of a collective bargaining agreement, or as a consequence of individually negotiated clauses in employment contracts. Within the legal limits, their design depends on what companies negotiate with their employees or associations, and they are subject to different levels of inspection by the public authorities.

## Pillar 3: Voluntary plans

**Pillar 3** is an umbrella for the voluntary individual pension and savings plans which are usually managed by private financial entities and where the account holders therefore decide the contributions they wish to make.

Compared with the previous pillars, these plans are subject to less intervention by the authorities, which is usually at the same level as for other financial products linked to saving. This intervention adopts the same form as the regulation applied to mutual funds and their management entities, financial entities and insurance companies, and may govern the solvency of these financial products as well as the protection of consumers.

## Pillar 4: Non-financial arrangements

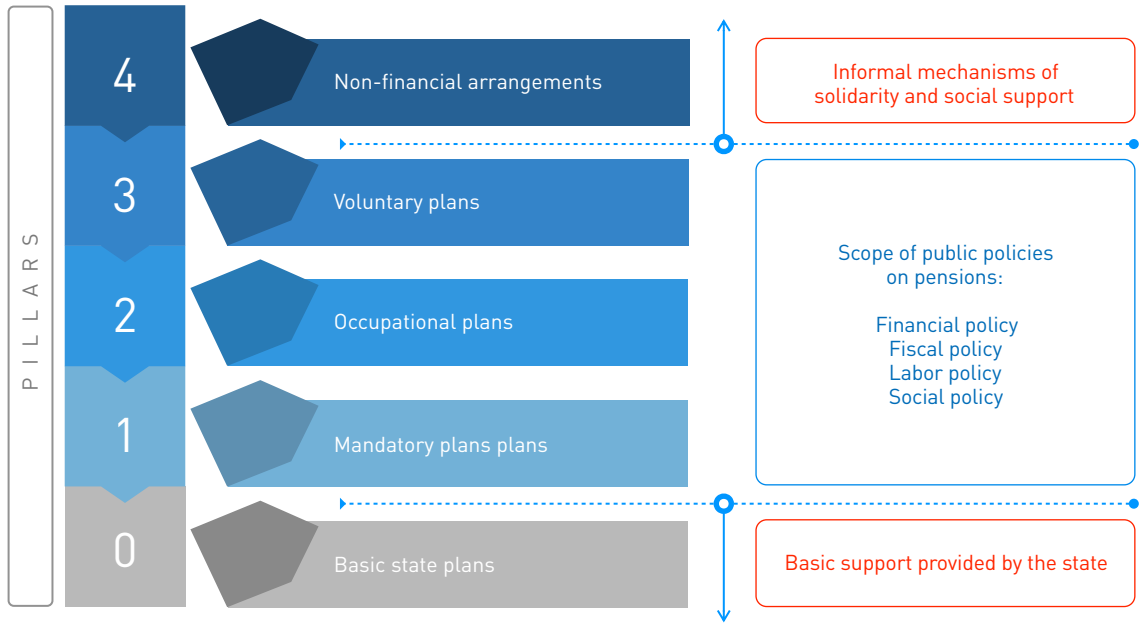
Lastly, **Pillar 4** refers to the set of informal arrangements regarding social and family support that people receive during their retirement. It includes the mechanisms of basic support provided by non-governmental organizations and the family network itself, which are not the same as those defined in Pillar 0 as components of public social protection policies.

## Scope of public policies affecting pensions

As Chart 1.2-b shows, Pillars 0 and 4 are non-contributory mechanisms and are therefore not covered by the scope of the public policies that affect pensions. Rather, and especially in the case of Pillar 0, they correspond to budgetary programs implemented with a certain level of discretion by governments.

In the first case (Pillar 0), it is a matter of applying public budgetary polices on basic protection of the population so that certain sectors of society (usually the most vulnerable) can receive a minimum income in their old age, irrespective of their employment record or contribution to social security schemes.

Chart 1.2-b
Conceptual framework: pillars for analyzing pensions systems and the scope of public policies




Source: MAPFRE Economic Research

The second case (Pillar 4) refers to the informal mechanisms that exist in society (non-governmental organizations, family arrangements, community support) through which retired individuals may receive economic assistance in addition to any other support they may receive through formal pension systems and basic state protection.

This study therefore focuses on Pillars 1, 2 and 3, which fall within the scope of the public policies that affect pensions insofar as they involve the design and implementation of political financial, fiscal, labor and social measures aimed at influencing the equity, efficiency, stability and financial sustainability of pension systems.

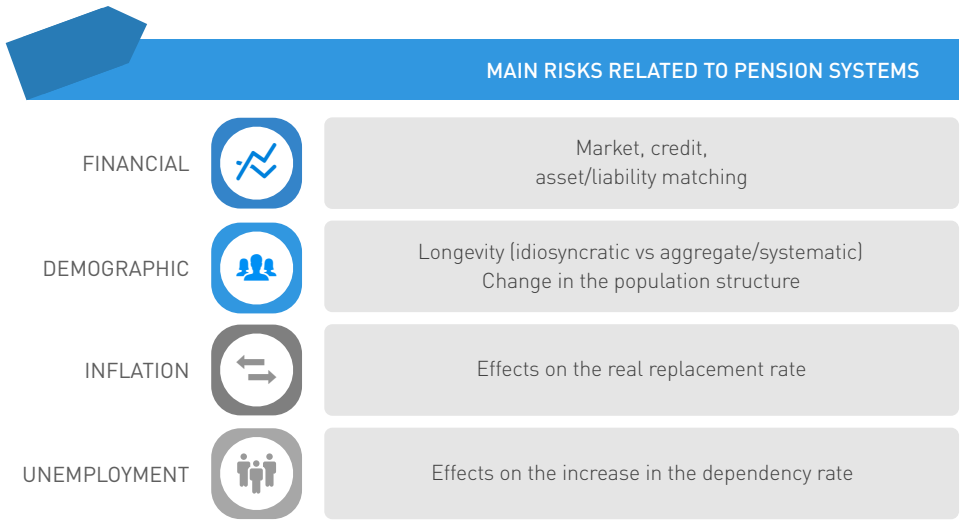
## 1.3 Risk-based approach

For the purposes of this report, a conceptual risk-based approach has been adopted to analyze the different pension systems (see Chart 1.3-a). According to this approach, there are four broad risks related to pension systems with varying degrees of frequency and severity as regards their materialization.

- **Financial risks** specifically linked to the market, credit and asset/liability matching in fund management.

- **Demographic risks** associated with longevity and the changing structure of the population. The longevity risk comprises two dimensions: the idiosyncratic risk, which implies the probability of certain members of the mutual provident society living longer than others and which may be compensated within a mutual society of independent risks; and aggregate or systematic risk, which entails the possibility that the members of the mutual society jointly achieve greater longevity as a result of improved hygienic and medical conditions, giving rise to a risk that cannot be compensated within the traditional idiosyncratic parameters.

Chart 1.3-a
Conceptual framework: main risks for the analysis of pension systems




Source: MAPFRE Economic Research

- **Inflation risk**, which entails the potential decline of the effective replacement rate as a result of the difference between the criteria for updating the pension allowance and the increase in the general level of prices in the economy.

- **Unemployment risk** associated with the economic cycle. In pay-as-you-go plans in particular, this implies an increase in the real dependency rate (relationship between the retired population and the working population).

Each of these risks has a different impact depending on the structure and operation of the pension system in question (relative weight of Pillars 1, 2 or 3) and implies a different transfer process in each case.

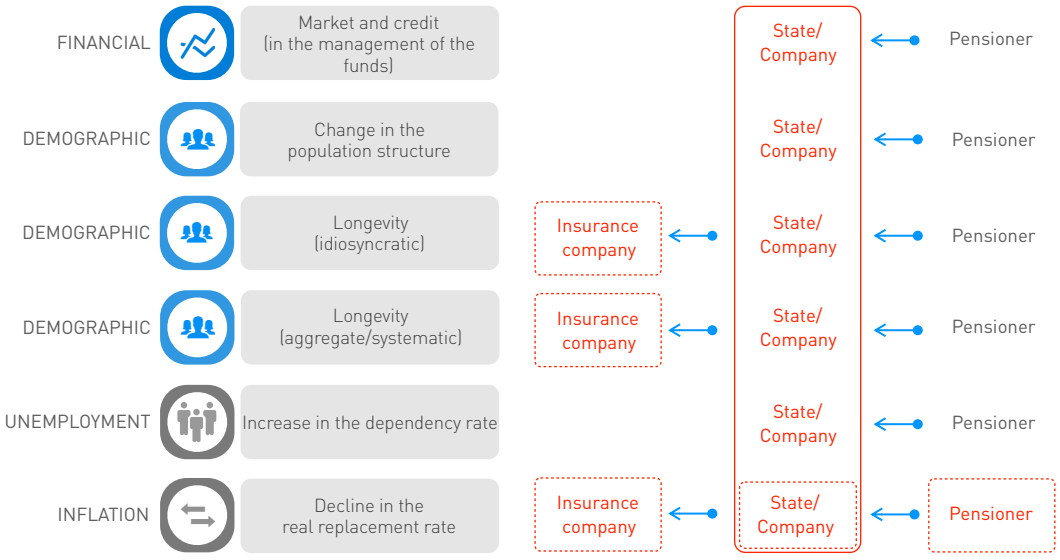
## a) The risks in defined benefit plans (Pillars 1 and 2)

In relation to defined benefit plans in Pillar 1 (under state protection) and Pillar 2 (managed by companies on behalf of their employees), Chart 1.3-b shows the main risks associated with them and the traditional direction in which the transfer operates.

As revealed by this analysis, the four risks indicated above have a direct influence on defined benefit pension systems, which in general terms are transferred by the pensioner to the state (in the case of Pillar 1 defined benefit plans), or to the company that promotes them (in the case of the Pillar 2 type of plan).

In the first place, irrespective of the nature of the pay-as-you-go system, is the influence of the **financial risks** (market and credit) on the management of the funds received from the working population until they are redistributed to pensioners. While this risk is limited by the short duration of the assets and liabilities (as a general rule, the funds captured are used to cover liabilities in the same period), the financial volatility and potential default by a counterparty could generate losses for the fund managers, which would not impact pensioners because of the defined nature of the benefit to cover.

**Chart 1.3-b**
**Conceptual framework: risks associated with defined benefit plans (Pillars 1 and 2)**




Source: MAPFRE Economic Research

In second place are the **demographic risks**. First, the one related to the possibility of the correct compensation of the idiosyncratic risk. In the case of Pillar 1 systems there are usually no significant implications because of the wide universe they normally cover, which means that the compensation can be carried out properly. However, this is not the case with Pillar 2 defined benefit pension plans where the mutual society of workers is too small to guarantee proper compensation. Second, the aggregate risk related to longevity implies higher life expectancies of the retirement population in general, increasing the level of funds required to pay their pensions. And third, the risk associated with changes in the population structure (aging population), which implies a population pyramid that is smaller at the base and wider at the top. This entails greater effort by the working population to contribute to the pay-as-you-go system on behalf of the retired population, i.e. an increase in the dependency rate.

In third place, and again implying an increase in the dependency rate, is the **unemployment risk**, which is closely linked to the behavior of the level of general economic activity. A higher unemployment rate in the economy—all the other risks and the benefits to cover for pensioners being equal—would imply an increase in the dependency rate; in other words, an increase in the contributions required from the working population to finance the payment of pensions to the retired population.

In the last place is the **inflation risk**. It is not unusual for Pillar 1 defined benefit plans (and occasionally Pillar 2 plans as well) to include a guarantee to maintain the value of pensions in real terms through indexation mechanisms. These guarantees do not necessarily exist in Pillar 2 plans of this type. In the first case, the potential risk of a decline in the real value of the pension implies a risk for the state, while in second case that risk remains in the hands of the pensioners who, in the event of high inflation, will see a reduction in the real value of their pension.

In the case of defined benefit systems the effect of the materialization of these risks therefore has financial consequences for the entity that has assumed them (mainly the state or the sponsoring companies, depending on the type), with implications for pension spending and, in a more structural sense, for the long-term sustainability of these plans (see Box 1-3-a which analyzes the sensitivity of this type of plan to different risks).

Consequently, if these risks were to materialize, maintaining the value of pensions would necessarily mean increasing the funds used to pay them, but it might not be possible to modify certain key variables: the size of the working population contributing to the payment of pensions (dependency rate), the percentage of incomes allocated to this purpose (contribution rates), and the moment at which people receive their pension (retirement age).

Lastly, it is important to note that the financial and demographic risks associated with this type of plan (especially those managed by private companies on behalf of their employees) are occasionally externalized from the sponsoring company to an insurance company.

### b) The risks in defined contribution plans (Pillars 1 and 2)

With regard to defined contribution systems associated with both Pillar 1 (under state protection or managed by public or private entities) and Pillar 2 (under company protection), Chart 1.3-c shows the main general risks to which these plans are exposed, as well as the possible transfers.

One of the essential differences observed in defined contribution systems is the absence of the implicit cross-subsidy mechanisms (inter and intra-generational solidarity) that characterize the pay-as-you-go systems. This means that because there is no defined benefit, the pensions are the result of the saving efforts of the individuals concerned

**Box 1.3-a**
Sensitivity exercise:
analysis of the key factors in a defined benefit system

### Characteristics of the exercise

While it is true that in defined benefit pension plans the risks to which they are typically exposed are assumed by the government (or the companies when they are the sponsors of the pension plan), the pension allowance and the replacement rates have varying degrees of sensitivity to each of the associated risk variables.

In this case, the sensitivity exercise considers the effect of the following variables on both the pension allowance and the replacement rate: (i) interest rate for the accumulation of funds; (ii) number of years of contributions; (iii) contribution rate; and (iv) increase in life expectancy.

### Assumptions of the exercise

The exercise is based on the following assumptions in estimating the level of sensitivity:[1]

| | Assumption |
|---|---|
| Interest rate for the accumulation of funds | 2% |
| (Base) contribution rate | 30% |
| Life expectancy at 65 | 23 years |
| Annual salary growth | 1.9% |
| Years of contributions | 40 |
| (Base) monthly pension | 100 monetary units |
| (Base) replacement rate | 60% |

### Main results

The charts below demonstrate that in a defined benefit system the resource base to support the pension allowance (and consequently the replacement rates) is affected by multiple risk variables. The main positive ones are the interest rates in the economy at which the funds may be capitalized before payment of the corresponding benefits, the years the worker has contributed to the system before receiving the corresponding benefit, and the respective contribution rate. Meanwhile, the increase in life expectancy has a negative effect on the resource base.

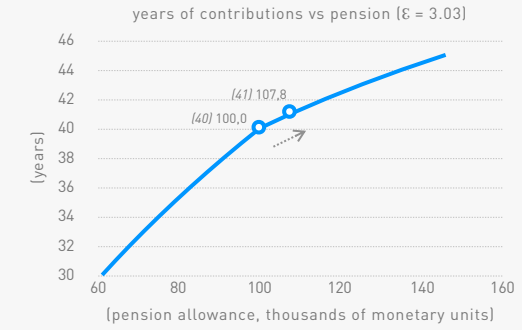
It is clear that in defined benefit systems the negative effect of the materialization of any of these risks does not necessarily affect the amount of the benefits paid to pensioners because the financial impact falls on the pension plan sponsor (the state or, as applicable, the company). Consequently, the data shown in the sensitivity exercise for this case do not imply the effective reduction of the pension allowance or relative replacement rates. Rather, they should be understood as the implicit financial impact that would be derived from maintaining the benefit in spite of the adverse effect of the movement of the variable in question.

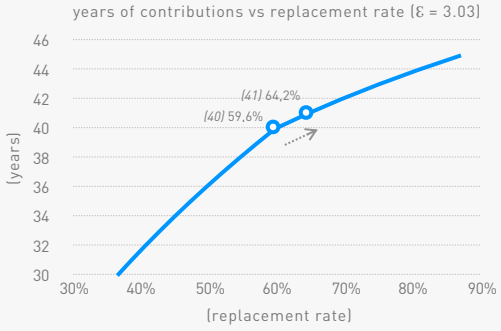
From a financial point of view, the sensitivity analysis shows that the impact of the movement of these variables on the pension allowance and replacement rates is not very different from the impact observed in defined contribution systems. The most important difference, as has already been indicated, is the fact that it is not the pension allowance or replacement rate that would need to be adjusted, but rather the public resource base (or the resource base of the companies in the case of private plans of this type), which would need to be increased to sustain the corresponding benefit.

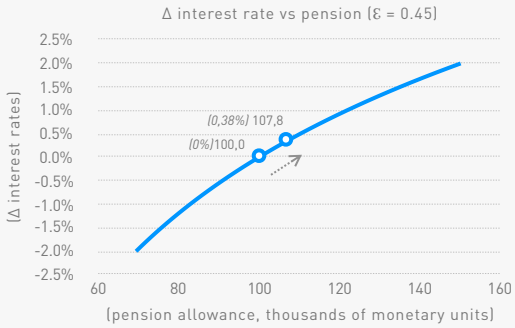
In terms of sensitivity, the increase of one year in the mandatory contribution to the system (the effect of the additional saving by delaying the start of the pension by one year),—all other things equal—would have the positive effect of increasing the pension allowance by 7.8 percent and the replacement rate by 4.6 percentage points (pp); these effects are equivalent to a rise of 38 basis points (bps) in the interest rate at which the funds would be invested before payment of the benefits, to a rise of 2.3 pp in the contribution rate, or a life expectancy at 65 nearly two years less than initially projected.

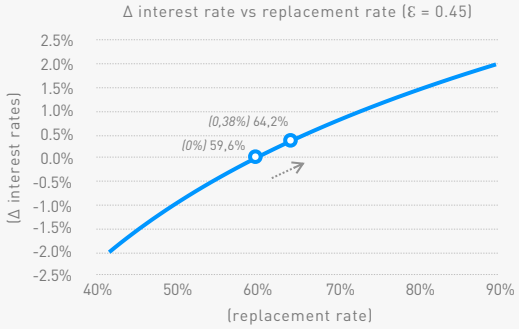
As indicated earlier, the bias of each risk is indicative of its probability. While variables like the years of contributions are subject to legislative changes, others like interest rates depend on the fluctuations of the financial markets, while the variations in life expectancy have a clear structural and permanent bias.

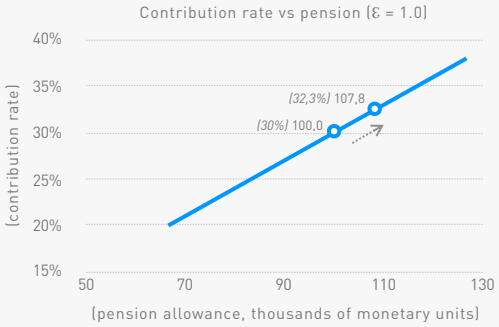
**Box 1.3-a (continued)**
Sensitivity exercise:
analysis of the key factors in a defined benefit system

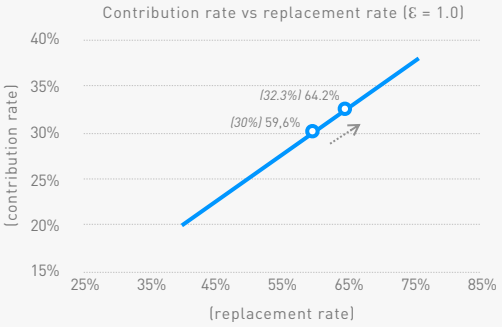


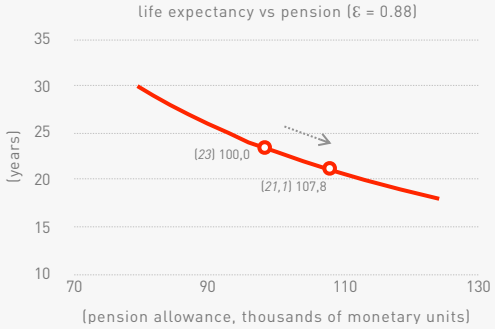



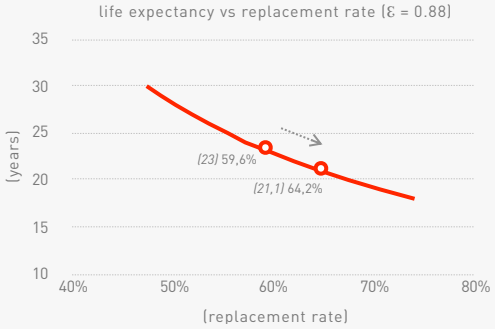



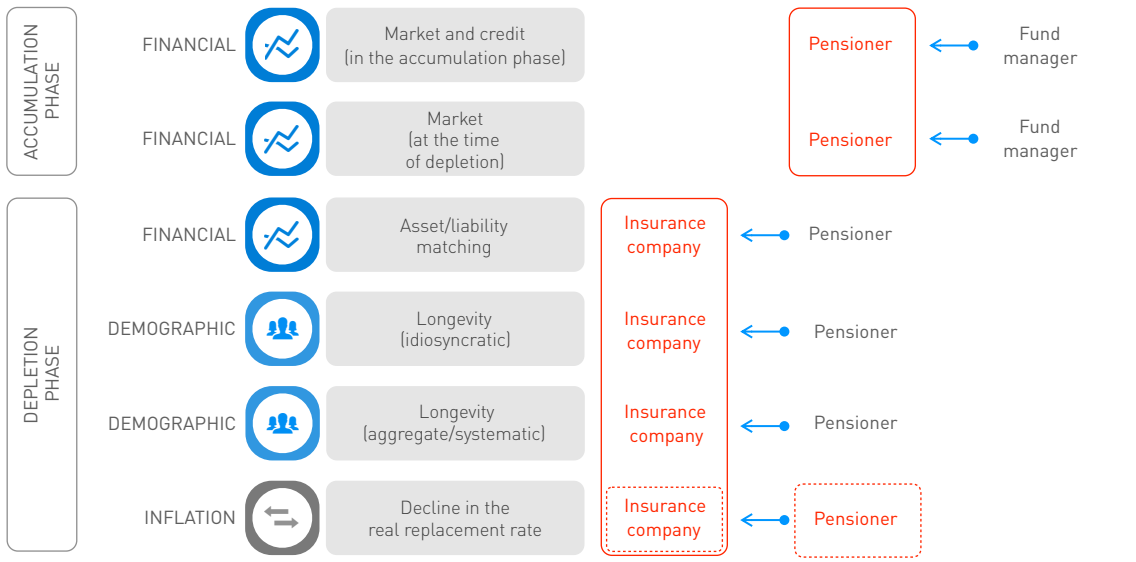




Source: MAPFRE Economic Research

**Chart 1.3-c**
**Conceptual framework: risks associated with defined contribution plans (Pillars 1 and 2)**




Source: MAPFRE Economic Research

and the efficiency executed in the management of the funds saved and the life annuities acquired with them.

In general terms, defined contribution plans comprise two phases. The first is the **accumulation phase,** which coincides with the person's working life and the period during which they accumulate the savings that will serve as the basis for the payment of their pension.

In this first phase, the risks are retained by the future pensioner insofar as the fund manager (which charges a commission for this task) does not assume the potential cost derived from the materialization of any of the financial risks (credit or market) associated with the management of the funds. In any case, the impact of these risks falls on the individual, who will have a lower amount of resources to purchase the life annuity through which they will receive the pension.

And the second is the **depletion phase** in which the savings are used to pay the pension, more often than not through the purchase of a life annuity, under a variety of methods, and the associated risks in this period are therefore transferred in their entirety from the pensioner to the insurance company.

During the **accumulation phase,** when the future pensioner's invested savings are managed, the risks are essentially financial, i.e. the traditional market and credit risks associated with the management of the investment, and the frictional market risk that occurs at the beginning of the retirement period when the investment is liquidated to purchase the life annuity and start paying the pension.

The **depletion phase** is also a period when the insurance companies retain a series of risks. The first is the financial risk (market and credit) derived from the management of the funds that have been received as a premium for the purchase of the life annuity, and the management risk associated with matching the durations of the assets and liabilities (reinvestment risk). Second are the demographic risks associated with the longevity of the pensioners in the mutual society: the idiosyncratic risks (compensated through the mutualization of the risks), and the aggregate or systematic risk (which because of its characteristics cannot be compensated through the traditional

mechanisms of idiosyncratic mutualization). Lastly, there is the inflation risk which may or may not be transferred to the insurance company when the life annuity is taken out by applying a mechanism consisting in the indexation of the pension allowance to the general behavior of the prices in the economy.

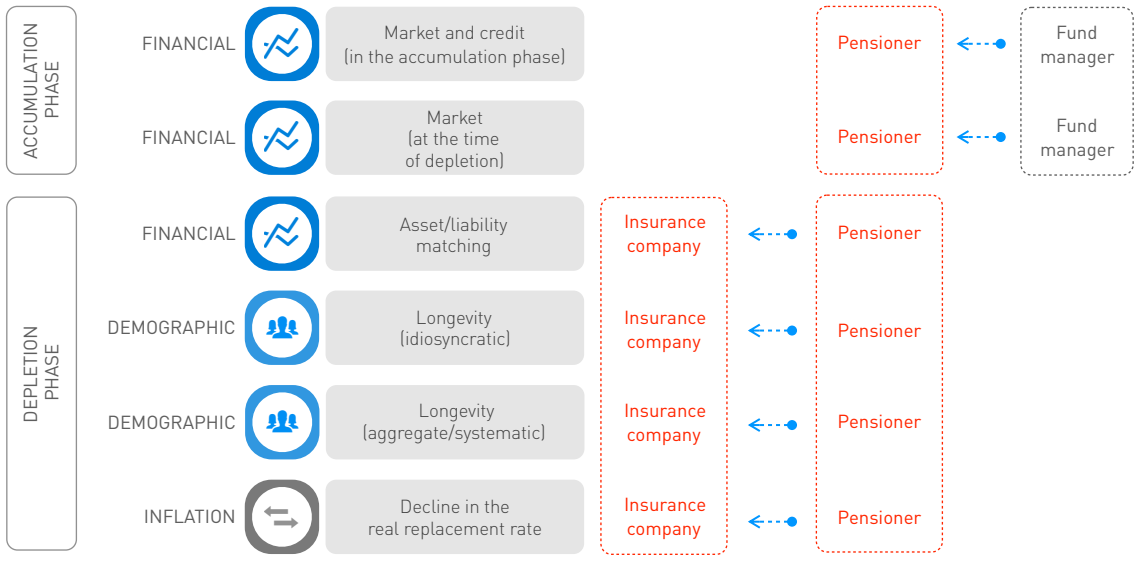
As far as defined contribution systems are concerned, while during the accumulation phase the risks associated with the management of the saved funds are retained by the future pensioner, during the depletion phase nearly all of the risks are transferred to an insurance company. Consequently, while the materialization of the financial risks that characterize the accumulation phase may cause a reduction in the amount of resources available to purchase a life annuity, once this first phase has ended the pension allowance that the pensioner receives is guaranteed by the insurance company (see Box 1.3-b explaining the sensitivity to risks in this type of plan).

## c) The risks in voluntary plans (Pillar 3)

Voluntary plans involve a decision by the individuals concerned to channel an additional part of their income through saving mechanisms that enable them to supplement the pension they will generate through any of the plans covered in Pillars 1 and 2.

By their very nature, voluntary plans are subject to the same risks contemplated in the defined contribution plans grouped under Pillars 1 and 2 (see Chart 1.3-d). In the **accumulation phase,** the risks (essentially financial) are retained by the worker who, directly or through a specialized entity, manages the savings. In the **depletion phase**, the individual may decide to manage the pension directly, assuming the potential effects on the allowance derived from the materialization of financial, demographic or inflation risks, or alternatively transfer all or part of them to an insurance company by purchasing any of the available life annuities.

Chart 1.3-d
Conceptual framework: risks associated with voluntary plans (Pillar 3)




Source: MAPFRE Economic Research

**Box 1.3-b**
Sensitivity exercise:
analysis of the key factors in a defined contribution system

### Characteristics of the exercise

Defined contribution pension systems are exposed to a series of characteristic risks (financial, demographic, inflation). Typically, in this type of plan the risks in the accumulation phase are assumed by the worker, whereas in the depletion phase they are retained by the insurance companies.

In this case, the sensitivity exercise considers the effect of the following variables on both the pension allowance and the replacement rate: (i) interest rate for the accumulation of pension funds; (ii) discount rate used to calculate life annuities; (iii) number of years of contributions; (iv) contribution rate; (v) commissions for fund management; and (vi) increase in life expectancy.

### Assumptions

This exercise is based on the following assumptions in estimating the level of sensitivity:[1]

| | Assumption |
|---|---|
| Interest rate for the accumulation of the fund | 4.6% |
| (Base) contribution rate | 8% |
| Life expectancy at 65 | 19 years |
| (Base) commission for fund management | 100 bps over the fund balance |
| Discount interest rate for calculating annuities (life annuities) | 3.6% |
| Annual salary growth | 3.9% |
| Years of contributions | 40 |
| (Base) monthly pension | 100 monetary units |
| (Base) replacement rate | 28% |

### Main results

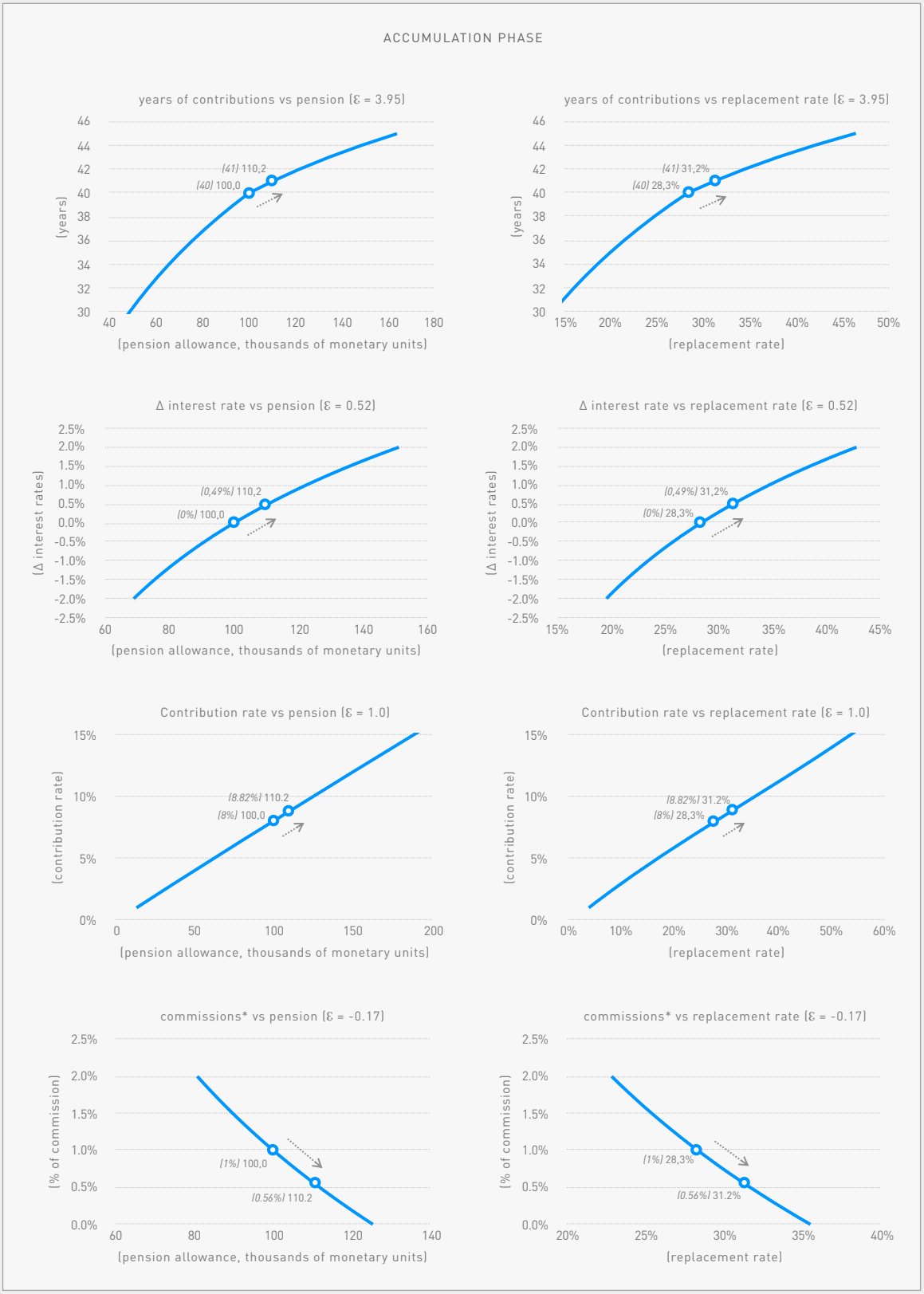
As shown in the charts below, in a defined contribution system the pension allowance (and therefore the replacement rates) is positively affected throughout the accumulation phase by variables such as the interest rate at which the fund is capitalized, the years of contributions and the contribution rate, and during the depletion phase, basically by the discount interest rate used to calculate the life annuity. Meanwhile, the pensions and their replacement rate are negatively affected during the accumulation period by an opposite behavior of the interest rates, as well as by the commissions charged for fund management, and in the depletion phase by the increase in life expectancy.

In terms of sensitivity to these variables, the exercise undertaken suggests that in the accumulation phase the increase of one year in the mandatory contribution to the system (the effect of the additional saving by delaying the start of the pension by one year)-all other things equal-would have the positive effect of an increase of 10.2 percent in the pension allowance and 2.9 percentage points (pp) in the replacement rate; these effects are equivalent to the effect that would be generated by an increase of 49 basis points (bps) in the interest rate for the funds accumulated, a contribution rate 82 bps higher than initially considered, or a reduction of 44 bps in the commissions charged for the fund management.

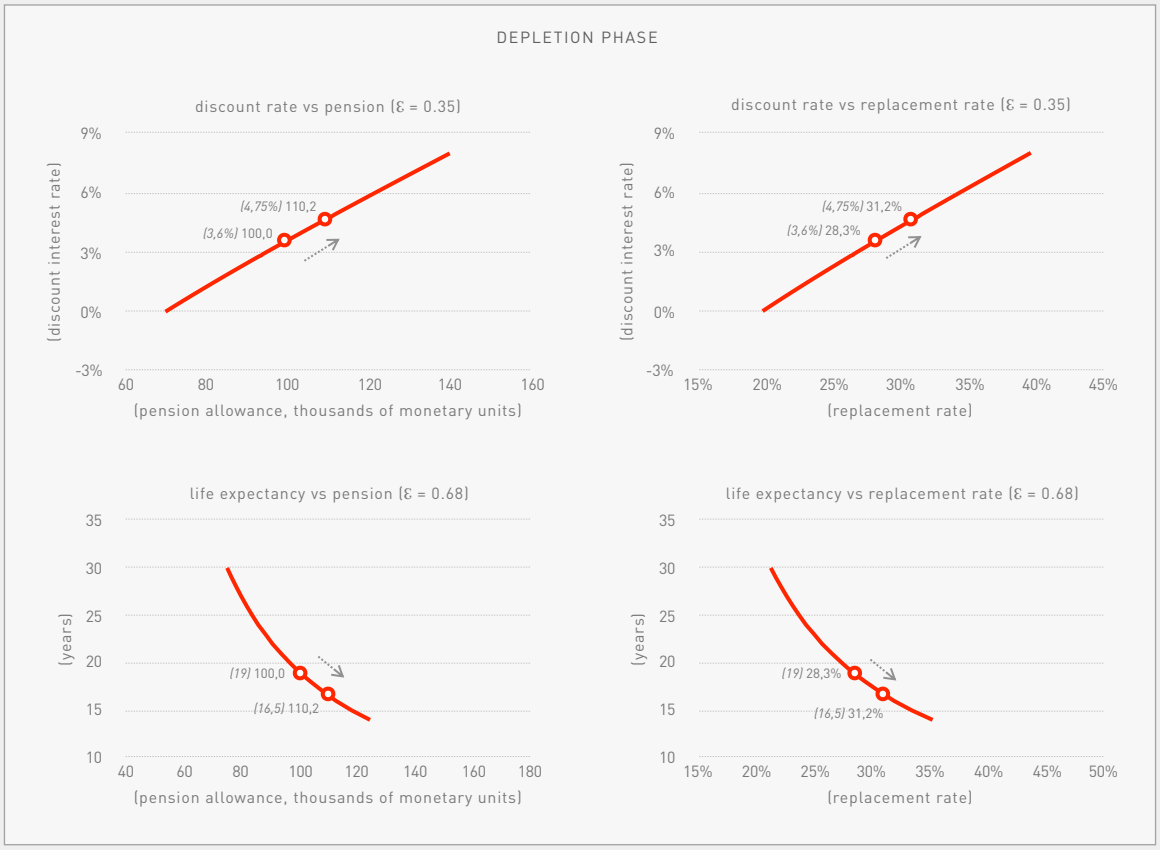
With regard to the depletion period in this type of plan, the sensitivity exercise suggests that-all other things equal-a similar positive effect (+10.2 percent in the pension allowance and +2.9 pp in the replacement rate) could be achieved with an increase of 1.15 pp in the discount interest rate used to calculate the life annuity (which constitutes a single financial effect), or that would be achieved if the life annuity were calculated on the basis of life expectancy at 65 being 2.5 years less than originally projected.

Lastly, it is important to note that the bias of each of these risks is indicative of their probability of improving or diminishing pensions. While variables like years of contributions and contribution rates are subject to legislative decisions, others, like interest rates fluctuate according to the behavior of the financial markets, whereas the demographic variables (increase in life expectancy) have a clear structural and permanent bias.

**Box 1.3-b (continued)**
Sensitivity exercise:
analysis of the key factors in a defined contribution system



**Box 1.3-b (continued)**
Sensitivity exercise:
analysis of the key factors in a defined contribution system




Source: MAPFRE Economic Research

# 2. Main Demographic Trends and Selection of the Benchmark Models

## 2.1 Main long-term demographic trends

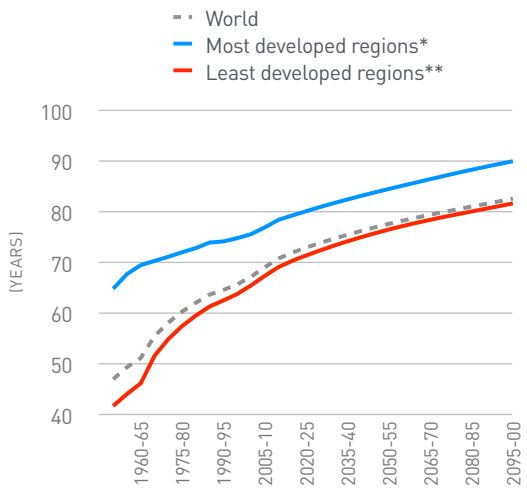
### Life expectancy, mortality and fertility

According to United Nations (UN) estimates, life expectancy at birth of the global population has grown steadily since 1950. That year, the global average life expectancy at birth was 47 years, whereas by 2015 it had climbed to nearly 71 years. In other words, a person born in 2015 could expect to live 50 percent longer on average than people born in 1950.

While life expectancy is higher in the most developed regions of the world, the upward trend in the longevity of the population is a global phenomenon. Between 1950 and 2015, life expectancy at birth of the population in the most developed regions rose from 65 to 78 years. This increase of 13 years is equivalent to a rise of 20 percent in longevity compared with 1950. Meanwhile, life expectancy in the least developed regions climbed from 42 to 69 years, indicating a rise of 27 years and a 64 percent increase in longevity compared with 1950.

According to the UN estimates, this upward trend in longevity is set to continue for the rest of this century. In keeping with these projections, the average life expectancy of the global population will reach 83 years in 2100, with an indicator of 90 years for the most developed regions and 82 years for the least developed. If these longevity levels materialize, people born in 2100 will have a life expectancy 17 percent higher than those born in 2015. This will be the same for inhabitants of both the most developed and least developed regions of the planet: by the end of the century longevity will have increased by 15 percent and 19 percent, respectively, in relation to people born in 2015 (see Chart 2.1-a). These trends are replicated when the male and female populations of the world are analyzed separately, with a clear upward trend in the longevity of women compared to men (see Chart 2.1-b).

Chart 2.1-a
Life expectancy at birth: total population, 1950-2100

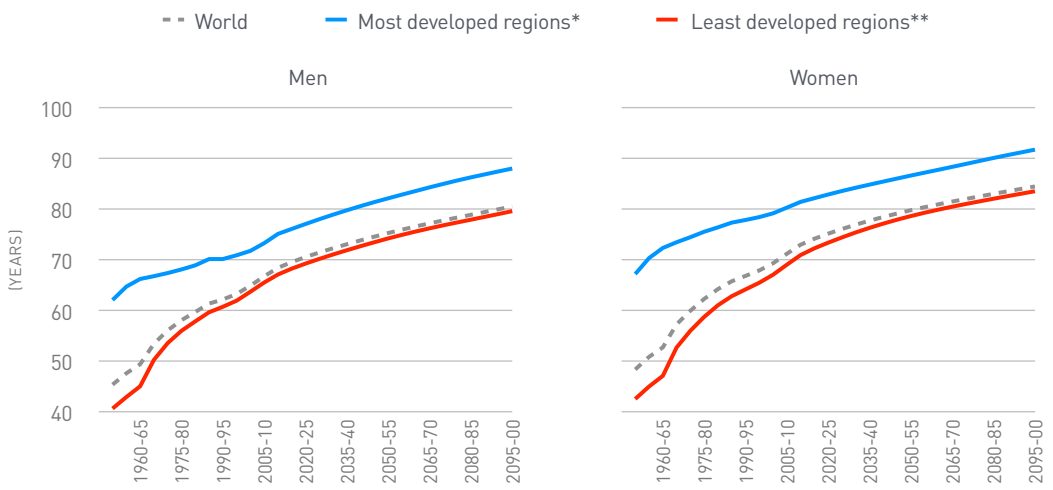



Source: MAPFRE Economic Research (based on UN data)
* Includes Europe, North America, Australia, New Zealand and Japan.
** Includes all regions of Africa, Asia (except Japan), Latin America and the Caribbean, Melanesia, Micronesia and Polynesia.

In addition to the increase in life expectancy, more and more people are reaching extreme old age. This is confirmed by the estimated deaths per age group in different regions of the planet. While in 1950 only 16.4 percent of deaths worldwide corresponded to the 70+ population (50.4 percent corresponded to the 0-24 years group), by 2015 this percentage had risen to 45.4 percent and is estimated to reach 82.8 percent by around 2100.

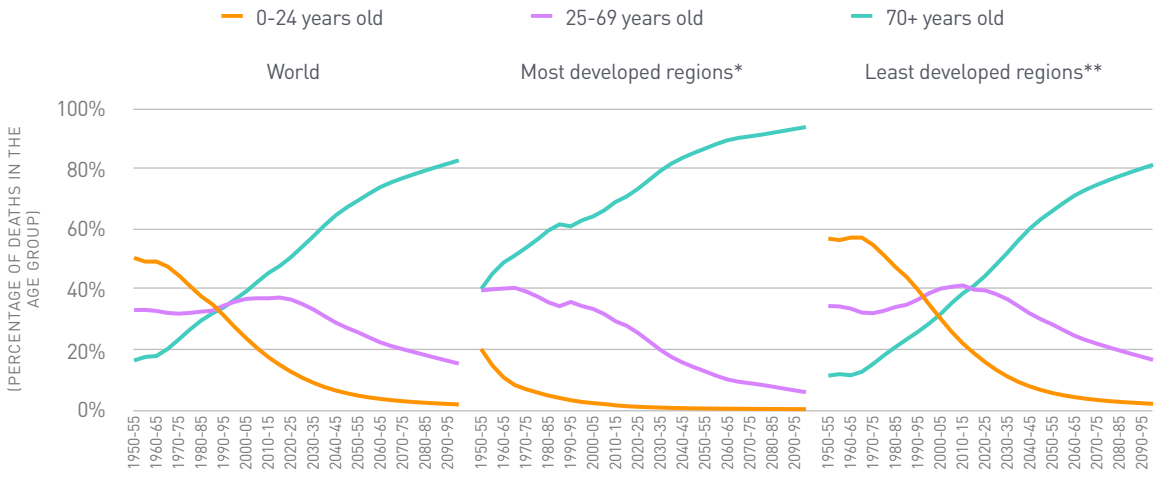
Once again, this trend is more dynamic in the least developed regions, where the indicator was 11.4 percent in 1950 and 38.6 percent in 2015, and is estimated to reach 81.3 percent in 2100. By contrast, while in the most developed regions the initial values are higher than the global average, the trend is similar: deaths of people over 70 rose from 40.1 percent in 1950 to 69 percent in 2015 and are estimated to reach 93.8 percent in 2100 (see Chart 2.1-c).

## Chart 2.1-b
## Life expectancy at birth: men and women, 1950-2100




Source: MAPFRE Economic Research (based on UN data)
* Includes Europe, North America, Australia, New Zealand and Japan.
** Includes all regions of Africa, Asia (except Japan), Latin America and the Caribbean, Melanesia, Micronesia and Polynesia.

## Chart 2.1-c
## Percentage of deaths by age group and region, 1950-2100



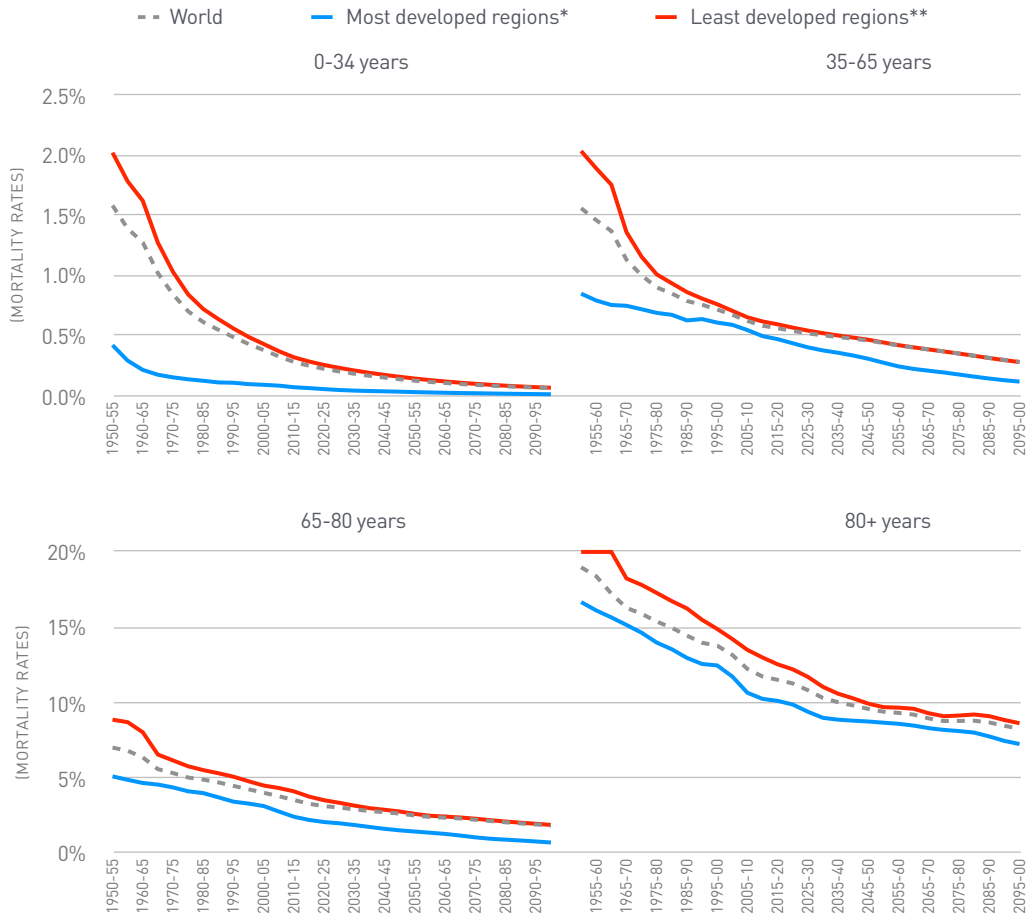

Source: MAPFRE Economic Research (based on UN data)
* Includes Europe, North America, Australia, New Zealand and Japan.
** Includes all regions of Africa, Asia (except Japan), Latin America and the Caribbean, Melanesia, Micronesia and Polynesia.

The other dimension in this trend is related to the behavior of mortality rates, which have fallen steadily since 1950. As shown in the analysis in Chart 2.1-d, all the age groups analyzed reveal a downward trend in mortality rates and a process of convergence in the long term, with very similar mortality rates all over the planet by the year 2100.

Lastly, these trends are complemented by the behavior of the fertility rate (number of children per woman). Chart 2.1-e shows that the period 1950-2015 saw a sharp decline in the global indicator. While in 1950 the average global fertility rate was 5 children per woman, by 2015 the indicator had halved (2.5) and it is estimated to fall to 2 by 2100. In the case of the most developed regions, the indicator has followed a similar downward trend, falling from 2.8 in 1950 to 1.7 in 2015.

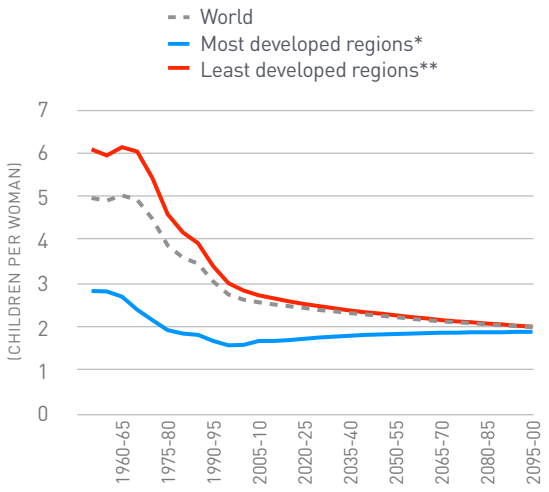
An interesting aspect in the behavior of the fertility rate is the convergence of the trends observed in all regions of the world by 2100 (1.9 in the most developed regions and 2.0 in the least developed). Although they are dependent on the behavior of the mortality rates and the male/female ratio reached by the global population in the future, by the end of the century these fertility rates will be close to what is known as the zero growth rate, which corresponds to the level at which the planet's population growth is supposed to stabilize.

**Chart 2.1-d**
**Mortality rates by age group and region, 1950-2100**




Source: MAPFRE Economic Research (based on UN data)
* Includes Europe, North America, Australia, New Zealand and Japan.
** Includes all regions of Africa, Asia (except Japan), Latin America and the Caribbean, Melanesia, Micronesia and Polynesia.

**Chart 2.1-e**
**Fertility rates, 1950-2100**




Source: MAPFRE Economic Research (based on UN data)
* Includes Europe, North America, Australia, New Zealand and Japan.
** Includes all regions of Africa, Asia (except Japan), Latin America and the Caribbean, Melanesia, Micronesia and Polynesia.

## Population pyramids

The demographic dynamics and trends indicated above will shape the pattern of development of the world population during the remainder of this century. The general structure of this evolution can be simplified by using population pyramids (see Box 2.1-a).

As shown in Charts 2.1-f and 2.1-g, the relative weight in the global population of the least developed regions will define the overall pattern. Both charts show how from 1950 to 2100 the population pyramids will have evolved from the typical expansive pyramid to a stationary one, without really passing through the constrictive pyramid, although certain specific regions of the sub-group of least developed countries (e.g.Latin America around 2030) may have done so.

By contrast, the population pyramid for all the developed regions in the world during the period 1950-2100 (see Chart 2.1-h) shows the transition from an equally expansive pyramid in the mid-20th century to a stationary pyramid by 2100. However, in this evolution of the pyramid structure, the population in the most developed regions will have passed through a period in which the pyramid is constrictive (with the passing of the so-called baby boomer generation), from the beginning of the 1960s to the middle of this century.

Even so, it is interesting to note that the demographic projections seem to coincide in the convergence of stationary population pyramids worldwide by the end of this century. This trend is partly explained by the decline in fertility rates and their convergence throughout the 21st century toward a zero growth rate of the global population (see Chart 2.1-e), and partly by the sustained pattern of declining mortality rates (see Chart 2.1-d).

However, over and above the broad trends and dynamics predicted by orthodox demographic views, advances in research for the treatment of diseases like cancer and the development of new antivirals, to name just a few areas of progress, suggest that the improvements in life expectancy will continue and may exceed expectations based on population inertia.

For example, biometric actuarial tables usually assume a maximum age limit of 120 years, which has not yet been reached. However, research is currently underway to try and differentiate chronological age from biological age, which will make it possible to measure life expectancy in a more personalized manner through genetic tests, the analysis of immune and metabolic profiles, and even by measuring the telomere length of chromosomes.

For more than a decade it has been possible to read the sequence of the human genetic code, and today the cost of these analyses is far lower than when the technique was first discovered. Personal genetic maps are used to make increasingly accurate predictions about the hereditary diseases that a person may suffer during the course of their life.

This opens up an opportunity to prolong life through the preventive treatment of these diseases and healthy lifestyles, as well as genetic therapies. The research currently

**Box 2.1-a**
Population pyramids

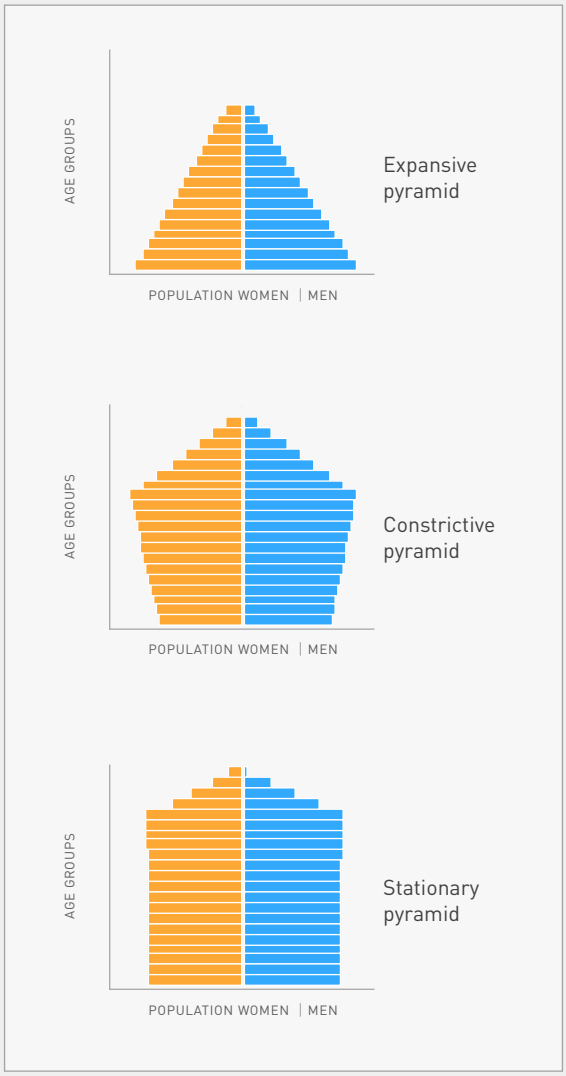
Population **pyramids** illustrate the structure of a population by age group and gender. Showing the number of men and women in each group makes it easier to analyze the essential characteristics of a population. Population pyramids reflect the main demographic dynamics and trends, such as fertility and mortality.

In general terms, there are three types of population pyramid: expansive, constrictive and stationary.

**Expansive population pyramids** have a wide base and a narrow apex, with a large part of the population concentrated in the younger age groups. This type of pyramid usually characterizes populations with high fertility and mortality rates.

**Constrictive population pyramids** (also known as regressive pyramids) are narrower at the base than in the middle and usually reflect populations that have experienced a rapid decline in the fertility rate.

**Stationary population pyramids** are rectangular in shape and illustrate populations with a similar structure across all age groups until the most extreme ages, where the percentage of people falls sharply. These pyramids are typical of mature populations with low fertility and mortality rates.




Source: MAPFRE Economic Research

underway in the fields of genetics and biotechnology could give rise to a disruptive change that prolongs human life beyond what is presently conceivable, to what biogerentologists call longevity escape velocity (see Box 2.1-b).

Since the project to decipher the human genome was completed, efforts have concentrated on improving the ability to chemically synthesize DNA and create cells artificially. This could even lead to the capacity to build a complete group of human chromosomes. Today, there are also techniques for modifying the DNA of cells by adding genes from other chains, and even modifying the code of existing genes.

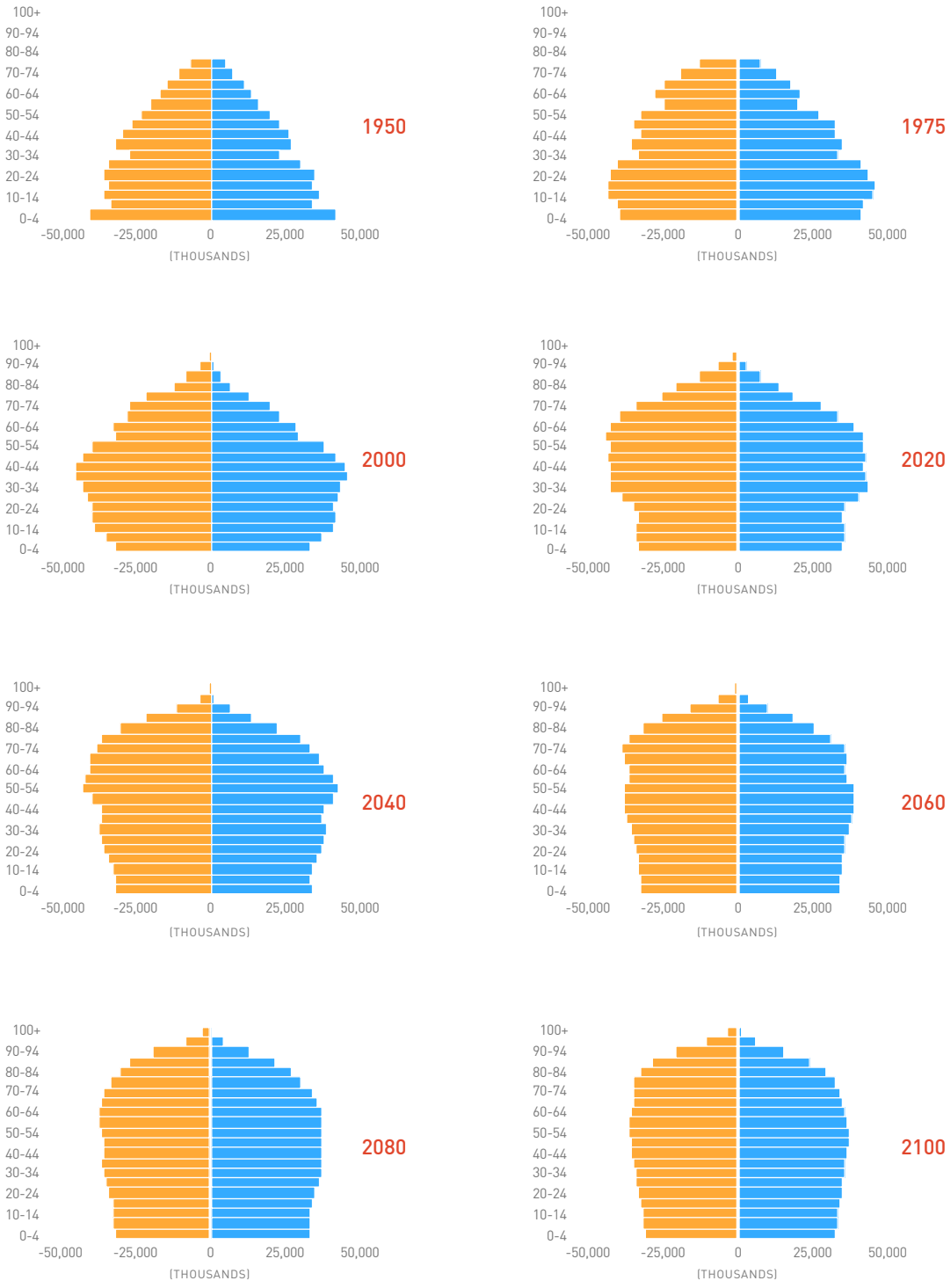
## Chart 2.1-f
## Changes in the population pyramid: global population, 1950-2100


Source: MAPFRE Economic Research (based on UN data)

## Chart 2.1-g
## Changes in the population pyramid: population of least developed countries,* 1950-2100


Source: MAPFRE Economic Research (based on UN data)
* Includes all regions of Africa, Asia (except Japan), Latin America and the Caribbean, Melanesia, Micronesia and Polynesia.

## Chart 2.1-h
## Changes in the population pyramid: population of most developed countries,* 1950-2100




Source: MAPFRE Economic Research (based on UN data)
* Includes Europe, North America, Australia, New Zealand and Japan.

**Box 2.1-b**
Longevity escape velocity

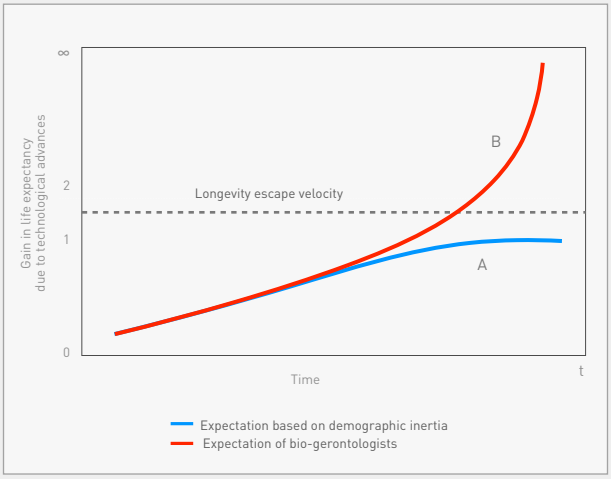
The concept of longevity escape velocity expresses the idea that it is hypothetically possible to extend the life of human beings practically indefinitely.

It is based on the theory that sustained technological advances are required to achieve significant gains in life expectancy. To date, the research time required to improve technology has been much higher than the gain observed in life expectancy. However, bio-gerontologists argue that the speed of technological advancement is gradually reducing the research time necessary to extend life expectancy by one year.

In keeping with traditional demographic analyses, the function that relates research time with increases in life expectancy is a constantly decreasing function (curve A in the chart), insofar as the advances achieved are confined by the fact that longevity has a physical limit (the deterioration of the human organism as a result of the metabolic process).

However, bio-gerontologists believe that the application of regenerative medicine to age-related diseases will make it possible to repair the underlying damage to the body's tissues, cells and molecules, which in turn will make it possible to extend life significantly, way beyond the parameters that are conceivable today.

This means that the function that associates research time with increases in longevity will behave exponentially (curve B in the chart). Longevity escape velocity will be achieved when the research time necessary to increase life expectancy is less than the gains in longevity that it generates. Furthermore, this time will gradually become shorter due to the effect of accelerating technological advances, significantly extending life.




Source: MAPFRE Economic Research (based on: Aubrey De Grey, "Rejuvenation biotechnology", SENS Research Foundation)

These techniques are used, for example to synthesize insulin. Additionally, genetic manipulation is currently being tested in animals that have managed to prolong their life significantly with respect to non-manipulated animals. Experiments are even being undertaken with non-viable human embryos using a technique known as CRISPR (clustered regularly interspaced short palindromic repeats).

Scientists are also researching ways of prolonging life through biological therapies that reverse aging, and through the application of regenerative medicine to age-related diseases (see Box 2.1-c). Although still at the experimental stage, it is already to possible to generate mini-organs and tissue in vitro using embryonic stem cells. Advances have also been made in the development of new materials to replace worn parts of the body, such as bones.

**Box 2.1-c**
Two disruptive approaches to the extent of longevity

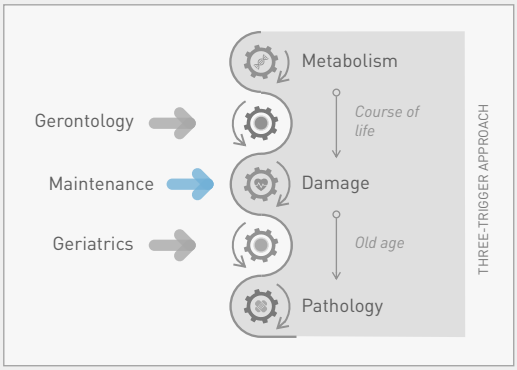
### SENS Research Foundation

The SENS Research Foundation is a private organization that funds research at universities around the world and at its own research center in Mountain View, California, in the United States.

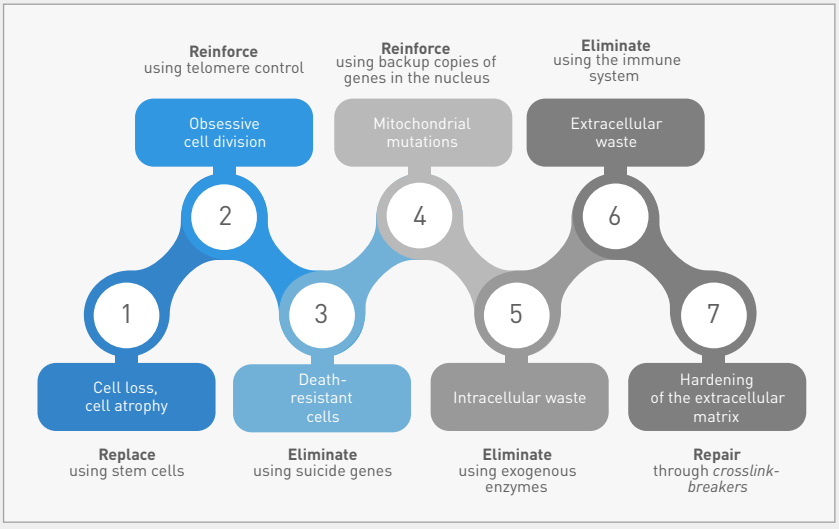
Its research efforts focus on the use of regenerative medicine to treat age-related diseases, aimed at repairing the underlying damage to the body's tissues, cells and molecules.

The Foundation believes that over time metabolic processes generate damage in the body, causing different types of pathologies as a person ages. The traditional medical approach is centered around gerontology and geriatrics to treat the damage that has occurred during the course of a person's life, while the approach of the SENS researchers concentrates on maintaining the body by correcting the damage caused by the metabolic function.

SENS researchers have therefore focused their efforts on developing specific therapies to treat the seven causes of death in human beings: the use of stem cells to offset cell loss and atrophy; the use of telomere controls to offset the effect of obsessive cell division; the use of backup copies of genes in the nucleus to combat mitochondrial mutations; the use of exogenous enzymes to solve the problem of intracellular waste; reinforcement of the immune system to combat extracellular waste; and the use of crosslink-breakers to correct the hardening of the extracellular matrix.




According to these researchers, the first generation of rejuvenation therapies could extend life expectancy by 30 years, which could be possible by 2020. They also believe that subsequent improvements in these therapies will lead to longevity escape velocity, which implies extending life expectancy indefinitely, by around 2040-2045. In fact, the SENS researchers believe that first person to live 1,000 years may have already been born.




Source: MAPFRE Economic Research (based on: Aubrey De Grey, "Rejuvenation biotechnology", SENS Research Foundation, and Michael R. Rose, *et.al.*, "An Evolutionary Genomic Strategy for Aging in the 21st Century", University of California)

**Box 2.1-c (continued)**
Two disruptive approaches to the extent of longevity

### The Rose, Mueller, & Greer Laboratories

The work of the Rose, Mueller, & Greer Laboratories of the Department of Ecology and Evolutionary Biology at the University of California, Irvine, in the United States, is based on genomics, experimental evolution, large-scale bioinformatic, and new types of evolutionary genetic theory.

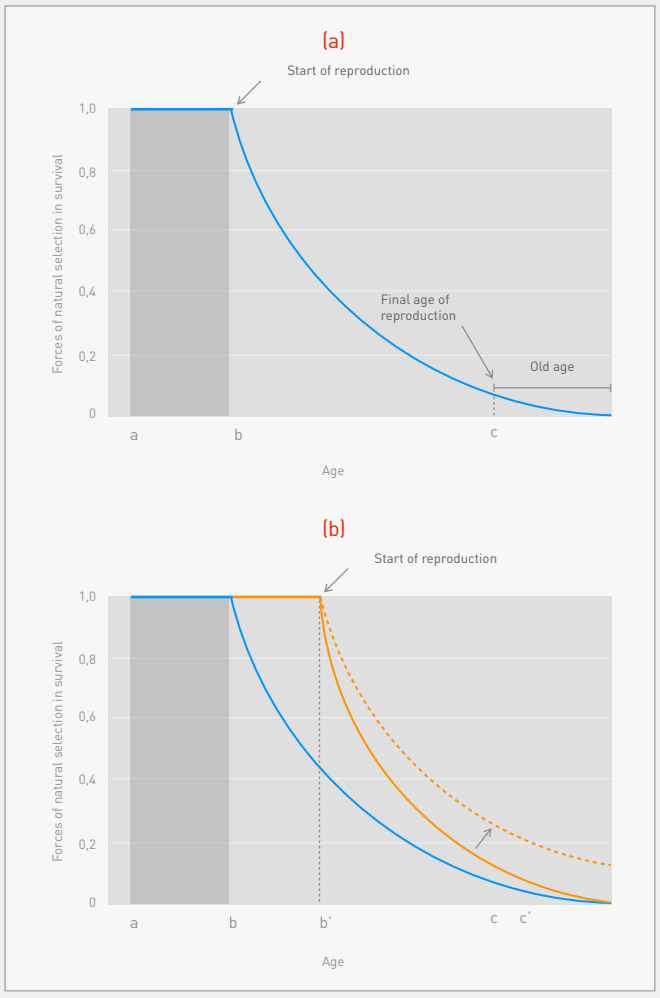
There are organisms that share our same cellular biology and which, from a demographic point of view, do not age. For example, the creosote bush (*larrea tridentata*), which lives more than 10,000 years, certain sea anemones (*anemoneae*), hydra (*hydridae*), and flatworms (*platyhelminthes*).

Instead of an aging theory as a phenomenon of the deterioration caused by the metabolic function, these researchers adopt an evolutionary biological approach. In this case, longevity is the result of evolutionary processes to advance adaptation. They argue that at the beginning of the reproductive phase, the forces of natural selection for survival start to decline (Chart a) and gradually weaken until the end of the reproductive phase, when old age commences and finally death occurs.

Significant increases in longevity can be achieved by making various cumulative genetic adjustments over the course of a great number of generations. This has been achieved in experiments with fruit flies, first by postponing the onset of the reproductive phase and then through successive genetic adjustments (Chart b).

This achievement in these simple organisms is also possible in complex organisms like human beings, but it requires a vast quantity of genetic adjustments.

Consequently, it is estimated that longevity escape velocity will not be achieved by people already in their forties, but it may well be achieved during the course of the 21st century. Three instruments are required to reach this goal. The first one is the use of stem cells and technologies related to tissue repair and replacement (from the year 2020). The second is through genomics and technologies associated with the development of drugs to reduce age-related diseases and health problems (from 2030). And the third one is through the genomic analysis of aging, which will lead to a third generation of medicines and repair technologies that will finally achieve longevity escape velocity (from the year 2050).




Source: MAPFRE Economic Research (based on: Aubrey De Grey, "Rejuvenation biotechnology", SENS Research Foundation, and Michael R. Rose, *et.al.*, "An Evolutionary Genomic Strategy for Aging in the 21st Century", University of California)

In short, these technical and scientific advances could have enormous implications for the life possibilities of future societies. At the same time, they are creating considerable uncertainty about the extent of longevity in the near future.

### Longevity and pension systems

The increase in longevity, be it in line with the parameters predicted by a population inertia approach or those predicted by more disruptive approaches, will have profound implications for societies all over the world.

While it is true that there is great uncertainty about the specific impacts that the increase in longevity may have during the present century, and about the changes in the population structure, there seems to be a consensus that great strides will continue to be made in the process to extend human life. Although the specific aspects are difficult to predict, greater longevity will impact every area of society. From the economic point of view, it will impact consumption and saving, as well as the structure of the labor market and salary growth, especially in light of its convergence with the technological revolution associated with the digital age and production processes. And from the social point of view, it will substantially alter the patterns of social organization and coexistence, as well as the basis of family relationships.

However, where it is relatively simple to anticipate the effects of the greater longevity of the population is the field of pension systems. Higher life expectancy, coupled with the potential materialization of other risks (financial, inflation, unemployment) will undoubtedly affect pension spending, and it will therefore be necessary to adjust these systems to make them stable and sustainable in the long term.

It is well know that the first pension systems emerged at the end of the 19th century and proliferated in the first half of the 20th century. A first wave of adjustments took place in the 1990s. However, the origin of that reaction (which was an increase in the gap between retirement age and life expectancy) has not disappeared. On the contrary, that gap has become ever wider due to greater expectations about the longevity of populations all over the world (see Chart 2.1-i).

In this context, the primary objective of this study is to analyze a series of pension models (benchmark models) which, because of their characteristics, represent the majority of the existing models worldwide. Based on the theoretical framework explained at the beginning of this report, the authors have analyzed both the characteristics of these models and the impact of the adjustments made to them. The ultimate aim is to identify experiences and best practices to be able to forge ahead with the necessary task of reformulating these systems to ensure that they meet the social purpose for which they were created, on solid foundations that will guarantee their long-term financial viability.

## 2.2. Criteria for the selection of the benchmark models

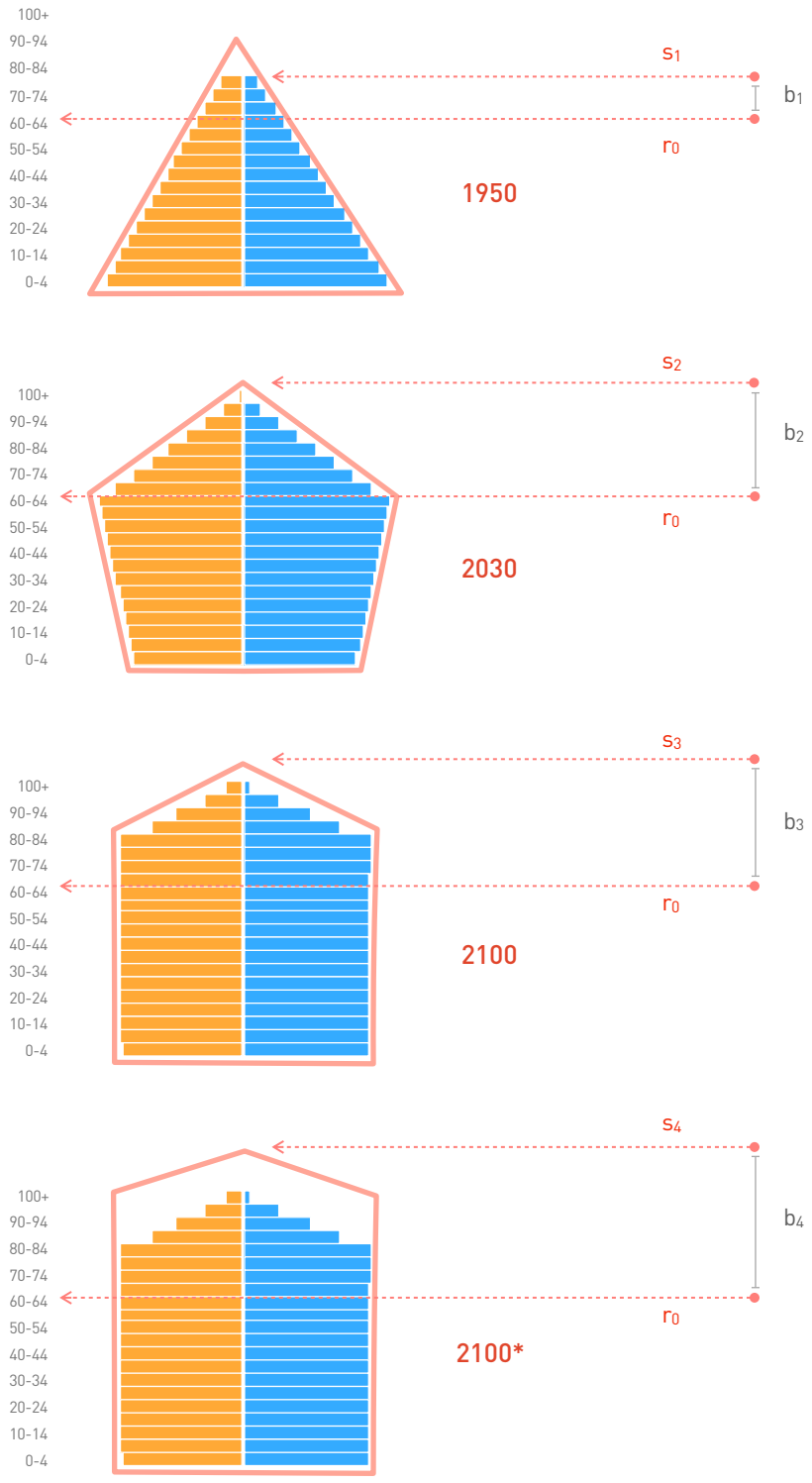
Based on this risk-based conceptual framework and analysis of the demographic trends and characteristics of the pension systems in the countries selected, the study identifies the adjustment mechanisms and measures that have produced the best results in the reform of these systems and that could therefore provide a general point of reference in implementing future reforms of pension systems aimed at equipping them with long-term stability and sustainability.

In line with these criteria, six benchmark models were selected: Chile, the United States, Spain, the United Kingdom, Sweden and the Netherlands. The main aspects that justify this selection are described below.

### Chile

The Chilean pension system was completely reformed at the beginning of the 1980s when the state pay-as-you-go system was replaced with a defined contribution individual capitalization account system. The reform aroused great interest in Latin America and other regions of the world, and it has been upheld as a model to imitate. Today, however, it is being questioned because the replacement rates have proved to be lower than

Chart 2.1-i
Conceptual framework: changes in the gap ($b_i$) between the retirement age ($r_0$) and survival limit ($s_i$)




Source: MAPFRE Economic Research
*With disruptive increases in longevity

## Chart 2.2-a
## Changes in the population pyramid: Chile, 1950-2100


Source: MAPFRE Economic Research (based on UN data)

anticipated, and various new reforms are currently being discussed (see Box 2.2-a).

At the beginning of the 1990s, several Latin American countries, like Peru in 1993, Argentina[2] and Colombia in 1994, Uruguay in 1995, Mexico and Bolivia in 1997, El Salvador and Venezuela in 1998, Costa Rica and Nicaragua in 2000, and Ecuador and the Dominican Republic in 2001, followed the path of Chile and introduced partial or entire individual capitalization account systems based on the same principles as the Chilean pension model. At the end of that same decade, the 1990s, other countries outside Latin America (Hungary, Poland, Kazakhstan) also embarked on similar reforms of their own pension systems.

Chart 2.2-a shows the population dynamics and trends for Chile. As illustrated, the population pattern in this country is similar to that of the most advanced regions of the world, having evolved from an expansive pyramid in 1950 to what will become a stationary pyramid by the year 2100, but passing through a period of population aging characterized by a constrictive pyramid during a period that commenced at the end of the last century and will last until practically the end of this century.

Interesting to note, this population behavior is related to the trend observed in that period for the fertility and mortality rates, as well as the increase in the life expectancy for that country (see Chart 2.2-b).

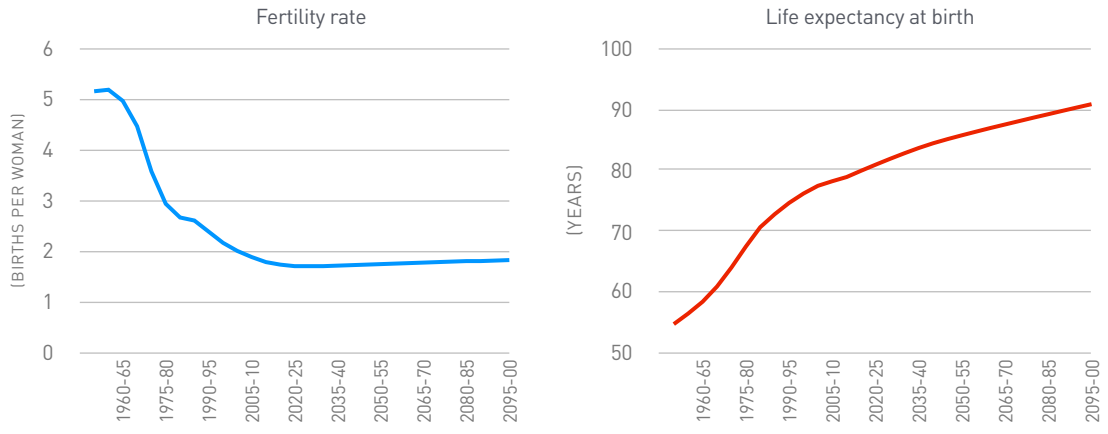
## United States

The United States pension system is undoubtedly one of the most important in the world, both in terms of the relative weight of the country's economy in the international context and the structure of the pension system itself.

One of the main characteristics is that while the role of the first pillar is negligible, especially for medium and high incomes, the second pillar is one of the largest in the world. With regard to the mandatory nature of the second pillar, the U.S. system also manifests differences and particularities with respect to similar systems (e.g.the United Kingdom).

From the point of view of the population dynamics, the United States pyramid was perhaps the first to evidence a constrictive behavior, which occurred in the middle of the last century with the emergence of the first generation of baby boomers, and it will

Chart 2.2-b
Chile: fertility rate and life expectancy at birth, 1950-2100




Source: MAPFRE Economic Research (based on UN data)

## Chart 2.2-c
## Changes in the population pyramid: United States, 1950-2100


Source: MAPFRE Economic Research (based on UN data)

**Box 2.2-a**
Replacement rates: selected countries, 2015

Replacement rates measure the percentage of the last salary received at the end of working life that is paid out as a retirement pension. They also reflect the level of the loss of purchasing power upon ending working life and entering retirement.

The chart below compares the replacement rates in the pension systems selected as benchmark models for the purposes of this study, based on data from the Organization for Economic Cooperation and Development (OECD). These replacement rates refer to people who contribute to the system from the age of 20 until the retirement age in force in each system at the time of conducting this study. The calculation does not include the effect of incomplete working lives (which in reality reduce these replacement rates). The private component includes the benefits from the mandatory and quasi-mandatory systems, as well as from the voluntary systems in those countries where it occupies a significant place (basically, the United States and United Kingdom).

| Countries/regions | Public component | | | Private component | | | Replacement rate | | |
|---|---|---|---|---|---|---|---|---|---|
| | Income level | | | Income level | | | Income level | | |
| | low | medium | high | low | medium | high | low | medium | high |
| **Chile** | 6.8 | | | 32.7 | 32.8 | 32.9 | 39.4 | 32.8 | 32.9 |
| **United States** | 44.4 | 35.2 | 29.1 | 32.6 | 32.6 | 32.6 | 77.0 | 67.8 | 61.7 |
| **Spain** | 82.1 | 82.1 | 82.1 | | | | 82.1 | 82.1 | 82.1 |
| **United Kingdom** | 43.3 | 21.6 | 14.4 | 29.8 | 29.8 | 29.8 | 73.1 | 51.4 | 44.2 |
| **Sweden** | 37.0 | 37.0 | 27.4 | 19.0 | 19.0 | 37.8 | 56.0 | 56.0 | 65.2 |
| **Netherlands** | 54.2 | 27.1 | 18.1 | 39.8 | 63.4 | 71.2 | 94.0 | 90.5 | 89.3 |
| **OECD34** | | | | | | | 69.1 | 57.6 | 52.4 |
| **EU28** | | | | | | | 73.0 | 62.1 | 57.4 |

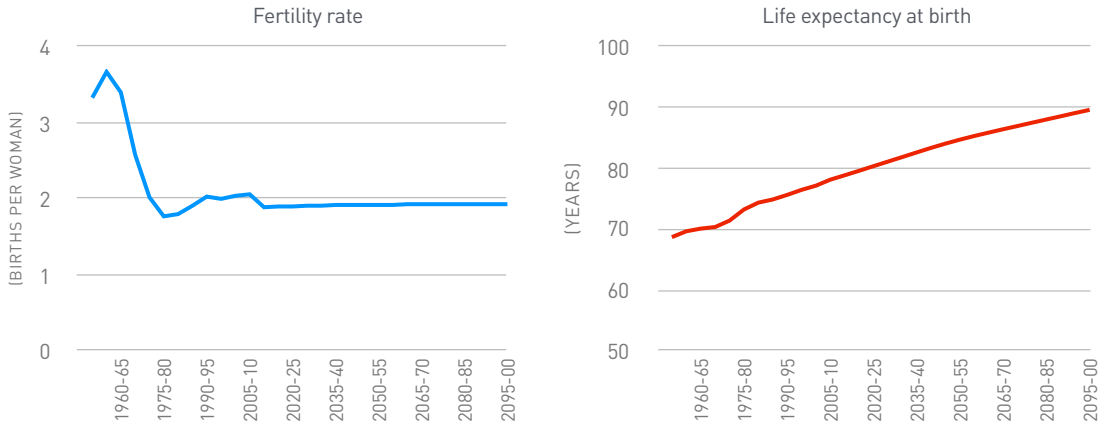
Based on the OECD data, the chart shows the replacement rates for three different income levels, broken down into public and private components. The income level shown as "low" refers to a person with a salary equivalent to 50 percent of the average salary, while the income level shown as "high" is equivalent to 150 percent of the average salary in each country at that time.

It is important to note that these replacement rates have been calculated as the percentage of the last gross salary paid out as the gross pension. However, once the retirement pension starts to be received, the obligation to contribute ends. Furthermore, income tax is usually progressive, insofar as the highest incomes pay a higher rate of tax than the lowest incomes; since the income level falls in retirement, the progressive nature of the tax paid has a lower impact. Taking both effects into account, the replacement rates (measured in terms of the net amount received before and after retirement) are higher than those shown in the chart. According to the calculations performed in the OECD report, the aggregate replacement rate could be around 10 percent higher, as shown in the chart below:

| Countries/regions | Gross replacement rate | | | Net replacement rate | | |
|---|---|---|---|---|---|---|
| | Income level | | | Income level | | |
| | low | medium | high | low | medium | high |
| **OECD34** | 69.1 | 57.6 | 52.4 | 79.1 | 68.4 | 63.9 |
| **EU28** | 73.0 | 62.1 | 57.4 | 83.0 | 73.4 | 68.5 |

Source: MAPFRE Economic Research (based on OECD information, *Pensions at a Glance 2015*)

Chart 2.2-d
United States: fertility rate and life expectancy at birth, 1950-2100




Source: MAPFRE Economic Research (based on UN data)

also be one of the first to adopt a stationary form, as early as the third quarter of this century (see Chart 2.2-c). As a mature society, this behavior is directly related to the fertility and mortality trends, and to their impact on life expectancy (see Chart 2.2-d).

## Spain

In the case of Spain, the pension system is based on a pay-as-you-go model, which therefore relies heavily on a first pillar of defined benefits. Due to the characteristics of its structure, coupled with the population dynamics and trends discussed below, pension spending as a proportion of the gross domestic product (GDP) and the national budget is currently high compared with other developed economies. Furthermore, this spending is expected to continue rising, suggesting tensions regarding the sustainability of the current replacement rates due to population aging and the predicted decline in the dependency ratios (see Box 2.2-b).

In this respect, the Spanish population pyramid (with the typical characteristics of a developed economy) points to a progressive escalation of the problem derived from population aging in the next 25 years, due to the so-called baby boomer generation reaching the retirement age.

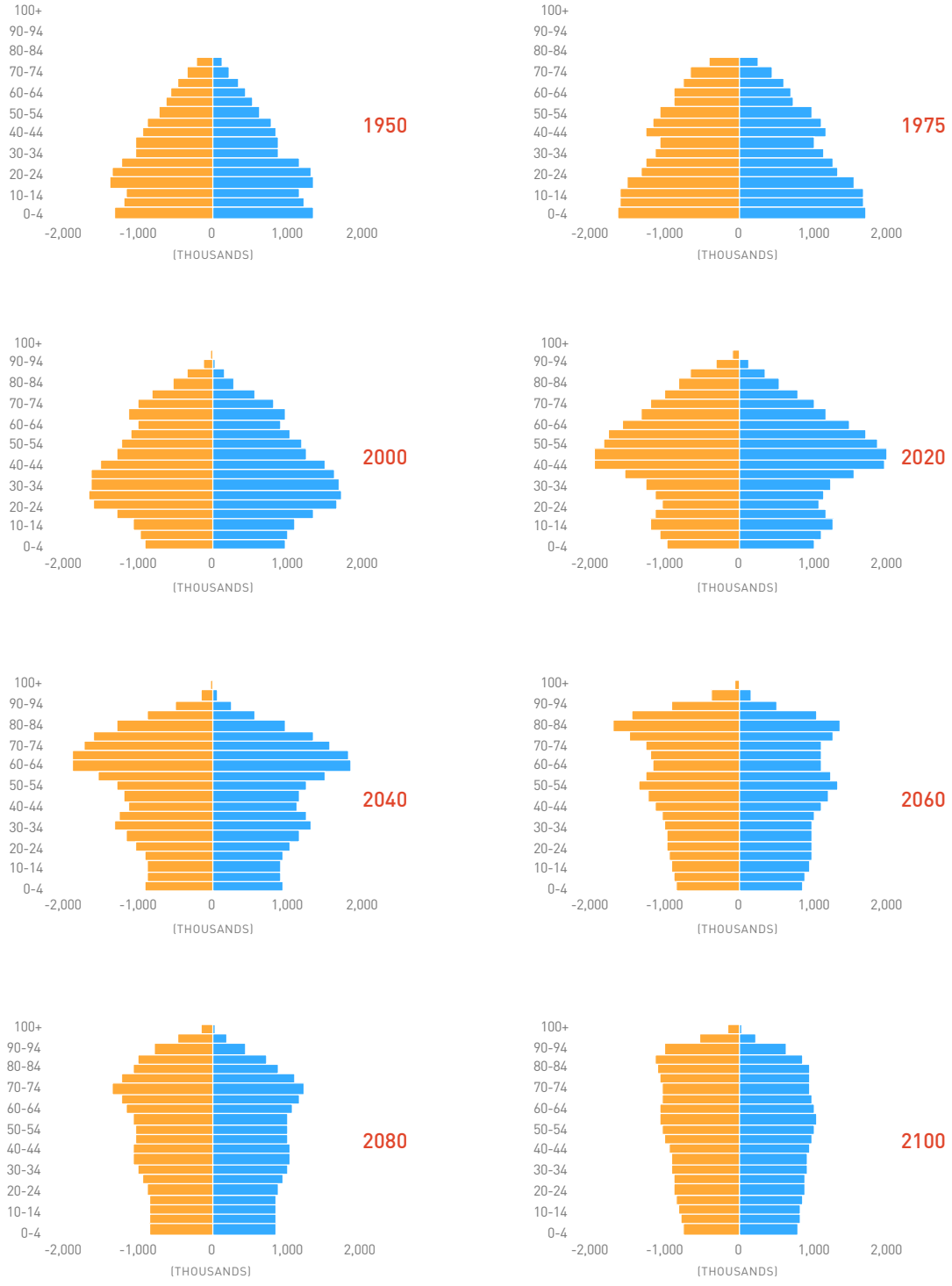
As shown in Chart 2.2-e, the Spanish population pyramid started evidencing this phenomenon in the middle of the last century. However, unlike the United States population pyramid, the constrictive effect (due to population aging) has been significantly greater, and in line with UN projections it will only give rise to a stationary pyramid toward the end of this century.

This population behavior is largely explained by the dynamics of the fertility rate, which has fallen sharply in recent decades and will take the rest of this century to approach the global convergence levels. At the same time, life expectancy at birth has been growing steadily since 1950 and is expected to continue its upward trend for the remainder of the century (see Chart 2.2-f).

## United Kingdom

In the case of the United Kingdom, the system is heavily based on the second pillar, with an almost residual role of the first pillar for high incomes and a negligible role for medium incomes. A particular feature of this system is that the progressive implementation of a reform has recently been approved aimed at simplifying the state pension system by introducing a single pension allowance, revised on an annual basis, but also introducing a second-pillar quasi-mandatory contributory

## Chart 2.2-e
## Changes in the population pyramid: Spain, 1950-2100




Source: MAPFRE Economic Research (based on UN data)

**Box 2.2-b**
Dependency ratios: selected countries, 1950-2100

### Analysis of the dependency ratios in the countries selected as benchmark models for the report

Of the various ways in which dependency rates and their future projections are usually addressed, the approach adopted here is the potential population whose contributions can help finance the pension system and that will benefit from these contributions on reaching the retirement age. The analysis is based on historical data and population projections made by the United Nations (UN) for each of the systems included in the study.

Two retirement age scenarios are contemplated, at 65 and 70 years, as shown in the charts in this box. Ratio 1 defines dependency as the relationship between the working-age population (20 to 64 years) and the retirement-age population (over 65 years), i.e. the reverse of the traditional demographic index, whereas the Ratio 2 dependency compares the population between 20 and 69 years with the population over 70 years. It is important to note that the 65-70 is the age group in which the retirement age is currently situated in most pension systems around the world. In many cases, the process of gradually raising the age from 65 to 70 years is a key aspect of their respective reforms.

Irrespective of the metric used to estimate the dependency rate, the historical data and projections of the percentage between the working-age population and the population that has reached the retirement age indicate a clear downward trend. As shown in the charts in this box, this trend (based on observations dating from the beginning of the 1950s and on UN population projections by age group up to the year 2100) will continue in the coming decades, converging—in general terms—toward a ratio of two working-age people to one retirement-age person, passing through periods in which this indicator will even fall below this level in certain countries, specifically between 2035 and 2050.

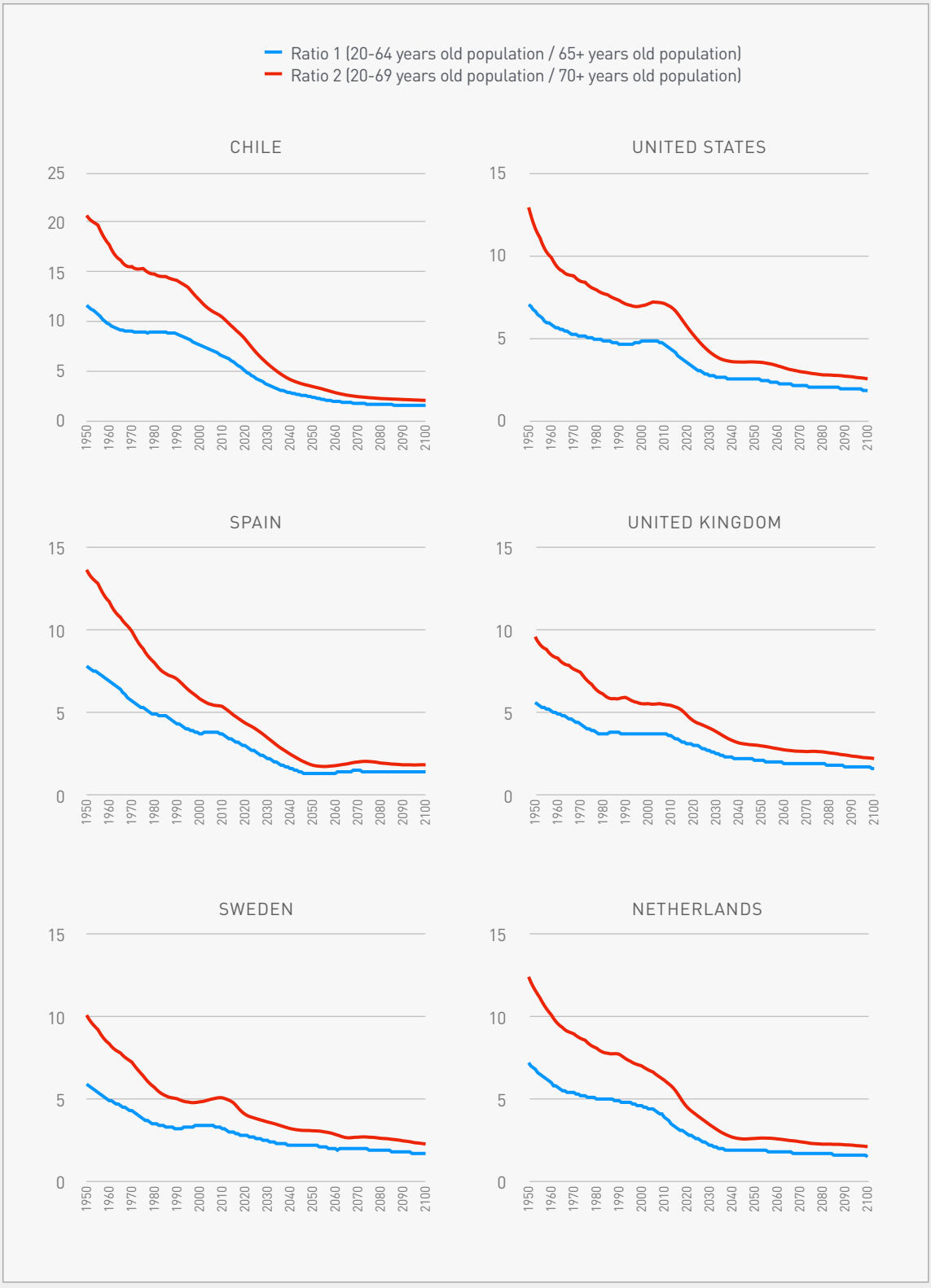
In the data shown below for the countries whose pension systems have been selected as benchmark models for the purposes of this study, it is clear that if the dependency ratio is calculated on the basis of entering the labor market at the average age of 20 and retiring at 65 (Ratio 1), the historical and projected trend declines very significantly. In several of these countries it falls to around half, comparing, for example, the year 2000 with the year 2035.

The situation improves slightly if the retirement age is raised to 70 years (Ratio 2). However, the ratio still follows a downward trend, converging at values above two.

| Ratio 1 (20-64/65+) | 2000 | 2017 | 2035 | 2050 |
|---|---|---|---|---|
| Chile | 7.6 | 5.5 | 3.1 | 2.3 |
| United States | 4.8 | 3.8 | 2.6 | 2.5 |
| Spain | 3.7 | 3.2 | 1.9 | 1.3 |
| United Kingdom | 3.7 | 3.1 | 2.3 | 2.1 |
| Sweden | 3.4 | 2.9 | 2.3 | 2.2 |
| Netherlands | 4.6 | 3.1 | 2.0 | 1.9 |

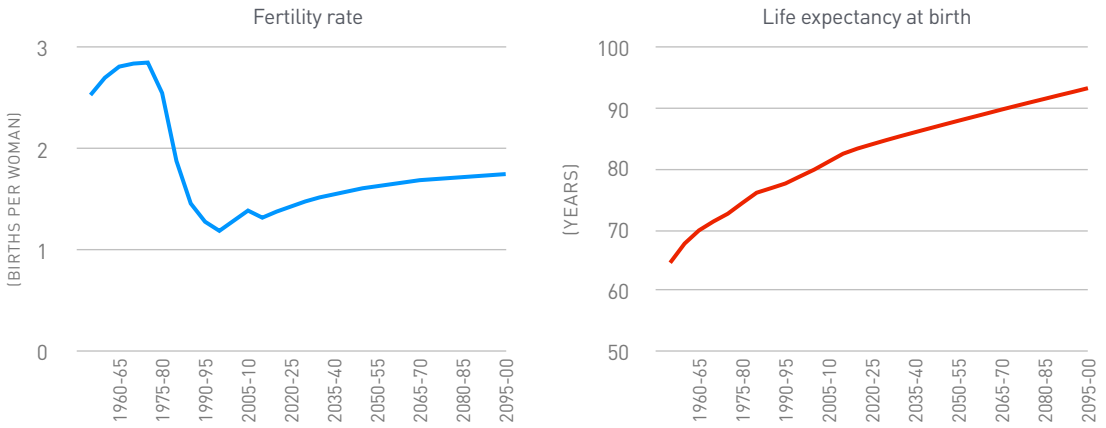
| Ratio 2 (20-69/70+) | 2000 | 2017 | 2035 | 2050 |
|---|---|---|---|---|
| Chile | 12.1 | 8.9 | 4.8 | 3.4 |
| United States | 6.9 | 6.3 | 3.7 | 3.5 |
| Spain | 5.8 | 4.7 | 2.9 | 1.8 |
| United Kingdom | 5.5 | 4.9 | 3.4 | 3.0 |
| Sweden | 4.8 | 4.5 | 3.4 | 3.1 |
| Netherlands | 7.0 | 5.1 | 3.0 | 2.6 |

**Box 2.2-b (continued)**
Dependency ratios: selected countries, 1950-2100




Source: MAPFRE Economic Research (based on UN data)

Chart 2.2-f
Spain: fertility rate and life expectancy at birth, 1950-2100




Source: MAPFRE Economic Research (based on UN data)

pension plan for companies, with employees entitled to opt out of paying these contributions.

In this case, the population dynamics evidence a constrictive pyramid in the middle of the last century, which has evolved (like the Dutch system but unlike the Spanish one) and started stabilizing, with the expectation that it will become a stationary pyramid by the middle of this century (see Chart 2.2-g).

Once again, these population dynamics are partly explained by the behavior of the fertility rate which, while falling from the 1960s to the beginning of this century, is expected to stabilize during the remainder of the period analyzed (see Chart 2.2-h).

## Sweden

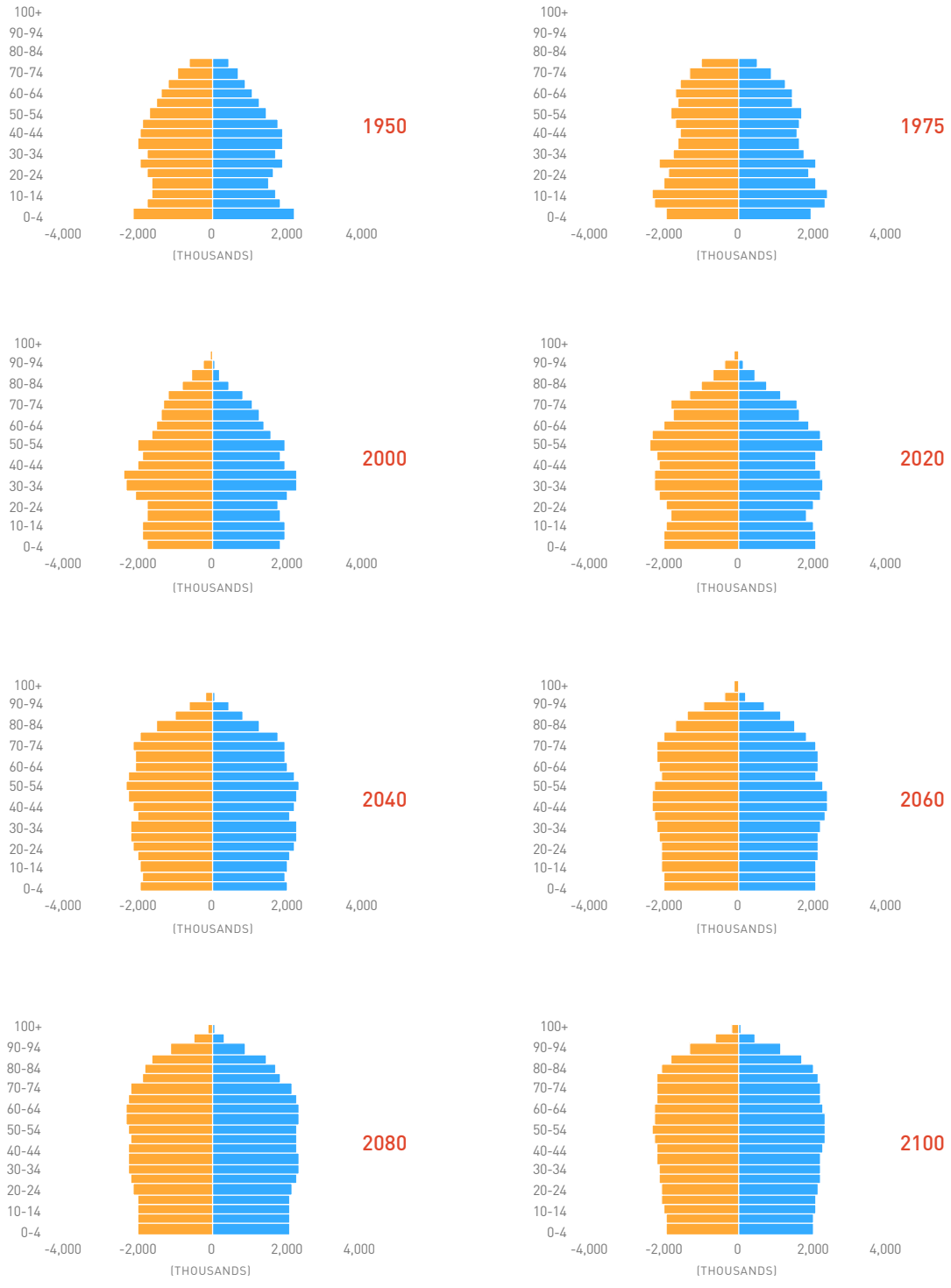
Another country selected as a benchmark model is Sweden, where the first pillar plays a significant role but is supplemented by a mandatory second pillar.

It is important to note that this system was completely reformed in the 1990s when a system of notional accounts was introduced. Adopted as a model for other countries, it aims to combine the traditional effects of the pay-as-you-go system (first pillar) with the benefits of saving incentives in the form of a supplementary pension (second pillar).

From the point of view of its population dynamics, as early as 1950 the Swedish population pyramid was evidencing a distinctly constrictive pattern (still the case today), which is expected to gradually give way to a stationary pyramid toward the end of this century (see Chart 2.2-i).

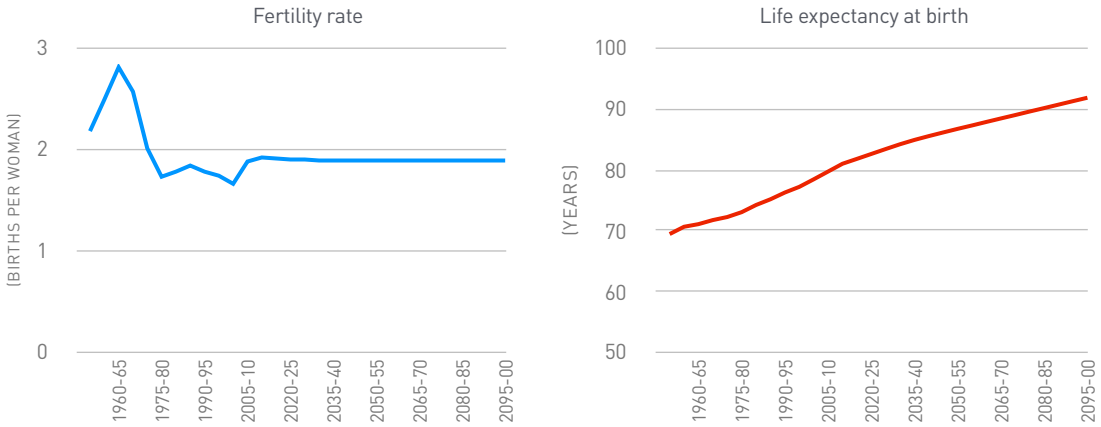
In this case, the fertility rate was already relatively low in the 1950s and after a period of decline it is expected to stabilize around the convergence values of the most developed regions of the world (see Chart 2.2-j).

## Chart 2.2-g
## Changes in the population pyramid: United Kingdom, 1950-2100




Source: MAPFRE Economic Research (based on UN data)

Chart 2.2-h
United Kingdom: fertility rate and life expectancy at birth, 1950-2100



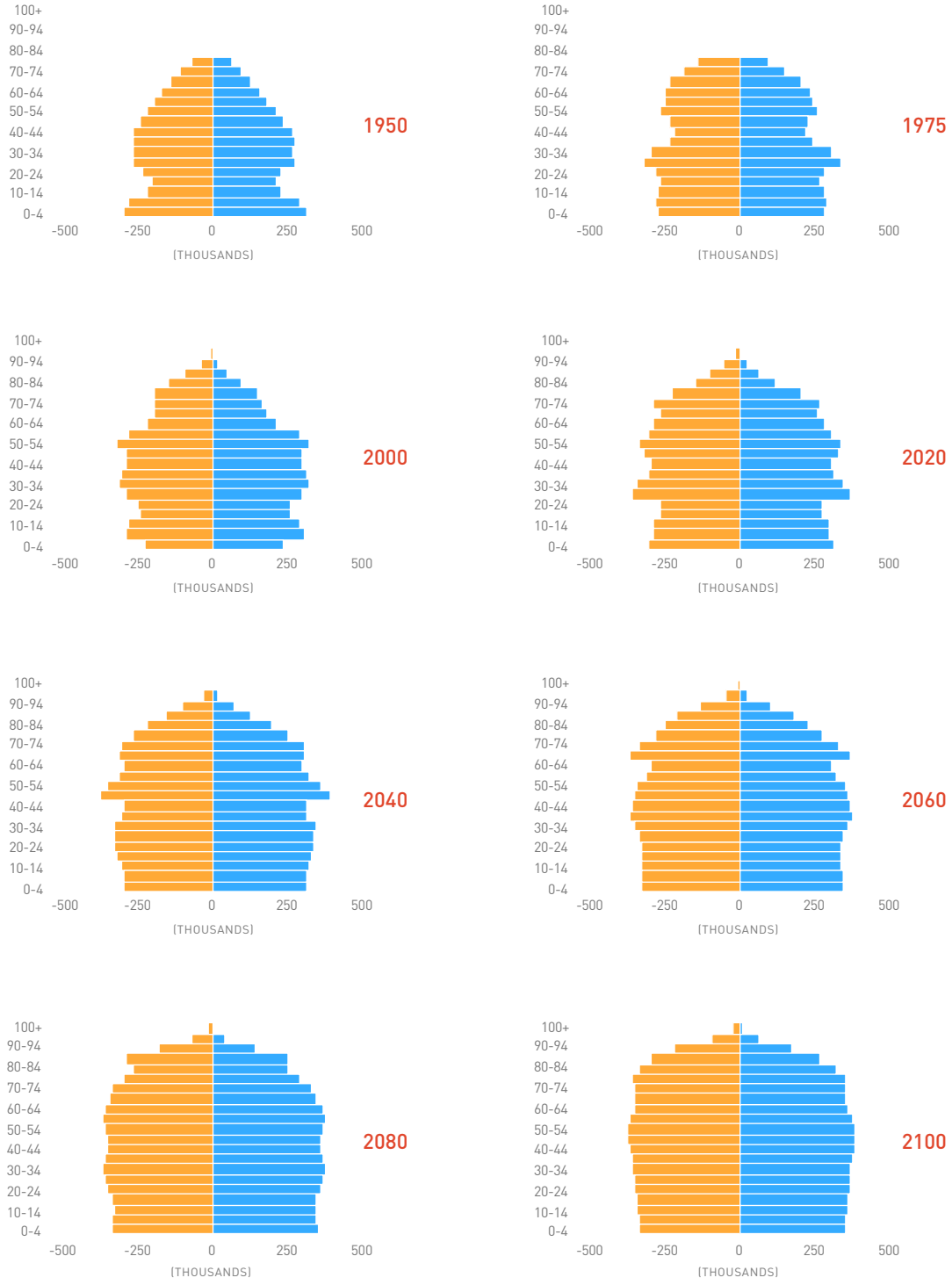

Source: MAPFRE Economic Research (based on UN data)

## Netherlands

Lastly, in the Dutch system the first pillar plays a significant role (the lower the income, the bigger its role) but is supplemented by a mandatory second pillar (the higher the income, the bigger its role). Today, the Dutch system has the highest replacement rates of all developed countries, with an aging population and a very modest cost for the state in terms of the proportion of GDP.

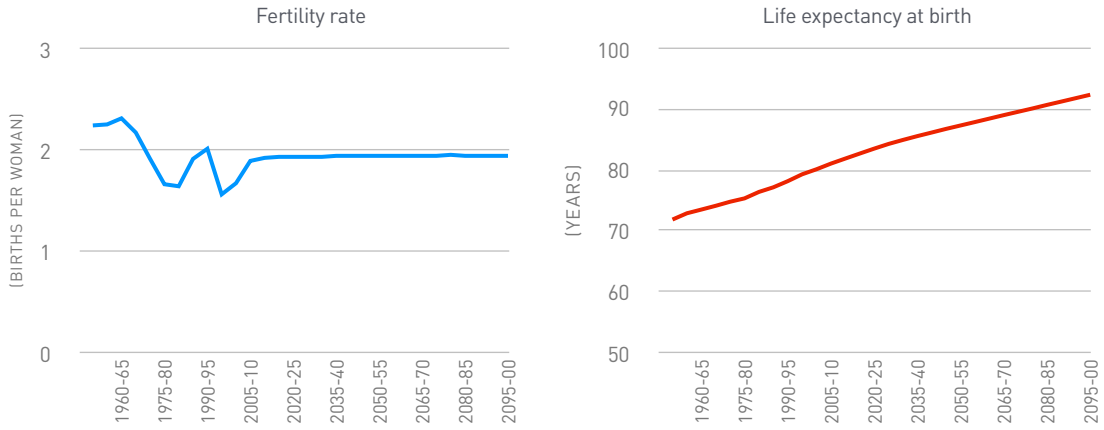
Chart 2.2-k shows how the Dutch population pyramid has evolved. As the analysis illustrates, the Dutch population pyramid was still expansive in 1950 and gradually evolved toward a constrictive pyramid, which is expected to disappear toward the middle of this century and be replaced by a stationary pyramid. Unlike the Spanish case, the population dynamics are more stable due to a lower decline in the fertility rate (see Chart 2.2-l).

## Chart 2.2-i
## Changes in the population pyramid: Sweden, 1950-2100



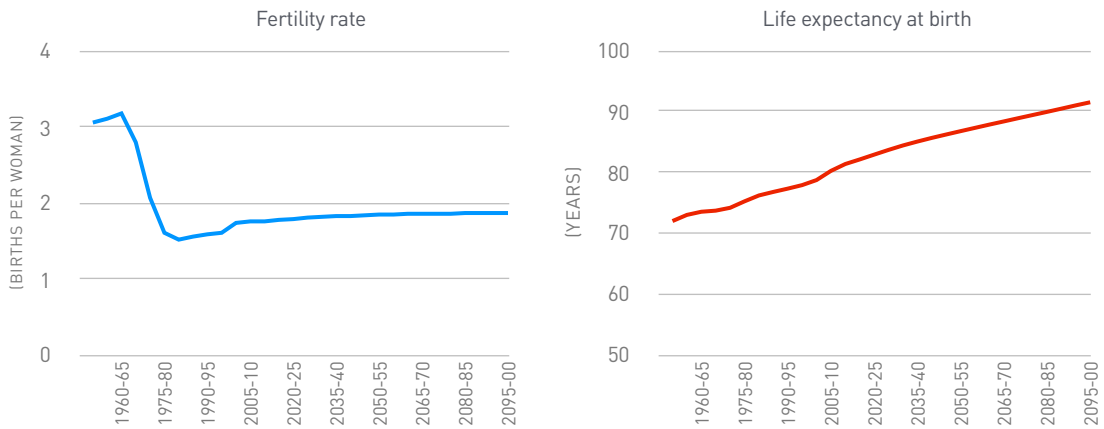

Source: MAPFRE Economic Research (based on UN data)

**Chart 2.2-j**
**Sweden: fertility rate and life expectancy at birth, 1950-2100**



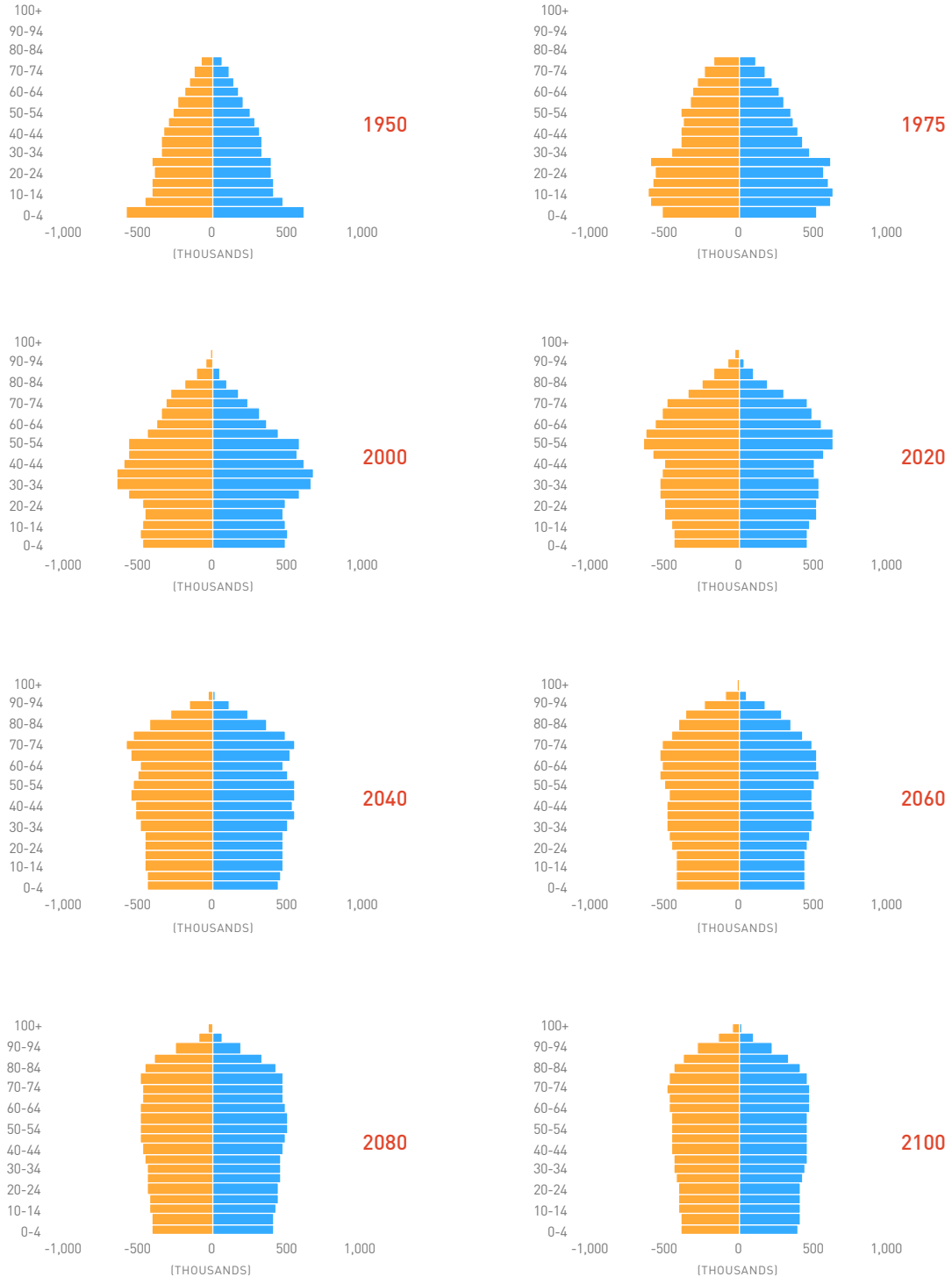

Source: MAPFRE Economic Research (based on UN data)

**Chart 2.2-l**
**Netherlands: fertility rate and life expectancy at birth, 1950-2100**




Source: MAPFRE Economic Research (based on UN data)

## Chart 2.2-k
## Changes in the population pyramid: Netherlands, 1950-2100




Source: MAPFRE Economic Research (based on UN data)

# 3. Analysis of the Benchmark Models

## 3.1 Chile

### 3.1.1 Regulation of the current pension system

The Chilean old age, invalidity and survivor pension system is regulated by Decree Law 3500 of 1980, which introduced a comprehensive reform to replace the old (defined benefit) pay-as-you-go system with a (defined contribution) individual capitalization account system.

The system is managed by Private Pension Fund Administrators (AFP), which are regulated and supervised by the state through the Superintendency of Pensions, the body responsible for the oversight of this new system. The Superintendency oversees the solidarity pension system and the old pay-as-you-go system that still exists for certain sectors of society. By law, this body is obliged to coordinate with the Superintendency of Securities and Insurance over the life annuities that are granted by insurance companies in the depletion phase of the system.[3]

Although the private sector has traditionally managed the pension system, in June 2014 a bill was presented in the Chilean parliament to create a state AFP. In August 2016 the government of Chile announced its intention of enacting the bill into law, along with other measures to change certain aspects of the current pension system.

### 3.1.2 Description of the system coverage levels

#### Pillar 0

In line with the conceptual framework for analyzing pension systems that was described in the first section of this document (see Chart 1.2-a), in Chile Pillar 0 is represented by the coverage level provided through the Solidarity Pension System. The Social Security Institute (IPS) is responsible for administering the pay-as-you-go and solidarity pension systems.[4]

The 2008 reform extended and incorporated guarantees into this system, replacing the old welfare pensions and the fixed minimum pension with a series of guaranteed benefits, irrespective of the person's contributory record.

The programs at this basic level of protection are financed through the government's general revenues and consist of the following:

- Basic Solidarity Pensions (PBS). These are non-contributory pensions available to people who are not entitled to a pension under any social security regime, as either survivor pension recipients or beneficiaries, and who meet the age, focus and residence requirements stipulated in Law 20,255.[5]

- Solidarity Pension Supplements (APS). These supplement the pensions that participants of the AFP mandatory contributory system receive.[6] In the case of old age, they are granted to people whose pension base is lower than the Maximum Pension with Solidarity Supplement (PMAS).

The benefits awarded under these programs are adjusted to the variation in the consumer price index every 12 months, or when the variation reaches 10 percent, if this occurs first.

#### Pillar 1

The coverage at this level of protection is provided through a defined contribution individual capitalization account system. It is mandatory for all dependent workers, unless they are affiliated to the old pay-as-you-go system. Self-employed workers are also obliged to join the system, although this requirement has been phased in gradually and will only become mandatory for all self-employed workers from January 1, 2018.

### Contributions

The contribution to the pension system is 10 percent of workers' monthly remuneration or taxable income, which is transferred to individual pension accounts. The AFP also charge an additional commission for the administration of these individual accounts.[7] The commission is set by the market but usually ranges between 0.5 and 1.5 percent, depending on the AFP in question.

Contributions above 10 percent of the salary are only established in certain cases, for the purpose of permitting the early retirement of workers who carry out heavy tasks. The additional mandatory contribution is 2 percent or 4 percent, depending on the case in question, and in these circumstances the company pays half of the contribution.

There is another maximum limit on contributions, which in 2016 was 74.3 Unidades de Fomento (UF), equivalent to $1,904,241 (2,685 U.S. dollars). This limit is revised every year in with positive variations in the Remuneration Index (IR) published by the National Institute of Statistics.

### Retirement age

The normal retirement age in the Chilean system is 65 for men and 60 for women.

However, workers are allowed to defer retirement and carry on working, in which case they are no longer obliged to continue making retirement contributions, although they may do so on a voluntary basis.

Early retirement is also permitted if the balance in the individual account is sufficient to finance a pension equal to or higher than whichever of the following values is greater: 70 percent of the average remuneration in the last 10 years, or 80 percent of the maximum pension with solidarity supplement.

### Relevant factors in calculating benefits

The relevant factors for calculating pensions depends on the method chosen. In the Chilean pension system there are four pension methods:

a) **Immediate life annuity.** This is a constant pension in real terms for the duration of the pensioner's life. The amount of the life pension is calculated by using actuarial formulas and depends on the retirement age, the survival tables used and the guaranteed interest rate. This pension method is offered by life insurance companies. If the pensioner dies, the annuity reverts to the beneficiaries (survivor annuity), so their age is also a relevant factor when calculating the annuity. The balance in the individual account is transferred to an insurance company to pay the insurance premium corresponding to the responsibility of paying the life annuity and the capital for the survivor annuity coverage, if applicable.

b) **Temporary annuity with deferred life annuity.** Part of the balance in the individual account is used to provide a temporary annuity. The rest is transferred to an insurance company to acquire a deferred life annuity, which the recipient starts collecting at the end of the temporary annuity period. The temporary annuity is calculated according to financial parameters, depending on the market interest rate, and the life annuity is calculated using actuarial formulas, depending on the retirement age, the age of the beneficiaries, the survival tables used and the guaranteed interest rate.

c) **Scheduled withdrawal.** The pensioner withdraws money from the individual account on a monthly basis. The amount of

this withdrawal is calculated annually on the basis of the balance remaining in the individual account, the life expectancy of the pensioner and their family members entitled to benefits, and the interest rate. The resulting amount of the scheduled withdrawal is multiplied by an adjustment factor, the purpose of which is to create a reserve to soften the declining trajectory of the benefit. When the pension is less than 30 percent of the initial scheduled withdrawal, the reserve is used to reach that percentage until it is completely depleted. This method allows the pensioner to revoke the decision at any time and opt for a life annuity calculated according the balance remaining in the individual account.

d) **Scheduled withdrawal with immediate life annuity.** This method allows the affiliates who meet the retirement requirements to use part of the balance in their individual capitalization account to take out a life annuity for an amount higher than or equal to the basic old age solidarity pension. They may also maintain the remaining mandatory balance in any type C (intermediate), D (conservative) or E (more conservative) pension fund of their choosing, to use in the scheduled withdrawal method. Affiliates who have taken out a life annuity higher than or equal to 70 percent of the average taxable remuneration of the last 10 years or higher than or equal to 80 percent of the maximum pension with solidarity supplement, may assign the remaining mandatory balance in their individual capitalization account to a type A (more risky) or B (risky) pension fund).

**Limits applicable to pensions (maximum and minimum pensions)**

In all the above methods, if the worker obtains a pension higher than 100 percent of the maximum pension with solidarity supplement or 70 percent of the average monthly taxable income of the last 10 years, they may make use of the freely disposable surplus, i.e. the funds remaining in the individual capitalization account, after calculating the amount necessary to obtain the pension and discounting the accumulated balance. The affiliate may withdraw this surplus and use it for any purpose.

With regard to the minimum limits, the Solidarity Pension Supplements (APS) are used to supplement the old age pensions of people whose pension base is lower than the Maximum Pension with Solidarity Supplement (PMAS).

**Mechanism for updating pensions**

Pension amounts are expressed in Unidades de Fomento, a unit of measurement whose value is set by the Superintendency of Banks and Financial Institutions and adjusted monthly by this same body in light of any variations that have occurred in the consumer price index during the calendar month before it was set.

**Future improvements in life expectancy**

The Chilean pension system takes into account the effect of future improvements in life expectancy. This effect is incorporated into the mortality tables which insurance companies use to calculate the insurance premium for life annuities, which include a correction or security margin. These tables are updated approximately every five years and applied to the people who retire thereafter. Any deviations in life expectancy beyond what is incorporated into the tables used to calculate the single premiums must be assumed by the insurance companies.

## Pillar 2

The main instrument used at this level of protection is the Collective Voluntary Pension Savings plan (AVPC).[8] This is a saving mechanism that companies can offer, whereby the voluntary savings made by the workers are supplemented by their respective employers.

APVC plans include contributions from the employer and the worker. However, the system allows for plans where only the employer undertakes to contribute, in which case they may choose to differentiate their contributions, in terms of amount and vesting period, with respect to the plans where the worker also contributes.

The employer may freely negotiate the commissions charged for administering the deposits under APVC plans with the administrating institutions, and different commissions may be set for different contracts or within the same contract depending on the number of workers affiliated to the plan.

Workers may withdraw all or part of the accumulated funds they own in accordance with the terms and conditions of the tax regime selected at the point of contribution. To withdraw the contributions made by the employer, they must prove that they have fulfilled the minimum vesting period, as stipulated in the APVC plan contract.

### Pillar 3

The main coverage instrument at this level of protection is the Voluntary Pension Savings plan (APV), which may be administered by AFP, banks, insurance companies, administrators of mutual funds, or administrators of housing funds.

The voluntary savings account, also known as the "second account", is created as a supplement of the individual capitalization account to provide an additional source of savings for affiliates, enabling them to raise their pension amount. The voluntary savings account is independent from all the other accounts administered by the AFP.

The contributions to this plan enjoy certain tax breaks, depending on the legislation in force at the time they are made. Workers may withdraw the funds at any time, in which case there are certain mechanisms for recovering any tax benefits that may have been applied.

The voluntary pension savings plans also include another element known as the "agreed deposit". In this case, workers can arrange with their employers to deposit amounts assigned to their individual capitalization account, in order to increase the capital to finance an early retirement pension or increase the amount of their pension. These agreed deposits also enjoy certain tax breaks, which depend on the legislation in force at the time. However, unlike the voluntary pension savings, the funds accumulated as agreed deposits cannot be withdrawn before the worker retires. The exceptions to this rule are pensioners of regimes administered by the Institute of Social Security, who may withdraw from the administering entities all or part of the resources accumulated in agreed deposits.

In the event, the APV balances must be transferred to the individual account of the AFP to finance survivor pensions, except in insurance plans with savings, where the beneficiaries may request that the indemnity and savings are paid to them directly.

## 3.1.3 Analysis and opinion of previous reforms to the system

### Precedents

The most recent precedent of the current Chilean pension system dates from the early 1950s, although it was amended in the second half of the 1970s to create the Welfare Pensions Regime for the poorest people aged over 65 and invalids aged over 18.[9] A reform was also introduced to change the retirement regime from years of service to retirement due to age. Since then, the minimum age of retirement has been 65 for men and 60 for women.

Under this system, at the end of the 1970s there were 32 pension institutions administering more than one hundred different regimes, all with different requirements regarding access to benefits and with significant inequalities in the pension amounts.[10]

In this context, the financial situation of the system was weakened, mainly as a consequence of the decline in the relationship between contributors and pensioners but also due to the strong incentives for workers to under-declare their income for most of their working life because the pensions were calculated on the basis of the salaries received in the last three to five years worked, depending on the program.

A variety of partial solutions were tested but proved to be inefficient, and the decision was ultimately made to undertake a comprehensive reform and adopt a defined contribution system, accumulating financial reserves. Decree Law 3500 of 1980 regulates the new system.

The transfer of workers from the old system to the new one began in 1981, and the workers who opted for the new system were offered a direct incentive in the form of a reduction in the contribution rate. On January 1, 1983, it became compulsory for all workers to join the AFP.

The state plays a subsidiary role in the individual capitalization system, consisting in regulating and inspecting the system and granting guarantees. However, the government presented a bill to parliament with the aim of extending the scope and role of the state through the creation of a state pension fund administrator.[11]

It is important to note that the individual capitalization system does not apply to members of the Armed Forces and National Police, who are still affiliated to a defined benefit pay-as-you-go system. The pay-as-you-go system of the old pension funds, administered through the Institute of Social Security (IPS), also still exists to receive the contributions and pay the benefits of those who opted to remain in that system.

## Need for adjustments

Following the migration to a defined contribution system, the Chilean government assumed responsibility for financing the payment of the pensions in the old system until their extinction as well as the so-called "recognition bonds" (a financial instrument that recognizes the years of contributions in the old system made by contributors who changed to the new system).

In 2006, 25 years after the reform was introduced, the various presidential candidates opted to review its results, mainly as regards the actual coverage of the population in light of the low level of affiliation and the difficulty of affiliates maintaining their contribution density.

The estimates made in 2005 indicated that half of the population would not have any guarantees, 5 percent would only access a minimum pension, and 45 percent would self-finance a pension to supplement the minimum pension. The projections made at the time concluded that on the assumption of an annual growth of 2 percent in the real minimum pension, an annual growth of 2 percent in real salaries, and an annual real 5 percent net return on pension funds, the percentage of people self-financing their pension would be lower and the number of people eligible for minimum pensions would be higher, as would the number of people without any guarantees.[12] These results gave rise to a general consensus about the need to improve the pension system.

## The 2008 reform

Law 20,255 of 2008 on Pension Reform created the Solidarity Pension System to supplement the pension system regulated by Decree Law 3500 of 1980. The benefits granted by the new law are basic old age and invalidity solidarity pensions and old age and invalidity solidarity pension supplements. Their aim is to reinforce the solidarity nature of the pension system, offering greater state support to workers on lower incomes with a lower capacity to contribute and accumulate pension savings, and to ensure effective social protection for the entire population. The law also established conditions for improving competition between the AFP and created a Technical Investments Committee.[13]

In addition, the 2008 reform made contributory participation mandatory for a broad group of self-employed workers, introduced a series of measures to improve gender equality in the system, incentivized contribution through subsidies for the formal recruitment of young workers, and delivered more efficient tools for collecting outstanding contributions.[14]

## Need for a new evaluation of the system

On April 29, 2014 the Pension System Presidential Advisory Commission (known as the Bravo Commission) was created to carry out a new review of the effectiveness of the pension system and put forward recommendations on resolving its deficiencies. As explained in one section of the report drawn up, the 2008 reform left certain aspects pending, including low pensions, low coverage, the high commissions charged by the AFP, gender inequality, and the lack of confidence in the system.

The Bravo Commission estimates that 50 percent of the people who retired between 2007 and 2014 receive pensions of $82,650 (124 U.S. dollars) or less, including the Solidarity Pension Supplement (APS). Half of the women receive pensions of $42,561 (64 U.S. dollars) or less, while men receive pensions of $112,333 (168 U.S. dollars) or less. The replacement rate of nearly half of the pensioners is 34 percent: half of the men obtain replacement rates of 60 percent or less, while half of the women achieve a maximum of 31 percent.

The Commission has pointed out that the accumulation of savings for old age during working life is very low for a significant percentage of the population, especially women and low-income sectors. Meanwhile, the contribution rate of 10 percent of taxable remuneration is relatively low compared with international standards and also with the rate in the previous pension system. The Commission also mentions the low level of competition between the AFP regarding prices, and the fact that only 20 percent of contributors are affiliated to the AFP that won the tender introduced by the 2008 reform, which established a tendering mechanism granting the right to incorporate all new workers who join the pension system into the AFP that offers the lowest commission, making it compulsory for new workers to join that AFP for the following two years, at which point a new tender is put out.

The report also highlights the existence of rules that affect women and men differently, such as the application of mortality rates differentiated by gender and the different legal ages of retirement for men and women (65 and 60, respectively). Women live longer and contribute for a shorter period, which means that different self-financed pensions are generated for men and women for the same level of contribution. This is coupled with the low level of labor market inclusion among women, the higher proportion of periods of inactivity in their working life, and the more precarious conditions in general that affect the women who do participate in the labor market.

## Recommendations of the Bravo Commission

With regard to the recommended solutions for the problems detected, the Bravo Commission rejected the return to a pure pay-as-you-go system, opting instead for specific reforms to improve the benefits, adequacy and equity of the current system. It put forward two recommendations to strengthen the savings pillar and in both cases reinforce the solidarity pillar. It also recommended introducing a pay-as-you-go component in the system to allow, in certain circumstances, for the financing of some of the pensions in progress with the employer contribution related to active workers.

The first recommendation (Global Recommendation A) would significantly increase the solidarity pension and make its coverage universal. This increase would be financed through taxes and a new contribution of 2 percent from the employer, assigned to a solidarity fund. Significant changes are also recommended for the savings component, consisting in the introduction of a new contribution of 2 percent from the employer deposited in the individual capitalization accounts, and the creation of a state AFP with strict governance rules, as well as new measures to reduce the commissions charged by the AFP. The Commission also recommended improving gender equality by sharing contributions from couples on a year-by-year basis, making the legal retirement age the same for men and women, and implementing unisex mortality tables.

The second recommendation of the Bravo Commission (Global Recommendation B) would transform the current solidarity pension plan into social insurance, which would become the central part of the pension system with tripartite financing. It would be organized through citizen social insurance accounts (which could take the form of notional accounts), and both the basic solidarity pension and the individual capitalization component for the highest incomes of approximately 50 percent of workers would be maintained. The recommendation would allow the pensions of the current pensioners to be raised through the construction of a solidarity fund with contributions from workers, employers and the government. The coverage of the basic solidarity pension would be universal, except for people with very high incomes. The new social insurance would be financed with the 10 percent contribution from all contributors, with a fixed limit, with an additional increase of 3 to 4 percent in the employer contribution, and with fiscal supplements. The new social insurance component would facilitate the inclusion of self-employed workers, reduce gender inequalities, improve intra and intergenerational solidarity, diversify the exposure to risk, and centralize the administration of accounts.[15]

### The reform bill

On the basis of the Bravo Commission's report, the Chilean government submitted a bill to parliament on August 10, 2017[16] pointing out that the self-financed replacement rates in the current system are low, with average values of 12 percent for women and 33 percent for men in the latest cohort of new workers, within a context of population aging, increased life expectancy, and lower profitability of the financial markets, which in a defined contribution system translates into smaller pensions and greater uncertainty.

The bill also emphasizes that the contribution rate in Chile is much lower than the average in the pension systems of OECD (Organization for Economic Cooperation and Development) countries, currently around 18 percent, with a significant part of the contribution paid by the employer.

The bill therefore takes elements from the Bravo Commission recommendations and introduces solidarity elements to facilitate the transition from a system based on individual savings to one in which these savings are supplemented collectively through the creation of a new mandatory system, called the New Collective Savings Plan, aimed at diversifying the sources of pension financing through a mixed system in the mandatory contributory pillar.

Accordingly, the bill contemplates the reintroduction of the employer contribution and a stronger role for the state in the provision of social security. This contribution would be 5 percent of the taxable remuneration, of which 3 percent would be paid into the individual retirement accounts of the affiliated workers, to create a personal savings fund managed by a public body, and the remaining 2 percent would go to the Collective Savings Fund to finance, in order of precedence, the intergenerational solidarity supplement, a compensatory bond for women, and the intra-generational solidarity supplement.

Finally, a technical independent public body, called the Collective Savings Board, would be created to manage this new collective pension savings system.

The bill includes additional measures such as the increase in the maximum taxable limit, contributions from independent affiliates, certain adjustments to the life annuity and scheduled withdrawal methods, and to the solidarity pillar.

## 3.1.4 Risk analysis

### Pre-retirement period (accumulation phase)

Based on the conceptual framework of the risks associated with defined contribution plans (see Chart 1.3-c), explained in the first section of this study, the Chilean pension system contains the risks described below.

### Financial risks

Due to the nature of individual capitalization systems, affiliates maintain ownership of the funds accumulated in their capitalization account, therefore assuming the financial risk of the instruments in which they are invested. In other words, the negative effect of the potential materialization of financial risks on the amount of these funds will be reflected—all other things equal—in the pension the worker receives upon retirement.

The savings are administered under a multiple pension fund plan. Each of these funds (A to E, from higher to lower risk) is invested in different proportions in a series of fixed income and equity instruments. Affiliates who do not choose a pension fund are assigned one in accordance with their age. Younger affiliates are assigned to a fund with a predominance of equity instruments while older affiliates are assigned to one with a predominance of fixed income instruments.

From the financial point of view, affiliates also assume the frictional risk (or financial market risk) that occurs when the investments are liquidated to purchase the temporary or life annuities, depending on the method chosen. This risk is related to the divestment process carried out on their behalf by the AFP to generate the necessary liquidity to transfer the funds to the insurance company that will issue the life annuity in whichever method is chosen.

### Risks associated with asset managers

In the Chilean pension system, the AFP are the financial institutions responsible for administering the individual accounts of the affiliates that will provide the benefits established by law. The AFP are limited companies with a restricted purpose which are legally required to supply a minimum capital that is subsequently increased according to the number of affiliates until it reaches a maximum of 20,000 UF. They must also allow the AFP shareholders to own at least 1 percent of the pension funds.

In keeping with the legislation currently in force, every two years a tender is put out for the administration of the individual accounts of new workers who join the labor market and the pension system. This tender is awarded on a price basis and is open to all the AFP on the market as well as new investors authorized by the Superintendency of Pensions.

Workers affiliated to the AFP that wins the tender must remain with it for two years from the month of affiliation, unless the AFP goes bankrupt or falls into an irregular legal situation, or there is another AFP that charges a lower commission for two months in a row or obtains a differential return that compensates the lower commission. In turn, the AFP that wins the tender must maintain its commission percentage for a period of two years from the first month in which it started receiving new affiliates. At the end of this period, it may raise its commission, but in that case all the affiliates are released and may transfer to another AFP, irrespective of the month they joined the original one.

New affiliates who complete the minimum vesting period indicated in the paragraph above, and all the other affiliates, may freely transfer to another AFP without the obligation to fulfill another minimum vesting period of contributions.

In spite of the new tender mechanism introduced through the 2008 reform to reduce commissions and increase the competition between the AFP, the latest analysis from the Bravo Commission makes reference to the continuing low levels of competition in prices between the AFP and the fact that only 20 percent of contributors are affiliated to the administrators that won the tender introduced by the reform.

## Post-retirement period (depletion phase)

### Financial risks

If the worker opts for the scheduled withdrawal method, the financial risk associated with the investment of the funds is still retained by the pensioner, under very similar terms and conditions as those assumed during the accumulation period, although there are certain restrictions regarding the type of mutual fund due to profile risk in which the assets can be maintained, so as to limit that risk.

Meanwhile, if the worker opts for a life annuity, the financial risk associated with the instruments in which the insurance premium is invested and the guaranteed rates are assumed by the insurance company. The insurance companies therefore assume the credit risk of the investments in which the insurance premium is materialized. They also assume the market risk and the risk associated with reinvestment of the asset flows if there is an imbalance between the flows derived from the investments and those derived from the payment of the life annuities (asset/liability matching risk).

**Demographic risks**

As a capitalization system without any pay-as-you-go component, the Chilean pension system is not directly exposed to the demographic risk of changes in the population structure, with the exception of those affiliates who still belong to the old pay-as-you-go plan.

In cases where affiliates opt to receive a life annuity (irrespective of the method), both the idiosyncratic and aggregate or systemic demographic risks are assumed by the insurance company. However, pensioners who opt for the scheduled withdrawal method retain all of the risks derived from increased longevity; if this risk materializes, it affects the pension amount in the final phase of their life.

**Inflation risk**

In the Chilean pension system, payments derived from life annuities are expressed in Unidades de Fomento, which transfers the inflation risk to the insurance companies that pay them. It is therefore these companies that cover any deviations in the estimated inflation rates from the real inflation rates when calculating the price of the insurance premium.

Lastly, irrespective of the entity that ultimately assumes each of these risks in the accumulation and depletion phases, the pension amount and corresponding replacement rates have varying degrees of sensitivity to these risks due to their different structural characteristics.

## 3.2 United States

### 3.2.1 Regulation of the current pension system

The United States state pension system is regulated by the Social Security Act of August 14, 1935. The public control and regulation bodies are the Department of Labor and the Social Security Administration. With regard to supplementary social security, the Employee Retirement Income Security Act (ERISA) of 1974 imposes strict requirements on private pension plans. This law created the Pension Benefit Guaranty Corporation (PBGC), a government agency of the Department of Labor which protects and guarantees payments derived from defined benefit pension plans.

### 3.2.2 Description of the current system: coverage levels

#### Pillar 0

In the United States this basic level of coverage is provided through the Supplemental Security Income, which was created in 1972. This is a pension that supplements the social security allowance (financed through taxes) for people over 65 with less than $2,000 in assets, or less than $3,000 in the case of a couple. Housing is not classified as an asset for the purpose of this calculation. The maximum annual pension in 2017 was $8,830.84, or $13,244.80 where the spouse fulfills the requirements to receive this pension. This amount is adjusted annually in line with the increase in the cost of living (known as the cost of living adjustment), which is measured against the consumer price index.

However, it is important to note that a considerable number of U.S. states have their own supplementary pension system, while others grant supplements to this minimum pension.

## Pillar 1

In general terms, the coverage at this level of protection is provided through state pensions under a pay-as-you-go contributory system. Access to this plan is open to people who have reached retirement age and contributed for at least 10 years.

### Contributions

The contribution rate is 12.4 percent of the worker's salary, of which 6.2 percent is paid by the company and 6.2 percent by the worker. Self-employed workers contribute 12.4 percent of their earnings directly.

There is also a contribution base ceiling, which in 2017 was set at $127,200. This ceiling is revised every year in line with changes in salaries.

### Retirement age

The normal retirement age in the United States system is 66, but it has been raised to 67 for people born after 1960. The system allows workers to defer retirement until the age of 70, provided that they have been paying contributions for at least 10 years. This increases the pension by 8 percent for each year deferred. Workers may also combine the collection of their pension with paid employment, in which case they are obliged to carry on contributing the same percentage as all other workers.

Early retirement is allowed from the age of 62, provided that the worker has contributed for at least 10 years, but there is an annual penalty of 6.67 percent for the first three years and 5 percent thereafter, to a maximum of 30 percent.

### Years of reference and relevant contributions for pension calculations (factors related to working life)

The pension calculation is based on the average salary of the highest 35 years. To perform this calculation, salaries are updated in line with the changes in salaries until the contributor reaches the age of 60.[17] The contributions paid thereafter are calculated at face value, without any adjustment.

A particular feature of the U.S. system is that pensions are calculated on a tranche basis. This means that in calculating the pension payable, a percentage (replacement rate) is applied based on the amount of the updated contributions.

In 2017 the updated contributions were divided into three tranches. In the case of the bottom tranche, below $885 dollars, a 90 percent replacement rate was applied, a 32 percent rate was applied to the middle tranche of $885-$5,336, and in the case of the top tranche, up to the contribution ceiling, a 15 percent replacement rate was applied. In the case of beneficiaries with dependent family members, the tranches increases in accordance with certain terms and conditions.

The system is therefore characterized by redistribution to lower incomes, which in any case are eligible for the maximum replacement rate of 90 percent. The replacement rates for higher incomes decrease exponentially as the income level rises.

### Limits applicable to pensions (maximum and minimum pensions)

Meanwhile, there is a monthly maximum amount for the benefits received, which in 2017 was $2,687 per month for the normal retirement age.[18] The figure was $3,538 for people retiring at 70, and $2,153 for those retiring at 62. The same limit is applied to the contributions.

### Mechanism for updating pensions

Pensions are updated annually in line with the increase in the cost of living (cost of living adjustment), which is measured against the consumer price index.

## Pillar 2

The coverage at this level of private protection is articulated through company-based collective pension plans. Under U.S. law, companies have no obligation to offer their workers a pension, but this may be the mandatory outcome of individual or collective negotiations, in which case the resulting plans will not only be subject to the specific terms and conditions negotiated but also to federal legislation and any supplementary state legislation.

All of these private pension plans allow the deferral of tax on the contributions and on the returns from investments until the benefits are collected in retirement, and there are also tax breaks, with certain limits, as regards the annual contributions that can benefit from them. Transfers to another employment plan are usually possible if the new employer is in agreement.

There are three basic types of private pension plans: defined contribution (DC), defined benefit (DB) and hybrid.

### Defined contribution pension plans

In the mid-1990s nearly half of all workers covered by private pension plans belonged to this category, and their relative weight has grown significantly in the last decade. In spite of a certain level of standardization, there are several methods with widely varying characteristics.

The most popular defined contribution plans in the United States are the ones known as 401(k). Around 50 million workers participate in this type of plan, and assets worth around $4 billion in total were managed in 2016.

This type of plan is usually offered by major corporations that act as the sponsor and make contributions on behalf of their employees, although employees make the investment decisions. The management of the investment portfolios is outsourced to a management body chosen by the sponsor of the plan but workers retain control over their savings at all times. Updates on their investments should therefore be sent to employees on a regular basis.

Workers can match the contributions made by the company on their behalf, and these contributions are tax-exempt until the funds are withdrawn. The requirements vary from one entity to another and there is a ceiling on the annual contributions for tax purposes: $17,500 for the employer contribution and $5,500 for the extra contribution paid by the individual.

Plans may also include a profit-sharing component, and again their complexity varies considerably. The use of private pension plans has also spread to small and medium-sized companies as a vehicle for reducing their costs and administrative burdens.

The plan may pay out a one-off amount or offer other options, including payment over a period of time or a life annuity with monthly payments. The 401(k) plan allows redemptions at the age of 59 and a half, or if the individual encounters any of the specified difficulties. It also allows loans to be offered to the participants, within certain limits. There are also certain plan types that allow the payment of the accrued retirement benefit after a specific vesting period in the plan.

Furthermore, certain 401(k) plans contain features that differ from the traditional plan in terms of the mandatory contributions made by the sponsor or the vesting period for accrual by the worker (e.g.the safe harbor, SIMPLE and automatic enrollment plans).

Another type of defined contribution plan is the Individual Retirement Account(IRA). The SIMPLE IRA is fairly widespread among small companies in the United States. This private system of individual accounts was created in 1979 and allows contributions to be made within certain limits that vary according to the worker's age. It also offers tax breaks provided that the investment is made from annual earnings.

There are also profit-sharing plans and Employee Stock Ownership Plans (ESOP), which contain formulas for sharing company profits with employees. The aim of these plans is to encourage workers to improve their productivity. There is even the possibility of acquiring bank financing to establish or reinforce an ESOP, by facilitating the acquisition of a large block of company shares, which enables workers to buy part of the business, become majority shareholders or acquire it outright (e.g.the car rental company Avis Corp.), or to protect a company from a possible absorption (e.g.Chevron Corp.).

**Defined benefit pension plans**

Defined benefit plans offer life annuities and may be financed (if the employer and worker contributions are invested in a trust fund used to pay the benefits) of non-financed (if the funds are not used for the specific purpose of paying the benefits).

These plans may also be insured or non-insured, depending on whether the pension plan commitments are externalized to an insurance company or not. In the United States most defined benefit plans are non-insured (known asprivate non-insured pensionfund plans).

Some companies find that defined benefit plans offer business advantages, although they are more complex and costly than other types of plans. In general, they allow higher annual contributions than defined contribution plans, with the accompanying tax deductions. Additionally, employees usually find the benefits provided by these plans more attractive because as a general rule the benefits received are higher than those provided by other types of retirement plans.

**Hybrid pension plans (or cash balance plans)**

Lastly, hybrid plans combine the features of defined benefit and defined contribution plans. In these plans the investment risk is assumed by the sponsor, although the benefit is expressed in terms of a notional account balance belonging to each participant. Certain elements are similar to those of a defined contribution plan because the benefit amount is calculated on the basis of a formula that uses the contribution credits and their returns.

### Pillar 3

Lastly, individual retirement accounts (IRA) may be used as a private pension savings formula not linked to an employment relationship. Within certain limits, they allow the deferral of tax on the contributions and the returns from investments until the benefits are collected in retirement. These instruments include the so-called "Keogh" plans, which are designed specially for self-employed workers and people who want to build up an individual supplementary pension plan.

## 3.2.3 Analysis and opinion of previous reforms to the system

### Reforms related to Pillar 1

Since it entered into force in 1935, the Social Security Acthas undergone various amendments related to the regulation of state pensions. During the first phase, up to the 1970s, several parameters were reformed to increase the levels of coverage.

In the second phase the trend of the reforms changed and during the first half of the 1980s the amendments introduced were designed to reinforce the financing of the system in view of the concern aroused by the baby boom of the 1960s. Accordingly, the modifications of 1980 and 1981 limited the benefits paid to the families of disabled workers and abolished the child benefits for university students. But in spite of these reforms, in 1982 pension spending in the United States reached a record 5 percent of GDP (from 3 percent 12 years earlier), exacerbating concerns about the system's lack of financial sustainability.

In 1983 a new amendment was introduced in the wake of the Greenspan Commission's report, adjusting the benefits and contributions to address the immediate financing problems affecting the system. The surplus funds generated in successive years were threatened by the retirement of the baby boomers and in fact they were estimated to run out by 2042.

In 1985 the Balanced Budget and Emergency Deficit Control Act (PL 99-177), known as the Gramm-Rudman-Hollings Act, included several constraints regarding the U.S. social security budget. The years 1986 and 1990 both saw amendments introduced as a result of the annual budgets, leading to the Omnibus Budget Reconciliation Act. Furthermore, in 2000 measures were introduced to allow people who had reached the age of retirement to carry on working while still collecting their pension, provided certain terms and conditions were met.

All of these reforms have led to a state pension system that favors redistribution to lower incomes, with the pension amount falling considerably as the income level rises. A series of legislative reforms have also been implemented to reinforce retirement coverage through the second pillar, which plays a key role in the U.S. system for people with higher incomes.

## Reforms related to Pillar 2

With regard to the regulation of pension systems designed to supplement state pensions, until 1974 the federal legislation governing private pension funds was enshrined in the Internal Revenue Code and the Welfare and Pensions Plan Disclosure Actof 1958. Under this legislation, the value of pension funds could—and often did—fall below the value of the accumulated liabilities, with workers suffering the consequences of being left without a supplementary pension in cases where their plan ended with insufficient funds.

In view of the importance of these pension plans for workers in the United States, Congress addressed the problem by approving comprehensive legislation which required the sponsoring companies to make minimum contributions to the funds to maintain their actuarial solvency and guarantee the payment of benefits upon retirement. Known as the Employee Retirement Income Security Act (ERISA), the law was enacted in 1974.

ERISA establishes minimum standards for plan fiduciaries, administrators, managers and directors, ensuring that their decisions are made in the interests of the affiliates. The "prudent man rule" in investment choices has traditionally been interpreted as the necessary balance between safety, risk and return, which should translate into an adequate diversification of the portfolio, as a means of minimizing non-systematic risk. It also defines minimum standards regarding the rights of pension plan affiliates. For example, it stipulates that an affiliate who has worked for five years is entitled to accumulate 25 percent of the pension benefits, and the percentage rises to 100 percent after 10 years.

It also establishes a mechanism for guaranteeing the rights of pension beneficiaries, through the PBGC. This government agency acts as a pension insurer that collects mandatory annual premiums from plan sponsors and guarantees coverage of most of the benefits in private pension plans, which includes both the debts that companies have with those who fulfill the age and years of service requirements, as well as the payment of benefits to pensioners, even if the plan has ended or the sponsor has gone bankrupt.

Accordingly, if a pension plan ends and there are insufficient funds to pay the pensions, the PBGC will cover part of the deficit.[19] For these circumstances, ERISA includes a mechanism whereby the PBGC can recover its contribution in the form of preferential credit at the same level as tax credits, ahead of any non-guaranteed creditor, with the limit of 30 percent of the company's net value.

### 3.2.4 Risk analysis

## Pre-retirement period (accumulation phase)

**Financial risks**

As indicated above, state pensions are managed through a pay-as-you-go system and it is therefore the public sector, not the contributor, that assumes the financial risk. This is particularly important for people with low incomes since they benefit from high replacement rates upon retirement (see Chart 1.3-b).

The funds accumulated through the contributions made to supplementary pension systems by the active workforce and plan sponsors are owned by the worker, who assumes the financial risk of the assets in which they are invested (see Chart 1.3-c). In view of this circumstance, ERISA establishes certain prudential rules for the management of investments to reduce the financial risk, but the investment decisions regarding the accumulated funds are made by the participant. Most of these investments are usually channeled through diversified mutual funds and guaranteed investment contracts (GIC) issued by insurance companies, which incorporate a guaranteed interest rate on maturity.

However, in situations where a sponsoring company goes bankrupt, workers can sometimes suffer losses due to the plan funds being mainly invested in assets issued by the sponsor itself. Although at federal level there are no quantitative limits regarding the allocation of investments, there is a ban on investing more than 10 percent of the funds in shares owned by the sponsoring company.

Under ERISA defined benefit plans are covered by the PBGC, which assumes part of the risks if there is a deficit upon retirement. However, the coverage is not complete and there are major funds of this type with considerable deficits that could lead to replacement rates lower than the commitments assumed.[20]

As an active player in pension fund management during the accumulation phase, the PBGC draws up an investment policy approved by a board comprising the U.S. secretaries of labor, treasury and trade. In line with its current investment policy, the asset allocations are as follows: 30 percent in shares and other equity instruments, 70 percent in fixed income. This investment policy was approved by the PBGC board at its meeting of October 13, 2015.

**Demographic and unemployment risks**

As a pay-as-you-go system, in the coverages offered by the state pension system the demographic and unemployment risks are assumed by the public sector, which depending on certain population and economic dynamics could lead to financial sustainability problems if these risks were to materialize.

In the coverages committed through defined benefit plans, the demographic risks in the accumulation phase are assumed by the sponsoring company responsible for the commitments derived from the plan. These risks and the financial risks can be transferred to an insurance company. However, estimations of the obligations derived from defined benefit plans are based on factors like the turnover rates of workers who leave the company without generating retirement rights, or estimated salaries of employees to be taken into account when calculating the benefit, whose risk is retained in any case by the sponsoring company that assumes the plan commitments.

**Inflation risk**

When determining the state pension amount upon retirement, the salaries taken into account are updated to reflect changes in the nominal salaries until the contributor reaches the ages of 60. The contributions paid thereafter are calculated at face value, without any adjustment. This system practically eliminates for the pensioner the risk of the effect that inflation could have on their purchasing power if these adjustments were not made, again transferring the risk to the public sector. The severity of this risk in the case of defined benefit plans depends on the specific mechanism used to calculate them.

**Other risks related to the system**

It is important to note that there are certain elements which are likely to affect retirement saving capacity, specifically in the case of defined contribution plans. For example, university debt in the United States amounts to nearly $1 billion, with an average of approximately $28,000 per person. The risk for individual initiative is the growing indebtedness (less saving capacity) as a result of the debt undertaken for university studies.

### Post-retirement period (depletion phase)

**Financial risks**

State pensions follow a pay-as-you-go system, which means that the financial risks are assumed by the government rather than pensioners.

**Demographic and unemployment risks**

As occurs during the working life, in the coverage offered by the state pension system after retirement the demographic and unemployment risks are assumed by the public sector, due to the pay-as-you-go nature of the system, and could in any case lead to financial sustainability problems if these risks were to materialize.

Meanwhile, in the coverages committed through defined benefit plans, both the idiosyncratic and aggregate or systematic demographic risks are assumed by the sponsoring company responsible for the commitments derived from the plan. The idiosyncratic risk is greater the smaller the group covered. These risks and the financial risks can be transferred to an insurance company.

**Inflation risk**

As indicated above, state pensions are updated annually in line with the consumer price index (cost of living adjustment), so the inflation risk is assumed by the public sector.

Lastly, it is important to note that the adjustments introduced in the latest reforms of the U.S. pension system have mitigated the problem associated with the potential materialization of the risks to the public sector financial accounts since a greater role has been assigned to the other pillars in the generation of pension income, which in turn has diversified the risks associated with the coverages through those other pillars.

## 3.3 Spain

### 3.3.1 Regulation of the current system

In Spain the state pension system is regulated by Royal Legislative Decree 8/2015, which approves the amended text of the General Social Security Act and its implementation.

Meanwhile, the second and third pillars are basically regulated by Royal Legislative Decree 1/2002, which approves the amended text of the Pension Plan and Fund Regulation Act and its implementation.

### 3.3.2 Description of the current system: coverage levels

### Pillar 0

The coverage at this basic level of protection is provided through non-contributory pensions for people with insufficient funds for basic subsistence purposes, even if they have never contributed or have not contributed for long enough to qualify for a contributory benefit. This coverage is financed through taxes and the amount is updated every year in the General State Budget Act to at least the same percentage as the contributory retirement pensions.

## Pillar 1

The coverage at this level of protection is provided through a public pay-as-you-go lifetime pension system. To access this type of pension, a person must have reached the retirement age and contributed for at least 15 years, and at least two of the years of contributions must fall within the 15 years immediately preceding the pension entitlement.

### Contributions

Contribution to the public pay-as-you-go lifetime pension system is 28.3 percent of the salary received, of which 23.6 percent is paid by the company and 4.7 percent by the worker.[21] Self-employed workers contribute 29.8 percent of their earnings, which includes temporary disability coverage (26.5 percent if they decide not to cover this contingency).

There is a contribution ceiling, which in 2017 was set at 3,751.20 euros/month, and there is also a minimum contribution base which ranges between 825.60 and 1,152.90 euros/month, depending on the worker's professional category.

### Retirement age

Access to the retirement pension depends on the individual's age and the years of contributions throughout their working life, but they must be 67 years old, or 65 if they have contributed for 38 years and six months.

However, these retirement ages will be introduced gradually until 2027. In 2017 the requirement was 65 years and five months, or 65 years and 36 years and three months of contributions.

In principle, collecting a retirement pension is incompatible with working at the same time, although there are certain exceptions.[22] For example, partial retirement with a proportional reduction in the pension is allowed. Additionally, an "active aging" element has been introduced which, in certain circumstances, contemplates collection of the retirement pension with paid employment or self-employment. The pension amount that is compatible with work is equivalent to 50 percent of the initially recognized amount, without the right to any supplements for pensions below the minimum during the time that the pension is being collected while working. Self-employment for less than the minimum wage is also compatible with the pension and is exempt from social security contributions.

It is also possible to access the retirement pension after the legal retirement age, in which case an additional percentage is recognized for each complete year of contributions, as explained below.

### Factors related to working life: years of reference, relevant contributions and pension calculation

The pension calculation is based on the average contributions made in the last 25 years. The contributions of the two years prior to retirement are taken at face value, while all the others are updated in line with changes in the consumer price index.

However, there is a transitional period for the progressive increase of the calculation period, so the 25 years will be applied to people who reach retirement age in 2022. In 2017 the period considered is 20 years, increasing one year every additional year until 2022.

The pension amount is determined by applying 50 percent of the first 15 years of contributions to the regulatory base. From the 16th year, for each additional month of contributions between the first and the 248th month 0.19 percent is applied, and for each month of contributions after the 248th month 0.18 percent is applied, with the limit of 100 percent. The relevant sustainability factor is applied to the resulting amount.

If a person accesses the pension after the retirement age, an additional percentage is applied for each complete year of contributions between the date on which they reached the retirement age and the date when they finally collect the pension, depending on the years of contributions. This percentage is 2 percent but it is raised to 2.75 percent for people who have contributed between 25 and 37 years, and to 4 percent for people who have contributed more than 37 years.

**Limits applicable to pensions (maximum and minimum pensions)**

Minimum and maximum pension limits are established every year in the General State Budget Act. The maximum for benefits received in 2017 was 36,031.81 euros per annum.

Minimum pensions in 2017 ranged between 7,893.20 and 11,016.60 euros per annum, depending on the retirement age and whether the beneficiary had a dependent spouse or not.

**Mechanism for updating pensions**

Updates are performed annually in line with the revaluation established in the General State Budget, which is calculated according to an index that takes into account the variation rates in the social security system revenues, the number of contributory pensions, the average pension, and the revenues and expenses of the social security system. Moving arithmetic means of the last 11 years are taken, except for the system revenues and expenses, which are geometric means, with more weight attached to the latest observations. A parameter that is revised every five years is applied to these latter factors. The result cannot be lower than 0.25 percent, and nor can it exceed the percentage variation of the consumer price index of the previous year plus 0.5 percent. In 2017 pensions were revalued by 0.25 percent.

The pension amount, once it has been revalued, is limited to 2,573.70 euros. This sum refers to the ordinary monthly amount, irrespective of any extraordinary payments that may apply. The monthly limit is adapted according to whether the pensioner is entitled or not to receive 14 payments per year, including in both cases any extraordinary payments, to ensure that the amount does not exceed or reach, respectively, the annual amount of 36,031.80 euros.

**Future improvements in life expectancy: sustainability factor**

In the interests of supporting the long-term stability of the system, an automatic sustainability factor has been introduced to link pension amounts to the changes in pensioners' life expectancy. This factor will be applied once only to determine the initial amount of the retirement pension.

The sustainability factor is calculated on the basis of the year-on-year variation, in a five-year period, of life expectancy at the age of 67, which is obtained from the mortality tables for the retired population used by the social security system.

This sustainability factor will be applied to pensions from January 1, 2019.

## Pillar 2

The role of the second pillar in Spain is currently very limited. It is voluntary but in some companies has become mandatory in line with the terms and conditions negotiated in their employment contracts or collective bargaining agreement.

It is important to note that in these cases the companies are obliged to externalize the pension commitments from their balance sheets, as established in the first additional stipulation of Royal Legislative Decree 1/2002 approving the amended text of the Pension Plan and Fund Regulation Act. These commitments must be articulated through pension plans or insurance contracts, and may not be covered by internal funds or similar instruments that entail the company maintaining ownership of the constituted resources.[23] Exceptionally, credit institutions, insurance companies, and securities companies and brokers may maintain internal funds for the commitment assumed with their own workers.

## Pillar 3

In Spain, coverage through this voluntary pillar may be provided through contributions to private pension plans, insurance contracts or any other savings instrument. In the first two cases, it usually entails some form of tax break, depending on the legislation in force at the time and always with a limit in terms of contributions. There is also a legal protection framework for people who decide to make contributions to a private pension plan, which is enshrined in Royal Legislative Decree 1/2002 approving the amended text of the Pension Plan and Fund Regulation Act and its implementation.

### 3.3.3 Analysis and opinion of previous reforms to the system

Spain's current pension system dates back to the 1960s. The modifications introduced at that time aimed to correct the financial problems associated with the system, basically by attempting to align the contribution bases more closely with real salaries. However, at the beginning of the 1980s the system continued to suffer from viability problems as well as insufficient social coverage, with significant levels of improper use of the protection provided and defaults on contributory obligations.

In view of this situation, in the 1980s new parameters were adopted as well as measures to simplify the system. The maximum contribution limits were raised to reinforce the contributory nature of the system and improve the level of benefits, the period required to access benefits was increased from 10 to 15 years, and the contribution period used as the base for calculating pension amounts jumped from two to eight years. For the first time, Law 26/1985 linked the automatic revaluation of pensions to the consumer price index and the minimum pension was aligned with the minimum salary. The number of regimes was also reduced to less than half of the original number.

However, in spite of these reforms, the system still presented problems and in 1995 parliament approved the so-called Toledo Pact, agreeing to undertake a profound analysis of the structural problems in the system and the reforms required. The pact text pointed to a series of factors that could have an impact on the financing of the social security system, and it put forward certain recommendations. For example, it made reference to demographic variables such as the falling birth rate and the increase in life expectancy, with the consequent aging of the population.[24] Employment, the low rate of activity, the dependency rate, the financing of the system, and social changes like women's inclusion in the labor market were also highlighted. The recommendations included separating the financing sources, creating reserves with balanced budgets, amending the financing of the special regimes, improving the collection mechanisms, fighting fraud, and integrating the management bodies (collection and benefits).

Accordingly, since the beginning of the current decade several reforms have been introduced to the existing system. The most important of these is the reform implemented in 2011, which extends the retirement age in the terms and conditions discussed above.

Meanwhile, Law 35/2002 and the implementation regulations included measures to encourage active aging, which Royal Legislative Decree 5/2013 further developed in an attempt to reinforce the sustainability of the system. The retirement pension is now compatible with paid work or self-employment, hitherto restricted under Spanish law but generally permitted in the legal systems of comparable countries. Accordingly, workers who have reached the legal retirement age after a long working life during which they have paid their contributions can undertake full-time or part-time work and collect 50 percent of their pension, with limited social contribution obligations.

RDL 5/2013 also makes reference to the fact that the measures adopted by Law 27/2011 were insufficient to guarantee the long-term viability of the system, and the conditions for accessing early retirement are now more stringent.

Law 23/2013 of December 23 regulating the Sustainability Factor and Revaluation Index of the Social Security Pension System introduced another major reform to address the issue of

the baby-boom generation reaching retirement, which will significantly increase the number of pensions over a long period of time (2025-2060). Unfavorable demographics and the profound economic crisis had anticipated the appearance of deficits in the social security accounts, forcing the adoption of this reform.

However, in spite of the latest reforms, the progressive increase in pension spending and the impairment of the social security reserve fund prompted a new debate on the sustainability of the system and at the end of 2016 a commission was set up to monitor and evaluate the Toledo Pact agreements.[25] There has been little progress to date, although working groups have been created to analyze the situation and start preparing a series of recommendations.

### 3.3.4 Risk analysis

#### Pre-retirement period (accumulation phase)

**Financial risks**

As indicated above, state pensions in Spain are managed through a pay-as-you-go system, which means that the contributor does not assume any financial risks during this phase.

However, the funds accumulated through the contributions made to supplementary defined contribution pension systems are owned by the worker, who assumes the financial risk of the assets in which they are invested.

It has already been mentioned that in Spain companies are required to externalize from their balance sheets the pension commitments undertaken in employment contracts and collective bargaining agreements. These commitments must be articulated through pension plans or insurance contracts, and may not be covered by internal funds or similar instruments that entail the company maintaining ownership of the constituted resources. As such, and irrespective of the externalization obligation, in the coverages committed through defined benefit plans (of which very few remain in Spain), the financial risk is assumed by the sponsoring company responsible for the commitments derived from the plan. This risk could be transferred to an insurance company following externalization of the commitments, the only exception being the financial institutions, and securities companies and brokers, which may retain the risk due to the commitments assumed with their own workers.

**Demographic and unemployment risks**

With regard to the coverages offered by the state pension system, since a pay-as-you-go plan is followed the demographic and unemployment risks are assumed by the public sector, which could lead to budget sustainability problems in the medium and long terms if the risks materialize.

In the coverages committed through second-pillar defined benefit plans, the demographic risks in the accumulation phase are assumed by the sponsoring company responsible for the commitments derived from the plan. However, the externalization obligation means that these commitments must be articulated through pension plans or insurance contracts. Once these commitments have been externalized, companies' obligations and responsibilities are limited exclusively to what is undertaken in those insurance contracts and pension plans. Therefore, in the case of defined benefit plans, both the idiosyncratic and aggregate or systematic demographic risks would be transferred to an insurance company.

**Inflation risk**

The state pension amount calculated upon retirement takes into account the average contributions made in the last 25 years. The contributions of the two years prior to retirement are taken at face value, while all the others are updated in line with changes in the consumer price index. This system practically removes all risk for the pensioner derived from the effect that inflation could have on their purchasing power in the pre-retirement phase if these adjustments were not made, again transferring the risk to the public sector.

In the case of second-pillar defined benefit plans, it depends on the formula used to calculate them. However, as mentioned above, these plans are being phased out in the Spanish system, as is the case in most of the pension systems around the world.

## Post-retirement period (depletion phase)

### Financial risks

State pensions follow a pay-as-you-go system, which means that the financial risks in the post-retirement phase are assumed by the government.

The financial risk of the investment assets associated with the funds accumulated through the contributions made to supplementary defined contribution systems are owned by the pensioner, who assumes the investment risk. This risk may be transferred to an insurer by acquiring a life annuity in exchange for a premium, in which case the pensioner assumes the counterparty risk with the insurance company.

Irrespective of the externalization obligation, in coverages committed through second-pillar defined benefit plans the financial risk is assumed by the sponsoring company responsible for the commitments derived from the plan. This risk must be transferred to an insurance company to comply with the externalization obligation. Once the commitments have been externalized, companies' obligations and responsibilities are limited exclusively to what is undertaken in the insurance contracts and pension plans.

### Demographic and unemployment risks

As in the accumulation phase, because of the pay-as-you-go nature of the Spanish pension system, the demographic and unemployment risks are assumed by the public sector, which could lead to financial sustainability problems in the medium and long terms if these risks were to materialize.

To mitigate this risk, the current legislation contemplates the application of the so-called sustainability factor, which introduces a correction in the pension calculated upon retirement based on the performance of life expectancy, therefore transferring part of the risk effect to the pensioner. This could lead to a fall in the replacement rate in the future. This measure, which will enter into force in 2019, will only apply to people who retire at the actual retirement age, and not to pensions already in progress.

Irrespective of the obligation to externalize the funds, in the coverages committed through second-pillar defined benefit plans, both the idiosyncratic and aggregate or systematic demographic risks are assumed by the sponsoring company responsible for the commitments derived from the plan. The idiosyncratic risk is greater the smaller the group covered. However, as explained above, the obligations derived from these plans must be transferred to an insurance company. Once these funds have been externalized, companies' obligations and responsibilities regarding the commitments are limited exclusively to what is undertaken in the insurance contracts and pension plans through which they are externalized.

### Inflation risk

Lastly, the annual pension update is performed in line with an index that takes into account the variation rates in the social security system revenues, the number of contributory pensions, the average pension, and the revenues and expenses of the social security system. This means that the inflation risk is not transferred in its entirety to the state but may have a partial impact on the purchasing power of the pensions in progress. There is an absolute lower limit of 0.25 percent, which is the minimum revaluation applied each year, and variable upper limit to ensure that the revaluation does not exceed the percentage variation in the consumer price index of the previous year plus 0.5 percent.

## 3.4 United Kingdom

### 3.4.1 Regulation of the current pension system

In the United Kingdom the current state pension system is enshrined in the Pensions Act 2014 and its implementation regulations. This law applies to people who reach the retirement age after April 6, 2016. It will take a few years to implement the law fully because there is a transitional period for people who reached the retirement age or accumulated a significant amount in contributions before that date.

The United Kingdom pension system is conceived in such a way that the state pension grants basic coverage and is supplemented by private coverage, especially that provided through the employment system. These supplementary pension systems are regulated by the Pensions Act 2008, which makes it mandatory for companies to enroll their workers in a workplace pension plan. Meanwhile, the Pensions Schemes Act 2015 regulates the different types of plans, which are described below.

### 3.4.2 Description of the current system: coverage levels

#### Pillar 0

At this basic level of protection coverage is provided through the Guarantee Credit and applies to people over the age of 63 who do not have a minimum level of income.

This basic support is financed through taxes and in 2017 it was set at 159.35 pounds per week,of 243.25 pounds for couples. The applicable stipulations contemplate certain increases in the case of people who are sick, have dependants or a mortgage.

#### Pillar 1

The coverage at this level of public protection is provided through the new State Pension (nSP) that was introduced in the Pensions Act 2014. It consists of a flat-rate amount revised annually. This basic rate or single tier pension was set at 155.60 pounds per week for 2016/2017, and it is revised annually every April. In April 2017 it was raised by 2.5 percent to 159.55 pounds per week.

This pension applies to everyone who retires after April 6, 2016 and has contributed to the system for at least 35 years. People who have not reached this minimum contribution period may defer their retirement. There are also transitional stipulations that apply to people with at least 10 years of contributions, provided that at least one of the years was completed before April 6, 2016.

**Contributions**

Contributions to this pension system depend on the worker's status and income level. The normal rate in 2017 was 25.8 percent (13.8 percent paid by the company) for incomes under 3,750 pounds per month.[26] However, 680 pounds/month are deducted from the contribution base, so the effective contribution is around 21 percent, of which 12 percent is paid by the company and 9 percent by the worker.

People with lower incomes whose salaries fall within a certain bracket are not obliged to pay contributions but are treated in the same way as people who have contributed. In 2017 the minimum limit was 113 pounds and the maximum 157 pounds per week. People who earn less than this minimum limit are not entitled to the new state pension and will therefore receive the zero-pillar basic coverage.

Once a persons reaches retirement age, they are no longer obliged to pay contributions, even if they carry on working. The 35 years of

contributions do not only include periods of paid employment but also periods of looking after children or actively seeking work.

There is no contribution ceiling in this first pillar, but in 2017 the worker's contribution in cases of incomes above 3,750 pounds per month was set at 2 percent of the amount over that income, with the company paying the same contribution rate, i.e. 13.8 percent, except for special cases.

**Retirement age**

The retirement age in the United Kingdom is currently 65 for men and 63 for women. However, this will increase progressively to reach 67 in 2026 and 2028 for men and women, respectively. For those born between 1970 and 1978 ,the retirement age is 68 years.

**Years of reference and relevant contributions for pension calculations (factors related to working life)**

Entitlement to the full pension amount is dependant on having reached the retirement age and having worked for 35 years. However, it can be accessed with a minimum of 10 years of contributions. People who have worked for less than 35 years are entitled to a proportion of the pension amount (1/35 for each year worked).

**Mechanism for updating pensions**

Every April, the state pension amount is revised in accordance with the inflation rate, the average salary increase or 2.5 percent, whichever value is the highest. This update mechanism is known as the triple lock, although there is no guarantee that it will continue to be used because it is not expressly indicated in the new legislation.

**Future improvements in life expectancy**

The retirement age will be revised to adjust it to life expectancy and other factors deemed relevant by the government. The first review was set for May 7, 2017 and thereafter every six years. At this first review it was decided that people born between 1970 and 1978 would have to wait another year to retire, i.e. they would only be able to claim their state pension reaching the age of 68.

## Pillar 2

The coverage at this private level of protection is articulated through company collective pension plans, which have a long tradition in the United Kingdom and constitute a crucial pillar of the country's pension system.

**Defined benefit pension plans**

Twenty years ago, defined benefit plans (DB) were the most common instrument, with the benefit taking the form of a life annuity calculated either on the basis of the average salary during a specific period immediately prior to retirement or on the basis of the last salary of the working life. However, the sustained fall in interest rates has compromised the risk-free returns on these plans and they are gradually being phased out. Even so, the amount of the commitments instrumented through these types of plans remains high, with many of them of them operating with a deficit in relation tofunds required to cover the existing commitments until their extinction.

**Defined contribution pension plans**

The rapid decline in defined benefit plans, coupled with a significant wave of closures between 1995 and 2004, led to the promulgation of the Pensions Act 2008, which made it mandatory from October 2012 for companies to enroll all workers who fulfilled certain conditions in a workplace pension plan.[27]

This obligation was introduced in phases, beginning with companies of more than 250 employees in October 2012 and a deadline of April 2017 for smaller companies. New companies (created between April 1, 2012 and September 30, 2107) have until February 1, 2018 to fulfill this obligation. After that date, it will be mandatory for all companies to offer their workers a workplace pension plan. This type of pension is known as "quasi mandatory", a term which implies that it is mandatory for companies to offer a workplace plan but the worker may opt out. Basically, this opt-out was conceived to address special cases of people whose personal circumstances prevent them from making contributions at any given time.

The company, the worker and the government, through tax credits, contribute to these workplace plans. A calendar of gradual implementation has been drawn up for minimum contributions starting at 2 percent of the salary in 2012 and reaching 8 percent by 2019.

The minimum worker contribution is 0.8 percent of the qualifying salary, gradually increasing to 3 percent by April 2019. The minimum company contribution is 1 percent of the qualifying salary, gradually increasing to 3 percent by April 2019. Lastly, the government contribution, in the form of tax credits, is 0.2 percent of the qualifying salary, gradually increasing to 1 percent by April 2019.

The qualifying salary for calculating the contribution is defined by the company and may be the entire gross salary or a smaller amount (between 5,824 and 43,000 pounds).[28]

In view of the fact that it is mandatory for all companies to offer a workplace pension plan, for small companies without their own plan the government has created a scheme known as the National Employment Savings Trust (NEST),[29] with its own manager. This is a low-cost national scheme available to all companies.

Defined contribution plans may also be self-administered schemes, sponsored by the company and managed by a board of directors that must act in the best interests of the participants, or insurance schemes, in which case the company designates a pension fund manager, usually an insurance company.

**Hybrid pension plans or cash balance plans**

There are also hybrid plans, although their relative weight is still negligible. This category includes shared risk and collective benefit plans. These plans offer some level of guarantee and were introduced in the Pensions Schemes Act 2015. However, prior to that legislation there were already plans that could be considered to be hybrid (e.g., cash balance plans or profit sharing plans).

## Pillar 3

The personal pension plans in the third pillar are based on direct contracts between the participants and the fund managers (the company is not involved), and they are also classified as insurance schemes.

Although the company is not involved, it can still make contributions, which are tax deductible for the company. In this case, the company also benefits from a reduction in the national insurance contribution.

Until April 2001, individual personal pension plans were only available to the self-employed and individuals not affiliated with any workplace plan. Since that date, the introduction of stakeholder pensions, which have limited commissions, has gradually widened the access to these plans. Since April 2006, individual pension plans have been available to everyone under the age of 75.

Stakeholder pensions are classified in the category of Group Personal Pensions. These are defined contribution plans that enjoy tax relief and are available to everyone, irrespective of whether the individual is an employee, is self-employed or does not work at all. The main characteristic of these group plans is that the commissions are limited, in accordance with the terms and conditions established by the government. They work like any other personal plan (group or individual) and are governed by a contract between the participant and the manager, which is usually an insurance company or a fund manager but may also be a bank or building society. The majority of these plans are subject to a maximum commission of 0.75 percent of the managed assets.

### 3.4.3 Analysis and opinion of previous reforms to the system

The United Kingdom pension system was first introduced in the 1940s but has been changed on numerous occasions since the 1960s. In the 1970s a basic pension was introduced as well as an additional one which employees could renounce by opting to join a workplace plan with better terms and conditions. This system is still in existence for certain sectors of society but is gradually being phased out.

During the first decade of the 21st century various reforms were undertaken to raise the pensions of people with lower-income working lives, aimed at addressing growing concerns that people would have insufficient savings when they retired. Although measures had been adopted to encourage the private sector to contribute to this mission, they were proving to be less successful than originally anticipated.

The adoption of the Pensions Act 2007 improved the coverage of the state pension by reducing the number of years of contributions required. It also introduced pension credits to avoid retirees falling into poverty.

However, a profound analysis undertaken by the British government[30] revealed the existence of three major problems in the system:

- The complexity and uncertainty of the result of the state pension made it very difficult to calculate the amount that would be received upon retirement.
- Means-tested benefits were discouraging saving for retirement, leading to too many people relying on pension credit.
- The subsistence of significant inequalities in relation to women, people with low income and the self-employed, who tend to have smaller pensions.

The 2014 reform aimed to simplify the system, promote personal responsibility and introduce a sustainable system, which is designed to prevent increased public spending in the future.

### 3.4.4 Risk analysis

#### Pre-retirement period (accumulation phase)

**Financial risks**

In relation to the new state pensions,these are managed through a pay-as-you-go system, which means that the contributor does not assume any financial risks during this phase since they are all retained by the public sector.

Funds accumulated through the contributions made to supplementary pension systems (second pillar) by the active workforce and plan sponsors are owned by the worker, who assumes the financial risk of the assets in which they are invested.

Although defined benefit plans are currently being phased out in the United Kingdom, those that still exist operate with a deficit in relation to the funds to address the commitments until their extinction, in the event of the materialization of both financial and demographic risks. In these cases, the workers are exposed to the risk of the sponsoring company being unable to cover the deficit and going bankrupt. In fact, in certain cases the deficit is so high that what might be a viable solution, i.e. the acquisition of the sponsoring company by other companies, is proving to be extremely difficult or even impossible.

It is important to note that the Pension Schemes Act 2015 introduces transparency rules and significant control over pension plans aimed at making future pensioners aware of this risk and preventing them from incurring in losses stemming from poor management of their investments.

**Demographic and unemployment risks**

For coverages offered through the state pension system, the demographic and unemployment risks are assumed by the public sector due to the pay-as-you-go nature of the system. The new state pension amount is relatively small, which has minimized the impact that the materialization of these risks could have on the financial sustainability of the

system, irrespective of the decline in replacement rates.

In the coverages committed through defined benefit plans, the demographic risks in the accumulation phase are assumed by the sponsoring company responsible for the commitments derived from the plan. These risks and the financial risks can be transferred to an insurance company. However, estimations of the obligations derived from defined benefit plans are based on factors like the turnover rates of workers who leave the company without generating any pre-retirement rights, or estimated salaries of employees to be taken into account when calculating the benefit, whose risk is any case retained by the sponsoring company responsible for the commitments derived from the plan.

In defined contribution plans, the demographic and unemployment risks that could lead to insufficient funds to supplement the state pension with reasonable replacement rates are retained by the workers.

### Inflation risk

The new state pension is single tier and updated at least once a year in line with inflation, which means that the inflation risk is assumed by the government.

In the case of defined benefit plans, it depends on the formula used to calculate them. If they are referenced to the worker's last salary, the risk is assumed by the sponsoring company; however, if they are fixed amounts, it will depend on the existence of clauses to review the amounts in line with prices.

With regard to defined contribution plans, the inflation risk is retained by the workers, who will obtain the relevant coverage through the return on their investments.

## Post-retirement period (depletion phase)

### Financial risks

Once again, since the state pensions follow a pay-as-you-go system, the financial risks in the post-retirement phase are assumed by the public sector.

The investment assets associated with the funds accumulated through the contributions made to second-pillar supplementary defined contribution systems are owned by the pensioner, who therefore assumes the investment risk. This risk may be transferred to an insurer by acquiring a life annuity in exchange for a premium, in which case the pensioner assumes the counter party risk with the insurance company.

There are certain contracts which offer an additional guarantee through mechanisms known as ring-fenced funds, whereby the investments through which the insurance premium is instrumented are linked to the commitments undertaken with the insured, who has priority over other creditors if the company goes bankrupt.

In the defined benefit plans that are still operating with a deficit, the bankruptcy of the sponsoring company could compromise pensioners' benefits.

### Demographic and unemployment risks

Due to the pay-as-you-go nature of the coverage offered through the state pension system, the demographic and unemployment risks are assumed by the public sector in both the pre- and post-retirement phases, which could lead to financial sustainability problems if these risks were to materialize. However, this possibility is mitigated by the fact that the new state pension is only a single tier or basic amount that is supplemented with other sources, which means that the aggregate risk is spread between the different participants in the system.

In the case of coverages committed through defined benefit plans, both the idiosyncratic and aggregate or systematic demographic risks are retained by the sponsoring company responsible for the commitments derived from the plan. The idiosyncratic risk is greater the smaller the group covered. In any case, these risks and the financial risks can be transferred to an insurance company.

In the case of defined contribution plans, the demographic risk is assumed by the pensioner. In cases where participants opt to convert their accumulated funds into a life annuity by paying a premium, both the idiosyncratic and aggregate or systemic demographic risks are assumed by the insurance company.

**Inflation risk**

As indicated above, every April the state pension amount is revised in accordance with the inflation rate, the average salary increase or 2.5 percent, whichever value is the highest. Consequently, pensioners do not assume of the risk of the loss of purchasing power derived from inflation, and may even experience increases in real terms thanks to the guaranteed minimum increase of 2.5 percent. The inflation risk is therefore retained by the public sector. However, as has already been pointed out, this mechanism for updating pensions is not expressly indicated in the new legislation and, as a result, there is no guarantee that it will continue to be applied in the future.

With regard to payments derived from life annuities for people who have decided to convert the funds from their defined contribution plans into this type of income, the risk will depend on the terms and conditions agreed regarding the growth of the income and changes in the inflation rate.

## 3.5 Sweden

### 3.5.1 Regulation of the current pension system

The Swedish pension system currently in force was designed during the 1990s. Approved by parliament in 1994, the reform was not implemented until 1999 and the first retirement benefits were only paid in November 2001.[31]

State pensions are supplemented with industry-wide collective workplace pensions, which are mandatory or quasi-mandatory and widespread among the population. In certain cases there are private individual plans as well.

### 3.5.2 Description of the system coverage levels

#### Pillar 0

The basic level of protection is covered through a guaranteed minimum pension for people without an income or who have accumulated a very small income during their working life and whose contributory pension is topped up to reach the minimum pension amount.[32]

Entitlement to the guaranteed minimum pension is subject to 40 years' residence in Sweden and reaching the retirement age of 65. If the residence period is less than 40 years, the benefit is reduced proportionately.

#### Pillar 1

The coverage at this level of state protection in Sweden is the result of the combination of a system of notional accounts (pay-as-you-go) and a system of capitalization accounts.

The greatest weight in this pillar falls on the system of notional accounts, whose purpose is to record what individual workers have contributed throughout their working life to calculate the retirement pension on the basis of those contributions. However, since it is a pay-as-you-go system, the funds from the contributions noted in the notional accounts are not accumulated but are used to pay the pensions in progress of the people who have already retired.

Meanwhile, the funds accumulated in the capitalization accounts can be converted in to a pure life annuity or a variable annuity in which the pensioner assumes the investment risk. During the accumulation phase the funds are managed through private pension plans and workers may choose the assets in which their individual account is invested. These funds can also be paid into a collective fund managed by the government, in which case the investment decisions are made by the public managers.

Every year the Swedish Pension Agency[33] sends individuals a statement of their notional and individual capitalization accounts in what is known as the "orange envelope".[34] The agency also acts as a clearing house for the transactions with the funds in the capitalization accounts and supplies information on a daily basis about the participating funds.[35] It also has the monopoly on the provision of life annuities.

The agency is financed by an annual rate on the capital accumulated in the individual accounts. Set at 0.30 percent in 2012, the rate has gradually decreased since then as the volume of managed funds has grown. It is estimated to fall to around 0.08 percent in 2017 and to 0.04 percent in 2020.[36]

**Contributions**

The total amount of the contribution at this level of coverage is 18.5 percent, of which 16 percent is paid into the notional account system and the remaining 2.5 percent into the individual capitalization accounts.[37]

There is a ceiling on the benefits, also applicable to the company contribution base, of 115 percent of the average salary. However, there is additional tax on incomes above the ceiling, payable until the age of 65, at the same percentage as the pension contribution. A floor of 5 percent of the average salary is also applied, and contributions are therefore only paid if the income exceeds this minimum level.

**Retirement age**

The retirement pension can be claimed upon reaching the age of 61 and there is no maximum age limit for retiring. The state pension corresponding to the notional accounts and the benefit from the individual capitalization accounts can be claimed separately.

The information sent out each year by the Swedish Pension Agency (orange envelope) indicates the impact on the monthly pension of delaying the age of retirement. Four different ages are shown (between 61 and 67) to highlight the high cost, in income terms, of retiring at an earlier age.

**Relevant factors in calculating the benefits from the notional accounts (related to working life)**

This first component of the state pension is derived from the annual mandatory contributions of 16 percent of the contribution base and it is calculated according to the notional individual capital that each worker or professional has accumulated upon retirement.

The balance in the notional account is used as the basis for calculating the life annuity. It is therefore an individual calculation, based entirely on the contributions made throughout the working life, as recorded in the notional account. The amounts recorded in the individual notional accounts are adjusted each year in line with an income index, which takes into account the average growth in salaries over the last three years and the increase in

prices over the last year, adjusted to the latest forecast. However, it is important to note that there is a mechanism that automatically disconnects the indexation to the average salary growth when the stability of the system is compromised.[38]

The pension amount is calculated by dividing the amount accumulated in the notional account by a divisor that basically depends on life expectancy upon retirement. Life expectancy is obtained from the unisex mortality tables of the previous five years. This means that improvements in life expectancy automatically translate into a lower pension as people retire. The divisor also contains an implicit discount rate of 1.6 percent, although the income amount may vary each year in relation to the initial calculation if the real growth of the economy is lower or higher than this percentage.

**Relevant factors in calculating the benefits from the individual capitalization accounts**

The second component of the state pension is derived from the annual mandatory contributions of 2.5 percent paid into the individual capitalization accounts. These contributions are collected on a monthly basis by the Swedish National Tax Authority.

Individuals have a wide range of investment options to choose from for these funds during the accumulation phase, but if they do not indicate a specific choice the money is paid into a fund managed by the government (AP7) and the investment decisions are made by the public managers.

The investment fund managers charge a management commission but the Swedish Pension Agency must ensure that it remains below the normal commissions charged for such purposes (it currently ranges between 0.25 percent and 0.7 percent, depending on the funds; in the case of the AP7 managed by the government it is around 0.12 percent).

Individuals choose investment funds through the agency, which must ensure the confidentiality of their choice so that the manager does not know their identity.

Upon retirement, individuals have two options regarding the withdrawal of their funds. The accumulated pension account can be converted into a life annuity to avoid the investment risk, which in that case is assumed by the Swedish Pension Agency, or alternatively it can be converted into a variable annuity, which means that the funds continue to be invested by the chosen asset manager and the pensioner retains the investment risk.

The life annuity benefit is calculated in a similar way to the benefit from the notional accounts, i.e. by dividing the value of the account by a divisor based on life expectancy and a technical discount rate. However, in this case life expectancy is based on estimates and may include a correction for expected improvements in the future.

**Mechanism for updating pensions**

The pension amount is revised each year to take into account changes in the economic situation and may be reduced or increased throughout the pensioner's life.

The economic indexation mechanism allows for an annual pension adjustment based on the difference between the growth factor applied to calculate the initial pension (1.6 percent) and the real growth of the economy that year (measured against the income index, which considers the average growth of salaries over the last three years and the increase in prices over the last year).

However, as indicated earlier,there is a mechanism that automatically disconnects the indexation to the average salary growth when the stability of the system is threatened.

**Future improvements in life expectancy**

There is also a balance mechanism to adjust pensions to demographic changes. This adjustment affects both the notional accounts of workers and the pensions in progress. It is applied when the estimated value of the assets in the form of contribution revenues falls below the liabilities or notional value accrued in the form of capital by the pensions in progress. In this case, the indexation of both

the pensions and the revenues credited to the notional accounts is reduced according to the ratio of assets to liabilities.[39]

### Pillar 2

Company pension plans (in the second pillar) are a long tradition in Sweden, historically for skilled workers and public sector employees but nowadays among all kinds of workers. It is estimated that plans of this type cover around 90 percent of all employees and are mandatory or quasi-mandatory. The annual contributions agreed between companies and their workers usually range between 2 percent and 4.5 percent.

There are four main categories of collective company pension plans, which have evolved from defined benefit systems to defined contribution or mixed systems. This transition from one system to another began in the 1990s following the reform of the state pension system and it took 15 years to complete.

The four main categories of collective pension plans are as follows:

- Plans for unskilled workers (SAF-LO)
- Plans for skilled workers (ITP1, the supplementary ITPK, and ITP2)
- Plans for public sector employees of the government (PA 03)
- Plans for public sector employees of local bodies (KAP-KL)

An analysis of the main features of these collective pension plans reveals the following:

- Previous versions are still being applied to older workers in the defined benefit category.
- While workers have freedom of choice regarding the investment of the accumulated funds, there are also certain restrictions. For example, in the case of the ITP1 at least 50 percent of the contributions must be invested in traditional mutual funds with guaranteed interest rates. Meanwhile, the PA 03 plan requires at least half of the funds to be invested in traditional insurance.
- The ITP1 plan for skilled workers is applied in full to workers born in or after 1979. Although it is a defined contribution plan, it contains a defined benefit component for workers with high salaries, classed as seven and a half times the basic income. The contribution is 4.5 percent of the gross salary but if this exceeds seven and half times the basic income the contribution is 30 percent of the excess, aimed at financing the defined benefit component.
- The pension plans for public sector employees still contain a defined benefit component for those workers with salaries above the contribution ceiling in the state pension system.

### Pillar 3

Coverage through this voluntary pillar may be provided through contributions to private pension plans or another type of financial instrument. There are no associated tax breaks, although this may vary depending on the legislation in force at any given time.

## 3.5.3 Analysis and opinion of previous reforms to the system

The previous state pension system in Sweden (known as the ATP) was conceived in the 1950s, based on a pay-as-you-go system. This system combined a minimum universal pension with an additional pension based on the contributions made during the individual's working life. Under this system, people reaching the age of 65 with 30 years of contributions were entitled to claim the maximum pension, which was calculated according to the average of the 15 years with the highest contribution bases. It was therefore possible to start working at the age

of 35 and obtain the full retirement pension on reaching 65.

Prior to this, there was a pay-as-you-go system with a single basic pension indexed to inflation which provided very modest replacement rates. This led to skilled workers and public sector employees forcing the negotiation of workplace pension plans, which gave rise to a system with enormous differences in retirement incomes. The vociferous social debate that ensued led to a referendum on the reform of the pension system, which culminated in the ATP system. Introduced in the 1950s, this remained in force until problems of sustainability prompted a new reform and the current system was introduced.

The new system of notional accounts combined with individual capitalization accounts is applied to all people born in 1954 or after. It is being phased in for those born between 1938 and 1953: those born in 1938 receive 20 percent of the pension calculated with the new system and 80 percent with the former system, with the proportion received through the new system increasing by 5 percent for each additional year (those born in 1939 receive 25 percent, and so on).

### 3.5.4 Risk analysis

## Pre-retirement period (accumulation phase)

#### Financial risks

As indicated above, the coverage at the level of state protection is the result of the combination of a pay-as-you-go system, through notional accounts, and a capitalization system. With regard to the notional account balances, there is no financial risk for workers during the accumulation phase since the balances are not dependant on investments exposed to market or credit risks. In any case, the potential risk of any investment made with the remaining funds would be retained by the government.

By contrast, the investments made with the funds from the capitalization accounts are owned by the worker, who therefore assumes the financial risk of the assets. These funds are managed through private pension plans and workers may choose the assets in which their individual account is invested. The funds can also be paid into a fund managed by the government (AP7 fund), in which case the investment decisions are made by the public managers who spread the investments between a fixed income fund and equity instruments, with different weights according to the worker's age. According to the information provided by the Swedish Pension Agency, for workers under the age of 56 the entire funds are invested in equity and as the worker grows older an increasing percentage is invested in the fixed income fund. By the time a person reaches 70, half of the investments would be in the fixed income fund and the other half in equity instruments.[40] These investment decisions are designed to minimize the market risk for the worker as retirement grows closer.

The funds accumulated through the contributions made to supplementary defined contribution pension systems are also owned by the worker, who again assumes the financial risk of the assets in which they are invested. To mitigate this risk, while workers have freedom of choice regarding the investment of the funds, there may be certain restrictions depending on the specifications of the plan. For example, in the case of the ITP1 at least 50 percent of the contributions must be invested in traditional mutual funds with guaranteed interest rates. Meanwhile, the PA 03 plan requires at least half of the funds to be invested in traditional insurance.

Lastly, in the case of mixed plans, which still exist for skilled workers with higher incomes, the financial risk of the defined benefit component is assumed by the sponsoring companies.

#### Demographic and unemployment risks

For the coverages offered through state pension system based on notional accounts, the demographic and unemployment risks in the pre-retirement phase would in principle be assumed by the public sector due to the pay-as-you-go nature of the system. However, as indicated above, certain mechanisms have been introduced to at least partly transfer these risks to workers through adjustments to the notional account balances and the calculation of the new pensions.

In the coverages committed through defined benefit plans, the demographic risks in the accumulation phase are assumed by the sponsoring company responsible for the commitments derived from the plan. These risks and the financial risks can also be transferred to an insurance company.

In the case of the state pension system based on capitalization accounts, and of workplace and individual defined contribution plans, the demographic and unemployment risks are retained by the workers. This could lead to insufficient funds to supplement the state pension with reasonable replacement rates.

### Inflation risk

The amounts recorded in workers' notional accounts are adjusted every in line with the income index, which considers the average growth of salaries over the last three years and the increase in prices over the last year, with an adjustment according to the latest forecast. The risk of loss of purchasing power in this phase is therefore retained by the government. However, as indicated earlier, there is a mechanism that automatically disconnects the indexation to the average salary growth when the stability of the system is compromised by the adjustment, so the government does not assume the full risk and it may return to workers.

In the case of defined benefit plans, it depends on the formula used to calculate them. If they are referenced to the worker's last salary, the risk is assumed by the sponsoring company, and if they are fixed amounts, it will depend on the existence of clauses to revise the amounts in line with prices.

In the state pension system based on capitalization accounts, and in workplace and individual defined contribution plans, the inflation risk is retained by the worker, who will obtain the relevant coverage through the return on their investments.

## Post-retirement period (depletion phase)

### Financial risks

In the depletion phase of the part of the state pension derived from the notional accounts, since this is a pay-as-you-go system the financial risks are assumed by the government.

Meanwhile, the funds accumulated in the capitalization accounts can be converted into a pure life annuity or a variable annuity. In the first case, the risks would be retained by the government as the manager of the life annuity, but in the second case the pensioner assumes the investment risk. Accordingly, it is up to the pensioner whether to retain the financial risks or transfer them to the Swedish Pension Agency, the government agency that has the monopoly on the provision of life annuities.

The financial risk of the investment assets associated with the funds accumulated through the contributions made to supplementary defined contribution pension plans are also owned by the pensioner, who therefore assumes the investment risk. However, they can transfer this risk by acquiring a life annuity from the Swedish Pension Agency, in which case they would only assume the counterparty risk (sovereign risk). Additionally,workers are increasingly opting to convert the accumulated funds into temporary annuities. In these cases, the financial risk—but not the biometric risk—is transferred to an insurance company. This phenomenon appears to be more prevalent in the plans for unskilled workers and public sector employees of local bodies.[41]

### Demographic and unemployment risks

For the coverages offered through the state pension system based on notional accounts, the demographic and unemployment risks in the post-retirement phase are assumed in

principle by the public sector. However, mechanisms have been introduced which, in certain circumstances, transfer these risks to pensioners, who could see their replacement rate reduced according to demographic changes and the real growth of the economy.

Meanwhile, in the coverages committed through the defined benefit plans, both the idiosyncratic and aggregate or systematic demographic risks are assumed by the sponsoring company responsible for the commitments derived from the plan (the idiosyncratic risk is greater the smaller the group covered). In any case, these risks and the financial risks can be transferred to an insurance company.

With regard to the defined contribution plans, the demographic risk is assumed by the pensioner. In cases where pensioners opt to convert their accumulated funds into a life annuity by paying a premium, both the idiosyncratic and aggregate or systemic demographic risks are transferred to the insurance company. In cases where they opt to convert the accumulated funds into temporary annuities, the biometric risk is retained by the pensioners, who could see their replacement rate fall drastically when the temporary annuity expires, if they are still alive at that time.

**Inflation risk**

Lastly, coverage of the inflation risk is provided through the income index mechanism, whereby pensions are adjusted annually based on the difference between the growth factor applied to calculate the initial pension (1.6 percent) and the result of the index, which considers the average growth of salaries over the last three years and the increase in prices over the last year, with an adjustment based on the latest forecast. If the result is less than 1.6 percent, the adjustment will be negative, whereas increases above 1.6 percent will give rise to a positive adjustment.

In the case of the funds from workplace or individual defined contribution pension plans that have been converted into life annuities, the inflation risk is retained by the pensioner and the impact will depend on the growth terms and conditions agreed when the annuity was taken out and with annual changes in prices.

## 3.6 Netherlands

### 3.6.1 Regulation of the current pension system

In the Netherlands the state pension system is enshrined in the Old Age Pensions Act ("Algemene Ouderdomswet", AOW) of May 31, 1956.

With regard to supplementary systems, the pension system is conceived in such a way that private workplace plans constitute an essential pillar for supplementing the state pension. The Pensions Act of December 7, 2006 ("Pensioenwet", PW) introduced key protection and transparency legislation for the beneficiaries of private pension plans by strengthening the institutional system for monitoring the compliance of pension agreements between companies and their workers, the financial oversight of fund management, and the transparency rules regarding the information that workers and pensioners must receive about the state of their rights. This control is exercised by the Ministry of Employment and Social Affairs, the Dutch Central Bank (DNB), and the Dutch Authority for the Financial Markets (AFM).

### 3.6.2 Description of the system coverage levels

#### Pillar 0

The coverage at this basic level of protection is provided through income support (AIO supplement) which the municipal authorities can grant to people aged 65 or over, residents in the Netherlands, who have very little or no other income apart from the state pension and are therefore below the minimum income level. In these cases, a top-up is paid to reach the applicable social minimum.

## Pillar 1

With regard to the first pillar of the system, the contributory state pension (AOW pension)[42] consists of a life annuity based on a pay-as-you-go system in which the payment of the pensions in progress is financed through the contributions of the active workforce. The tax authorities collect the contributions, which are managed by the Sociale Verzekeringsbank (SVB).[43]

### Contributions

The contribution for pensions in the first pillar is 17.9 percent of the salary and is collected through income tax. The company withholds the amount from the worker's salary and pays it to the treasury. There is also a ceiling for the base on which the contribution percentage is applied, which in 2017 was set at 33,791 euros per year.

### Retirement age

An increase in the retirement age is currently being phased in and will reach 67 by 2021. The applicable retirement age therefore varies according to the year of birth, standing at 65 years and nine months for people who retired in 2017, 66 years for those born between April and December 1952, and increasing by an additional four months per age group to reach 67 years for people born between May and December 1954 (who will reach the age of retirement in 2021).

There are incentives to carry on working beyond the retirement age, and it is possible to claim the state pension (AOW) and undertake paid employment, in which case contributions are no longer mandatory. In any case, the maximum limit for claiming the state pension is 70. Anyone who is still working at that age may not continue contributing with a view to increasing the pension amount.

In cases where the working life is extended, the regime applicable to the rights derived from workplace pension plans depends on the terms and conditions. These usually include a certain amount of flexibility and even incentives in this respect (usually prior agreement with the employer), although circumstances vary.

### Factors related to working life: years of reference, relevant contributions and pension calculation

The right to the state pension accumulates at a rate of 2 percent for each year of contributions.

Entitlement to the full amount requires 50 years of contributions without interruption. The benefit is reduced proportionately to the period of contribution for people who have not completed 50 years.

This rate is applied to an amount which varies according to the pensioner's family status. For single people, the amount is 70 percent of the minimum salary in force at the time, whereas married couples or couples living together each receive 50 percent of the minimum salary.

In July 2017 the amount for a single person living alone and entitled to the maximum pension was 882.46 euros per month plus an additional similar payment in May (holiday pay). This monthly amount may be raised to 1,098.96 euros through tax credits depending on the person's situation, basically their total income. In the case of couples where both receive a pension, the amounts are 608.47 euros (without tax relief) and 757.80 euros (with tax relief). There is a transitional regime for people who retired before January 1, 2015 whereby an additional supplement is paid if they live with a partner or spouse under the age of 65 who has no income. These amounts are updated and published every six months.[44]

### Mechanism for updating pensions

The minimum legal salary used to calculate first-pillar pensions is updated every six months in line with the salary index.

### Future improvements in life expectancy

As indicated above, measures have been taken to phase in a new retirement age of 67 years by 2021 and there are plans to raise it to 70 years once this first phase has been completed. Although it has not yet been officially confirmed, there are also plans to link the retirement age to life expectancy from the year 2024.

## Pillar 2

The coverage at this level of private protection is articulated through workplace and professional collective pension plans, which are very widespread in the Netherlands. Approximately 95 percent of workers and public sector employees are affiliated to a supplementary pension plan. In these types of plans, the company contribution is around 16 percent of the worker's income.

It is important to note that the contributions to supplementary pension systems have to be externalized from the company's balance sheet, either through a pension fund or an insurance company. As a result, the Dutch reserve of accumulated funds to address these pension commitments is one of the largest in the world.

These plans usually form part of the collective bargaining undertaken between workers' unions and business associations. Workers' representatives can decide which level of coverage they prefer, either specific to the company or part of an industry-wide plan. By law, pension rights derived from such agreements start accruing no later than the date at which the employee reaches the age of 21.

There are specific regulations related to the consequences on the agreements reached through collective bargaining. For example, law "Wet Bpf 2000" on the mandatory participation in industry-wide funds stipulates that when a union reaches a pension agreement in a specific industry for its members and the representatives of the business organizations so request, the Ministry of Employment and Social Affairs may declare the agreement mandatory for all other employees in the industry in question (provided that the business organizations formulating the request employees at least 60 percent of the workers in the industry). This has happened, for example, in the metal, graphics and media industries.[45] This means that employees can change companies within the same industry without any consequences for their pension rights.

Other regulations contain rules for specific professions and for the equalization of pension rights generated during the period of marriage in cases of divorce.

### Defined benefit pension plans

Unlike other pension systems around the world, defined benefit plans are the most common type of supplementary system in the Netherlands. In these plans, the benefit in the form a life annuity is calculated on the basis of the average salary during a specific period immediately prior to retirement or on the basis of the last salary of the working life, depending on the applicable plan.

### Defined contribution pension plans

The company, the worker and indirectly the government, through tax credits, contribute to the defined contribution plans. Although these plans have been gaining ground in recent years, they still represent a small percentage of the total funds used for supplementary pensions.

### Hybrid pension plans

The Dutch system contains specific plans knowns as CDCs (Collective Defined Contribution schemes) which combine a promise of a defined benefit with a fixed amount payable by the employer. The fact that the amount payable by the employer is fixed means that if there are significant deviations in the assumptions used to calculate it, the final amount of the benefit is not guaranteed. For rating purposes, defined benefit plans are only considered as such if they provide an additional cushion to cover these deviations to a reasonable extent.

## Pillar 3

Lastly, coverage through the third voluntary pillar may be provided through contributions to private pension plans or other types of financial instruments. In the Dutch case, tax breaks have an enormous impact on the pension system. Contributions are usually deductible at the time they are made. They are taxed when the benefits derived from them are received during retirement, and lower marginal rates are applied. However, the application of these tax breaks to voluntary private pension plans is not always possible, depending on the tax regime in force at any

given time. They are not currently deductible in the Netherlands, although there may be transitional regimes still in existence.

### 3.6.3 Analysis and opinion of previous reforms to the system

The law that regulates the current Dutch pension system was enacted in 1956, so earlier versions of legislation date back a long way, specifically to 1919. The previous pension system was characterized by benefits closely aligned with contributions and there was no indexation to protect pensioners from the risk of the loss of purchasing power. In fact, it was the materialization of this risk that highlighted the need for reform.[46]

The development of the state pension system commenced in the 1950s and culminated in the current old age pension act, the "Algemene Ouderdomswet" (AOW) of May 31, 1956, which entered into force on January 1, 1957. This reform implemented the concept of a universal retirement pension for residents of the country, with first-pillar state pensions acquiring a marked redistributive nature and benefits linked to changes in salaries.

The system was conceived in such a way that second-pillar business pension plans play a key role in supplementing the state pension. Since then, the volume of funds derived from pension agreements between companies and their workers has increased steadily to reach current levels in excess of one billion euros.

The most significant reforms related to the old age insurance act (AOW) have taken place recently (in 2012 and 2015) and consisted in gradually raising the retirement age and taking measures to encourage people to extend their working life beyond the ordinary retirement age, respectively. The aim of both reforms was to relieve the pressure on public spending from increased life expectancy and population aging.

### 3.6.4 Risk analysis

#### Pre-retirement period (accumulation phase)

**Financial risks**

As indicated above, state pensions (AOW) are managed through a pay-as-you-go system, which means that the contributor does not assume any financial risks during this phase since they are retained by the state.

With regard to supplementary pension systems, in defined benefit plans and mixed plans the financial risk of the defined benefit component is assumed by the sponsoring companies. Meanwhile, the funds accumulated through contributions made to supplementary defined contribution pension systems are owned by the worker, who therefore assumes the financial risk of the assets in which they are invested.

To mitigate the potential effects of the materialization of this financial risk, the Pensions Act of December 7, 2006 ("Pensioenwet", PW) introduced transparency and control rules for pension plans. The Dutch Authority for Financial Markets (AFM) plays a key role in supervising the information on investments and their risk profile which, by law, has to be provided to pension plan beneficiaries.

**Demographic and unemployment risks**

For coverages offered through the state pension system, the demographic and unemployment risks are assumed by the public sector due to the pay-as-you-go nature of the system.

In the coverages committed through defined benefit plans, the demographic risks during the accumulation phase are retained by the sponsoring company responsible for the commitments derived from the plan. However, these risks and the financial risks can be transferred to an insurance company.

Nevertheless, estimations of the obligations derived from defined benefit plans are based on other risk factors apart from demographic and financial risks, such as the estimated future salaries of the active workforce and projections about changes in the state pension, all of which need to be taken into account when calculating the benefit. The risk derived from deviations in the assumptions used to calculate the future amount of benefits is in any case retained by the sponsoring company responsible for the commitments derived from the plan. By contrast, in CDC pension plans (Collective Defined Contribution schemes), which combine the promise of a defined benefit with a fixed amount payable by the employer, the risk of deviations in the assumptions is transferred to the workers.

Lastly, in the case of defined contribution plans, the demographic and unemployment risks (which may lead to insufficient funds to supplement the state pension with reasonable replacement rates) are retained by the workers.

**Inflation risk**

The AOW retirement pension is updated every six months in line with changes in salaries and the risk of the loss of purchasing power by the state pension is assumed by the government in both the pre- and post-retirement phases.

In the case of second-pillar defined benefit plans, the party that assumes that risk depends on the formula used to calculate them. If they are referenced to the worker's last salary, the risk is assumed by the sponsoring company ("final pay schemes"). If a longer period of earnings is considered, it depends on the mechanism used to update them for calculation purposes ("career-average schemes"). In the case of fixed amounts (unusual in the Dutch system), it will depend on the existence of clauses to review the amounts in line with prices. As a result, the circumstances vary and there is no specific guarantee of an update since it depends on the terms and conditions agreed in the plan.

Lastly, in the case of defined contribution plans the risk is assumed by the workers, who must obtain the corresponding coverage throughthe return on their investments.

## Post-retirement period (depletion phase)

**Financial risks**

With regard to the first pillar, the AOW state pensions follow a pay-as-you-go system, which means that the financial risks associated with the depletion phase (payment of pensions) are assumed by the government.

Second-pillar workplace defined benefit plans guarantee a life annuity to their beneficiaries, which means that the financial risks are assumed by the sponsoring company, which in any case may externalize them to an insurance company.

Meanwhile, the funds accumulated in workplace and private defined contribution plans can be converted into life annuities or other types of benefits, in the form of an income or capital. If they are converted into life annuities, the financial risk is transferred to an insurance company.

**Demographic and unemployment risks**

Due to the pay-as-you-go nature of the coverage offered through the state pension system, the demographic and unemployment risks are assumed by the public sector in both the pre- and post-retirement phases, which in certain scenarios could lead to financial sustainability problems if these risks were to materialize.

However, it is important to note that the AOW pension amount covers a small percentage of the replacement rate for pensioners, so the impact that these risks could have on the financial sustainability of the system is more limited than in other systems based on a strong first pillar and a residual second pillar. Even so, there is still a certain level of risk in the Dutch case and measures are currently being taken to gradually delay the retirement age and encourage people to extend their working life beyond the retirement age.

In the coverages committed through the defined benefit plans, both the idiosyncratic and aggregate or systematic demographic risks are assumed by the sponsoring company, which is the entity responsible for the commitments derived from the plan; the

idiosyncratic risk is greater the smaller the group covered. In any case, these risks and the financial risks can be transferred to an insurance company.

With regard to the defined contribution plans, the demographic risk is assumed by the pensioner. In cases where participants opt to convert their accumulated funds into a life annuity by paying a premium, both the idiosyncratic and aggregate or systemic demographic risks are assumed by the insurance company.

**Inflation risk**

Lastly as regards the inflation risk, the AOW retirement pension (first pillar) is updated every six months in line with changes in salaries and the risk of the loss of purchasing power by the state pension is therefore assumed by the government.

In the case of workplace defined benefit plans, it depends on the terms and conditions agreed in the plan. And with regard to defined contribution plans the risk is assumed by the workers, who must obtain the corresponding coverage through the return on their investments. Lastly, if the accumulated funds have been converted into life annuities, it will depend on the terms and conditions agreed regarding the growth of the income and changes in the inflation rate.

# 4. Synthesis and Conclusions

## 4.1 General aspects

As discussed in this study, since the second half of the 20th century societies different parts of the world have been witnessing, with varying degrees of intensity, an increasingly convergent global demographic pattern: an increase in life expectancy, accompanied by declines in the fertility and mortality rates. These demographic dynamics have significantly altered the population pyramids, which have evolved from expansive pyramids (at the beginning of the 20th century) to the constrictive variety (since the end of that century), and based on current population projections are likely to converge toward stationary pyramids in the second half of the 21st century.

Accordingly, the increase in longevity, in line with the parameters predicted by both traditional demographic approaches and more disruptive ones (which anticipate significant increases in longevity in the near future), will have profound implications for societies across the planet. However, while there is great uncertainty about the specific impacts that the increase in longevity may have during the present century, there is no doubt that greater life expectancy will affect all areas of the society. From the economic point of view, it will affect the structure of the labor market and salary growth, especially in light of its convergence with the technological revolution associated with the digital age and productive processes. And from the social point of view, it will substantially alter the patterns of organization and coexistence.

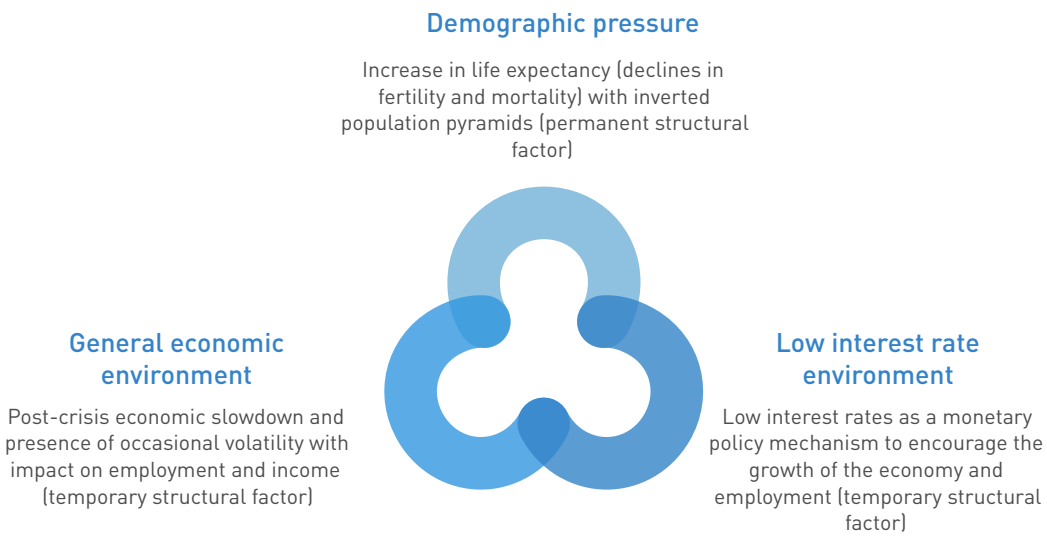
In spite of this level of uncertainty regarding the scientific capacity to extend human life, one of the areas that has recognized the need to anticipate the effects of greater longevity has to do with pension systems, which are a cornerstone of welfare levels in modern societies. Longevity, coupled with the potential materialization of other risks, will undoubtedly affect pension spending, which means that pension schemes will need to be adjusted constantly to ensure that they remain financially sustainable in the long term.

In addition to demographic pressures associated with population phenomena (a permanent structural factor), there are other elements that reinforce the urgency of addressing the long-term sustainability of pension systems (see Chart 4.1). The slowdown in economic activity caused by the economic and financial crisis of 2008-2009 (a temporary structural factor), coupled with the presence of occasional volatility, has had a major impact on employment and income levels in many societies. Meanwhile, the low interest rate environment (a temporary structural factor) that has been characterizing most of the world's main economies for several years has proved to be a useful monetary policy for stimulating the growth of economic activity and employment but it has also had unintended consequences for the rhythm of the accumulation of savings and funds used to pay pensions. The result of this combination of factors has been a tendency to undermine the technical and financial foundations of pension systems, which in many cases and in line with current parameters may seriously compromise their medium and long-term sustainability.

For the purposes of this study, the pension systems selected (benchmark models) are characterized by the fact that they cover the full spectrum of systems that currently exist, at least as regards the most important features, and therefore provide a broad picture from which to draw general conclusions. These benchmark models included are as follows:

- A system with a strong weight of first-pillar state retirement pensions based on a pay-as-you-go system in which the

Chart 4.1
Key factors affecting the medium and long-term financial sustainability of pension systems




Source: MAPFRE Economic Research

contributions are used to pay the pensions in progress and in which there is no clear link between the contribution levels and the benefits received, as in the case of the Spanish system.

- A system that emerged from one of the first comprehensive reforms of the late 20th century, whose first pillar is based almost entirely on individual capitalization accounts, as in the case of the Chilean system, which has also been replicated in a large number of countries.

- A system with a first pillar that basically consists of a pay-as-you-go system with a mechanism (notional accounts) that adapts the benefits received to the contributions made during the person's working life and that cedes greater weight to capitalization funds to supplement the state pension, as in the Swedish model, and in which the second pillar of supplementary pensions now plays a significant role.

- And a group of systems in which the second pillar of pension commitments assumed by companies with their workers plays a crucial role, as in the cases of the United States, the United Kingdom and the Netherlands.

## 4.2 Adjustment mechanisms and measures in pension system reforms

A general analysis of the reforms implemented in the benchmark models included in this study reveals that the effect of the aforementioned demographic, economic and financial factors on the medium and long-term sustainability of pension systems can be absorbed or corrected through a set of mechanisms and measures. The study identifies eight main mechanisms for analyzing and implementing public policies to address the pension issue: (i) the maintenance of a basic system of social protection; (ii) the increase in the retirement age; (iii) the adjustment of contribution rates; (iv) the adjustment of budgetary transfers for pension payments; (v) the adjustment of replacement rates; (vi) the generation of incentives to encourage companies to create and manage supplementary pension plans; (vii) the introduction of fiscal incentives for medium and long-term voluntary individual savings, again designed to supplement pensions; and (viii)

greater transparency to workers regarding the pension they are likely to receive (see Chart 4.2).

**Maintenance and reinforcement of a basic system of social protection**

As countries have progressed, their societies and governments have assumed the responsibility for the existence of a minimum level of social protection for people, irrespective of their contributory capacity, when they reach an age where they are no longer able to depend entirely on work to cover their basic needs.

A constant feature in all of the benchmark models analyzed is the maintenance (and, in some cases, reinforcement) of basic non-contributory systems of social protection (pillar zero in our conceptual framework). Although these pension supports are not based on contributions, in line with the conceptual framework used in this study, they are considered to be an integral part of any pension system insofar as they grant a flow of income during retirement to vulnerable groups of the population through solidarity mechanisms.

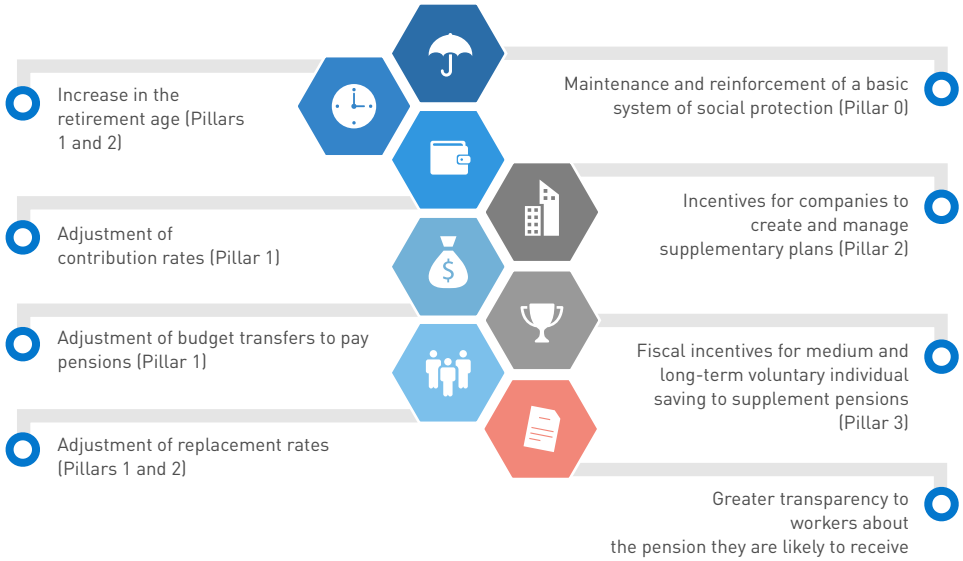
Besides, when this basic pillar of social protection is extended beyond the vulnerable population to provide a minimum level of income for those who receive a pension based on contributory criteria, it is a way of partly mitigating the effect of the materialization of risks (demographic, economic and financial) on pension levels.

**Increase in the retirement age**

A tool that has proved to be particularly effective in offsetting the effect of the risks on the sustainability of pension systems is the increase in the retirement age, to which pension amounts and replacement rates are highly sensitive (see Boxes 1.3-a and 1.3-b). Deferring the retirement age has a dual positive effect from the financial point of view in that it extends the period of contributions and reduces the time during which benefits are received. In practically all of the benchmark models analyzed, this is an essential instrument in the reform or adjustment of the pension systems.

Besides, from a broader perspective, the increase in the retirement age would appear to be consistent with the very phenomenon of longevity. Insofar as the scientific capacity to extend human life has been associated with

Chart 4.2
Main adjustment measures and mechanisms in pension system reforms




Source: MAPFRE Economic Research

extending humans' physical and intellectual abilities, it is reasonable to allow people to carry on working, and therefore contributing to society, for longer.

**Adjustment of contribution rates**

The adjustment of contribution rates is another measure used in some of the main pension system reforms analyzed, whether in pay-as-you-go plans (defined benefit) or individual account models (defined contribution). Clearly, one way to offset the negative impact of demographic, economic and financial risks is to increase the rates at which people contribute to the pension systems, specifically those in the first pillar.

Of the six benchmark models analyzed, four have aggregated contributions for the first two pillars above the average of OECD (Organization for Economic Cooperation and Development) countries, at around 18 percent. Chile has the lowest contributions, at 10 percent, but the system is currently being reformed with a view to raising this percentage.

However, it is important to note that while increasing contribution rates clearly has positive effects on the financing of pension systems, their implementation is limited by the growth of real salaries (when the contributions are made by workers), by the performance of the economy and productivity levels (when the contributions are supplemented by employers), and by the strength of the public purse (when the contributions are boosted by additional support from the government). Consequently, this is a tool which, if poorly implemented, could generate unintended negative effects on the economy in general and have a knock-on effect on the actual pension system.

It is also important to point out that several of the reforms analyzed have supplemented the adjustment measures by aligning contribution bases to real salaries, through higher contribution ceilings, and by extending the periods of contributions that are taken into account to calculate the pension amount.

**Adjustment of budget transfers for the payment of pensions**

First and foremost, the financing problems associated with defined benefit pension systems in the first pillar affect the public purse. As discussed throughout this study, in defined benefit pension systems nearly all of the risks are retained by the government and their materialization (in the form of demographic pressures, economic slowdown, loss of jobs) has repercussions for government budgets, which need to cover the deficits generated not only in the mandatory benefits paid out through the pension system but also in the contributions received.

However, budget transfers for this purpose cannot be unlimited or permanent, but rather a transitional measure implemented during the introduction of the adjustments to lend long-term financial stability to pension systems. This issue does not only affect pensions but also impacts the elements associated with maintaining healthy macroeconomic principles. In practically all of the benchmark models analyzed in this study, the measures and adjustments made are underpinned by this principle. In certain cases, these budget transfers are used in conjunction with the implementation of other measures (increase in the retirement age and/or the contribution rates), and in other cases this mechanism is used exclusively in the structural elements that lend sustainability to the pension systems.

**Adjustment of replacement rates**

Just as in first-pillar defined benefit pension systems (pay-as-you-go) the first problem derived from the materialization of the risks to which they are exposed is the need to use budgetary resources to cover the deficit of contributions with respect to the benefits paid out, in first-pillar defined contribution systems (individual accounts) the first problem is the fall in replacement rates (ratio between retirement income and the worker's last salary). The reduction in this indicator is a direct reflection (in the form of a loss of purchasing power upon retirement) of insufficient funds to finance pensions.

In the final instance, the replacement rate is a variable that can be adjusted through the different parameters that define the pension amount, such as length of working life taken into account and the retirement age. In general terms, the implementation of adjustment measures or reforms in the pension systems analyzed aim to maintain and ideally improve replacement rates by reinforcing the different pillars but preserving long-term sustainability.

**Incentives for companies to create and manage supplementary plans**

One of the key aspects observed in the benchmark models analyzed in this study is that in view of the complexities involved in implementing adjustment measures to correct financing problems in first-pillar plans (be they defined benefit or contribution), it is necessary to reinforce the role of the second (occupational plans) and third (voluntary plans) pillars.

In a general analysis, the benchmark models that have had the greatest success in offsetting the effect of the materialization of the demographic, economic and financial risks discussed are those that have managed, in the final instance, to improve the balance of the relative weight between the different pillars in financing pensions. In other words, those that have combined the benefits of intergenerational solidarity with incentives for individual saving (in Pillar 1), while simultaneously achieving a more effective spread of the risks to which the pension systems are exposed and diversifying their impact between all the participants (by strengthening Pillars 2 and 3).

As well as maintaining and rationalizing the plans in Pillar 1 (in both their defined benefit and contribution variants), a first element in this strategy has consisted in generating incentives for companies to create and manage (directly or indirectly through professional fund managers) supplementary contributory pension plans, and specifically defined contribution plans. These mechanisms encourage individuals to save through their workplace and they also raise awareness about the importance of medium and long-term saving by helping workers understand that they own the contributions that will finance their pensions.

**Fiscal incentives for medium and long-term voluntary individual saving to supplement pensions**

In the same line as the incentives described in the previous section, supplementing the funds used to finance pension systems with voluntary individual saving which workers can channel through professional managers is another method for improving the balance between pillars and achieving a better spread of the risks to which the pension systems are exposed. This mechanism also guarantees greater probabilities regarding long-term sustainability and stability.

Depending on the benchmark model, there are fiscal incentives on direct tax (income tax) aimed at stimulating medium and long-term saving when this forms part of company supplementary pensions, or (in Pillar 3 methods) when it is channeled through financial products designed to supplement the pensions received in Pillar 1 and Pillar 2 plans. These contributions are usually deductible at the time they are made—and taxed when the profit derived from them is received during retirement—and are subject to lower marginal rates, with certain limits on the annual deductible contributions, or in other cases through exemption on earnings.

**Greater transparency to workers regarding the pensions they are likely to receive**

Last but not least, workers (future pensioners) need to receive more information throughout their working life about the implications of the different risks that affect, or could affect, the system (specifically the plans in Pillar 1) and their pension.

This means increasing the transparency of the pension systems to raise awareness among the

active workforce about the pension they can expect to receive (especially from Pillar 1) and the supplementary saving mechanisms (Pillars 2 and 3) which they can access to improve the pension they will receive upon retirement. The key example in this respect is the "orange envelope" in Sweden through which workers receive information about the balance they have accumulated in their individual (notional) account and, as a result, the pension they will receive in the future.

## 4.3 Empirical evidence in the analysis of the benchmark models

While it is true that the first pension systems emerged at the end of the 19th century and proliferated in the first half of the 20th century, a first wave of adjustments took place in the 1990s. However, the origin of that reaction to the increase in the gap between retirement age and life expectancy (which is also a gap between benefits and contributions) has not disappeared. On the contrary, the gap has become ever wider due to greater expectations about the longevity of populations all over the world, combined with the effects of the materialization of economic and financial risks.

In general, and with varying degrees of depth and intensity, the benchmark models analyzed in this study have implemented reforms to address these problems and in certain cases have even carried out a second wave of reforms, not only to address the effect of the demographic and economic phenomena that make their pension systems financially vulnerable, but also to correct several unintended consequences of the first wave of reforms. Certain general conclusions can be drawn from the analysis of the benchmark models.

**Reinforce sustainability: the key objective**

The first conclusion from the analysis of the benchmark models is that as a result of the demographic pressure caused by the general increase in life expectancy, accompanied by a significant fall in fertility and mortality rates, all the reforms carried out in the recent past are designed to reinforce their sustainability.

This being their key objective, they all attempt to find formulas to maintain adequate coverage levels for the population, in terms of benefits and fairness, and avoid the introduction of disincentives to work and contribute to the system. As indicated above, this objective was not always achieved in the first wave of reforms and has therefore prompted the need for subsequent reforms as the pressure on the public purse has increased or replacement rates have proven to be manifestly insufficient.

**Speed of the materialization of risks and direction of the reforms**

The speed at which the risks (demographic, economic and financial) affecting pension systems have materialized in recent years has meant that the reforms have essentially been of a reactive nature. The changes in population dynamics have introduced similar patterns of behavior, with relatively generous parametric reforms in the periods in which the dependency ratios have improved, leading to a greater separation between the pension amount and the contributions paid during a person's working life. However, as the demographic pressure has increased, the reforms have changed direction by focusing on measures designed to align the benefits received with individual contributions, coupled with measures to reinforce the second and third pillars. The welfare pillar has also been reformed to avoid people with shorter working lives or people not entitled to a contributory pension falling into poverty.

**Application of supplementary instrumental measures**

In addition to the measures aimed at correcting the financial problems associated with contributory component of pensions, the reforms analyzed have also included more instrumental measures to reinforce that aim. These adjustments comprise reforms designed to eliminate or reduce the existence of special schemes that complicate the pension system, make it difficult to control and manage, and lead to the coexistence of different groups of

pensioners with widely varying, and socially disruptive, replacement rates. Other measures are designed to improve the collection mechanisms, fight fraud, and enhance the efficiency of the management bodies (collection and benefits) to reduce the levels of improper use of the protection and the failure to fulfill contribution obligations.

The benchmark models analyzed also include mechanisms to update the value of pensions and therefore cover the inflation risk that could lead to loss of purchasing power. In this respect, there is a tendency to introduce mechanisms in which the indices used for the indicators that measure the loss of purchasing power (the consumer price index, changes in salaries, or a combination of both) are coupled with other indicators related to the sustainability of the system.

**A better balance between pillars: only realizable in medium and long-term scenarios**

In the most stable systems, characterized by the absence of the need for successive reforms, the strengthening of Pillars 2 (pension plans to supplement the employment system) and 3 (incentives for voluntary individual saving in the form of financial products to supplement pensions) always play a crucial role. However, to achieve the greater stability that is derived from a better balance between the different pillars (and, consequently, between the risks), it has been necessary to sustain significant contribution percentages over long periods of time. Profound reforms designed to substantially alter the weight of the different pillars, in which the individual capitalization component plays a key role, have only been successful when carried out sufficiently in advance because they require many years of substantial contributions from companies and workers.

This is the case of the Dutch system, which is a paradigm in this respect and whose reform dates back to the 1950s. Since then, the contributions through Pillar 2 supplementary pension systems have led to what is now one of the largest aggregate funds in the world. But even in this case, the estimated impact of improvements in life expectancy has recently led to the introduction of certain adjustments to offset the possible negative effect on the system accounts.

**The balance between pillars: the key to long-term stability**

The low interest rate environment is another element which, together with demographic pressure and the post-crisis apathy of economic activity, has undermined and aroused uncertainty in individual capitalization systems concerning the replacement rates that people obtain upon retirement. In line with the evidence observed in the benchmark models analyzed, a better balance between intergenerational solidarity elements and incentives for individual saving, coupled with the reinforcement of Pillars 2 (occupational plans) and 3 (voluntary plans), would appear to be the correct path to take, although it involves the implementation of measures that will only bear fruit in the medium and long terms.

However, in the catalog of adjustment mechanisms and measures the only parametric reform that does not significantly alter the balance between intergenerational solidarity and the loss of the level of well-being is the extension of the retirement age. Besides, in the analyses conducted, this is the most sensitive variable in parametric reforms that aim to improve the sustainability of the pension system and the first pillar in particular. This is evidenced by the fact that all the reforms studied are already implementing measures to extend the retirement age and facilitate active aging beyond retirement. At the moment, these are ad hoc reforms that will be phased in by age group, but there is already some discussion about automatically linking retirement age to the increases in life expectancy.

However, as indicated earlier, these measures prove to be insufficient if they are not accompanied by other measures, most notably the reinforcement of the second pillar of supplementary workplace plans, which have enormous potential in terms of the accumulation of funds, and the strengthening of

the third pillar by designing incentives for voluntary individual saving in the form of financial products that will generate income on reaching the retirement age.

It is important to note that although the accumulation of savings for retirement during a person's working life (through this third pillar) is relatively low in the benchmark models analyzed, especially in the lower income groups, it nevertheless constitutes a long-term element which could inject a high degree of stability into pension systems and significantly improve replacement rates.

**Better balance between risks and control mechanisms**

Another point to note is that in the pension systems which introduce or strengthen the components to create a better balance between pay-as-you-go plans (defined benefit) and individual capitalization (defined contribution), and in which the risks are spread more evenly between the government, private companies and the workforce and pensions, all the reforms analyzed have introduced public control mechanisms that aim to prevent poor risk management due to an inefficient system leading to situations in which people who reach retirement age suffer the consequences in the form of lower replacement rates.

In the benchmark models analyzed, the importance of developing these mechanisms cannot be overestimated, and the latest reforms tend to increasingly involve public institutions and assign greater oversight powers to them. The main measures considered include the following:

- The creation of public compensation mechanisms for employees who have suffered a loss of their rights due to the irregular performance of the actors involved in the system, as in the case of the United States.

- Requirements to externalize funds intended to cover companies' pension commitments to their employees, as in the case of the Dutch and Spanish systems.

- The assumption by public institutions of some of the elements which imply the greatest risk and have the highest impact on pensioners (such as life annuities) so that the coverage of both the idiosyncratic and aggregate or systematic demographic risks are retained by a public company, as in the Swedish system.

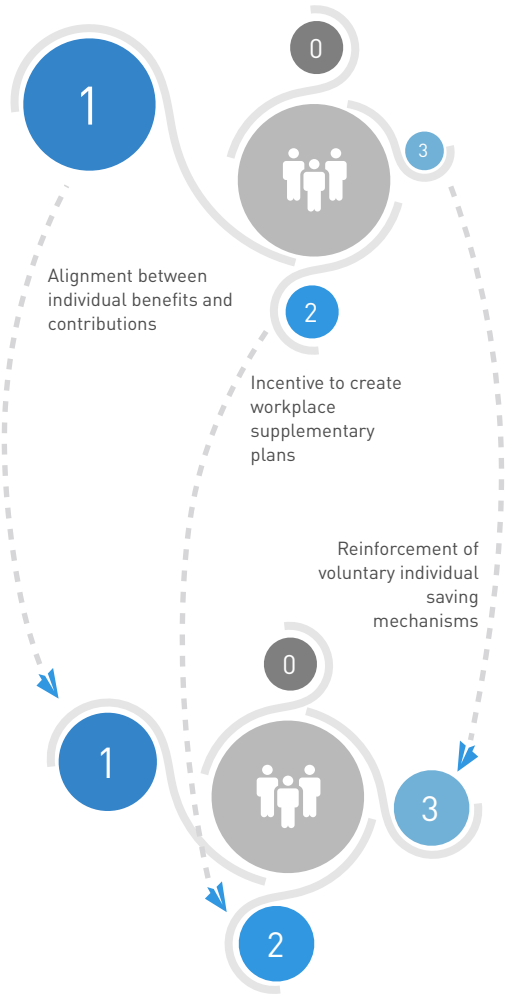
- Public control over the powers and the commissions charged by the private entities that manage the capital funds, through the creation of public entities with a stake in the system, as in the cases of the United Kingdom, Sweden and Chile.

## 4.4. Toward balance in the structure of pension systems

To put it simply, pensions are merely a mechanism that combines individual saving with intergenerational solidarity in a medium and long-term horizon. Depending on the particular principles of each society, the different pension systems mix these two elements (intergenerational solidarity and incentives for individual saving) through the use of technical mechanisms to ensure their efficiency and with the constraint that they must be financially and socially sustainable in the long term. Consequently, the measures and mechanisms aimed at addressing the challenges of sustainability derived from the demographic, economic and financial risks to which pension systems are exposed must be contemplated within a similar horizon. Any system in which a reform is undertaken with a view to generating definitive effects in the short term is bound to fail to resolve the problems and, ultimately, to fall prey to the same pressures that motivated it, thereby increasing the probability of having to address an even greater economic and social shock.

The conclusion that may be drawn from this analysis of the selected benchmark models is that in view of the pressure of the demographic, economic and financial risks which, to varying degrees, affect all pension systems worldwide, the reform that offers the greatest likelihood of providing sustainability and stability in the medium and long terms necessarily involves creating a better balance between the different

**Chart 4.4**
**General balance between pillars in the transition of pension systems**




Source: MAPFRE Economic Research

pillars, as a mechanism for redistributing the risks to which those systems are exposed and, in the final instance, improving the capacity to absorb the economic effects derived from their potential materialization.

It is important to remember that the materialization of these risks does not affect the different pillars in the same way, which means that a better spread between the participants moderates the impacts for the whole system once they have materialized.

From an instrumental point of view (as shown in Chart 4.4), the adaptation of pension systems as a means of working toward a better balance between pillars (and, consequently, between the risks to which they are exposed) must be contemplated in a medium and long-term scenario and can be summed up in the following general principles concerning public policies:

- Maintenance and reinforcement of a basic system of social protection (Pillar 0); i.e. a minimum non-contributory solidarity pension to support in particular the strata of workers who were unable to complete the working life that would have entitled them to a contributory pension.

- Rationalization of a first contributory pillar that combines intergenerational solidarity with the effort of individual saving, thereby aligning benefits more closely with individual contributions. In this process, measures like adjusting the retirement age (which has shown the greatest sensitivity to achieving the desired objective) and adjusting the contribution rates constitute the two essential tools.

- Generation of incentives for companies to create and manage (directly or indirectly through professional managers) supplementary pension plans (especially defined contribution plans) to provide a top-up for the first-pillar contributory pensions.

- Incentives for medium and long-term voluntary individual saving which workers can channel through professional managers with financial products designed to generate an income during retirement, thus supplementing the pensions from Pillars 1 and 2.

## 4.5 On a final note

Adjusting pension systems is possibly the economic and social challenge most widely diagnosed by governments, experts and society in general. It is the collective challenge for which there is the greatest consensus regarding the urgent need to take measures, and it is the challenge for which the most

efficient solutions depend on key aspects that not only affect the macroeconomic foundations of countries but their social stability as well. Even so, the characteristics of this challenge mean that the solutions are very complex.

Pension systems first emerged at the end of the 19th century and proliferated in the first half of the 20th century. Today, a century later and after major changes in the economic structure and population dynamics, these systems must be reevaluated if they are to continue to form part of the institutional infrastructure that lends cohesion to our societies.

As has been pointed out in this report, the existing pension systems need to be reformed and adjusted to guarantee their sustainability and stability in the long term. But it is not only a question of correcting the financing problems derived from the materialization of demographic, economic and financial risks. In certain cases, it is also a matter of addressing the unintended consequences derived from the very measures that have been implemented to correct those problems.

The best course of action would therefore seem to be to create a more structural foundation for the pension systems of the future. The risk-based approach for pension systems, as proposed in this study, indicates that the transition to a new formulation to provide long-term sustainability and stability should focus on improving the balance between pillars in order to limit and mitigate the risks inherent to their operation.

In view of the uncertainty about the potential impact of longevity, based on the projected demographic patterns, societies and their governments need to create a space for devising and implementing measures which will only mature in the medium and long term and which must therefore be adopted as soon as possible. In the final instance, societies cannot afford to ignore the fact that retirement is increasingly nearly as long as working life. This is financially unsustainable, but above all it is incompatible with the aspiration of the economic and social development of nations.

# Index of Charts and Boxes

## Charts

## Boxes

# References

1/ In general terms, for the purposes of the sensitivity estimates performed: (i) the theoretical interest rate is capitalized, applying a commission on the managed fund constituted in each period; (b) the fund is constituted by the sum of the contributions (constant percentage) from the theoretical average salaries, less the commission of the fund accumulated in the previous period; (iii) to calculate the pension, the fund is divided by the actuarial value of a unit income pre-payable at a technical (actual actuarial value) interest rate (discount); (iv) the increases in the discount rate used were 10 basis points (bps); (v) to calculate the increases in life expectancy a mortality table typical of emerging countries was used and the $q_x$ in the table were modified to obtain the life expectancies; and (vi) the years of contributions are based on an initial situation of 40 years (to reduce it to 30 years, the latest years of contributions were eliminated, and to increase it to 45 years of contributions the decrease in life expectancy during the respective years were taken into account).

2/ In 2008 Argentina reformed the system again, eliminating the capitalization scheme from the state pension system to be absorbed and replaced by a pay-as-you-go scheme, providing identical coverage and treatment to the affiliates and beneficiaries of the old capitalization system, which disappeared. Until then, both systems (pay-as-you-go and capitalization) coexisted, in a similar way to the Chilean model today. The funds in the individual capitalization accounts were transferred to the National Social Security Administration.

3/ Superintendencia de Pensiones. *El sistema chileno de pensiones*. Santiago, seventh edition, 2010.

4/ Before the reform, the risk of poverty in old age was covered by two basic programs: the minimum pension guaranteed by the government (PMGE), which provided a pension floor for individuals with at least 20 years of contributions, and the welfare pension (PASIS) for individuals not entitled to a pension in any retirement system.

5/ The amount of this benefit is $104,646 per month (157 U.S. dollars), which was introduced on July 1, 2017. The requirements to receive these benefits are having reached the age of 65 in the case of the old age pension, belonging to a family in the poorest 60 percent of the population, and the ability to prove residence for at least 20 years.

6/ Accessible to people whose pension base is greater than zero and less than or equal to the maximum pension with solidarity supplement (PMAS), which since July 2017 is $309,231 (464 U.S. dollars), and who meet the age, focus and residence requirements stipulated in Law 20,255: (i) having reached the age of 65 when applying; (ii) belonging to a family in the poorest 60 percent of the population, and (iii) the ability to prove residence for at least 20 years. This latter requirement is understood to be fulfilled if the beneficiary can prove at least 20 years of contributions in one or more of the Chilean pension systems.

7/ In December 2016 the commission charged by the AFP varied between 0.41 percent and 1.54 percent of the taxable income. The commission is charged according to the contributor's taxable salary and is only charged during the contribution period.

8/ *Compendio de Pensiones*. Book II, Title IV "Regulación conjunta de los Depósitos de Ahorro Previsional Voluntario Colectivo". Superintendencia de Pensiones. Retrieved from: http://www.spensiones.cl/compendio/584/w3-propertyvalue-2927.html

9/ Acevedo Rivas, V.M. and Ortega Carquín, V. *Los principios de la Seguridad Social en la reforma previsional y la nueva institucionalidad*. Dissertation to obtain the degree in Legal and Social Sciences. Santiago, Universidad de Chile, 2012.

10/ Iglesias, A. and Acuña, R. (1991). *Chile: experiencia con un régimen de capitalización 1981-1991*. Santiago, CEPAL.

11/ In June 2014, the president of Chile, Michelle Bachelet, signed the bill creating a state pension fund administrator. In August 2016 she pledged to proceed with the enactment of the bill into law, along with other measures to change certain aspects of the current pension system.

12/ Uthoff, A. (2011). *Reforma al sistema de pensiones chileno*. Santiago, CEPAL. Serie Financiamiento del desarrollo, nº 240.

13/ Acuña, R., Palomino, M., Villar, L., Villagómez, A., Valero, D. (2015). *Cómo fortalecer los sistemas de pensiones latinoamericanos. Experiencias, lecciones y propuestas*. Chile, SURA Asset Management.

14/ Superintendencia de Pensiones, *op. cit.*, page 1

15/ http://www.comision-pensiones.cl/Documentos/GetResumen

16/ https://www.camara.cl/pley/pley_detalle.aspx?prmID=11887&prmBoletin=11372-13

17/ https://www.ssa.gov/oact/cola/Benefits.html#aime

18/ https://faq.ssa.gov/

19/ http://www.pbgc.gov/wr/benefits/guaranteed-benefits/maximum-guarantee.html

20/ https://www.pbgc.gov/wr/benefits/guaranteed-benefits/maximum-guarantee

21/ Due to common circumstances associated with pensions (retirement, permanent disability, death and survival, temporary disability, maternity and paternity).

22/ Articles 213 to 215 RDL 8/2015.

23/ Obligation introduced in the First Additional Stipulation of Law 8/1987 in the wording expressed in Law 30/1995, transitional stipulations 14 and 15 of Law 30/1995, currently regulated by Royal Legislative Decree 1/2002.

24/ The number of pensioners was estimated to grow by 1.6 percent per year between 1995 and 2000 (7,607,000 pensioners estimated for the year 2000, compared with the real figure of 7,644,320), by 1 percent between 2000 and 2020 (8,831,000 pensioners estimated for 2015, compared with the real figure of 9,360,799), and above 1 percent thereafter.

25/ http://www.congreso.es/portal/page/portal/Congreso/Congreso/Iniciativas?_piref73_2148295_73_1335437_1335437.next_page=/wc/composicionOrgano&idOrgano=343&idLegislatura=12

26/ For special cases of other groups of the population the contributions can be consulted at https://www.gov.uk/national-insurance-rates-letters/contribution-rates.

27/ For example, being at least 22 years old, earning less than £10,000/per annum.

28/ For more details on contributions to workplace plans, consult: https://www.gov.uk/workplace-pensions/what-you-your-employer-and-the-government-pay

29/ See: www.nestpensions.org.uk/schemeweb/NestWeb/public/home/contents/homepage.html

30/ House of Commons Library: The new State Pension – background.

31/ The basic rules of the new system are enshrined in Law 1998:674 on contributory retirement pensions.

32/ Law 1998:702.

33/ Prempensionsmyndigheten

34/ https://www.pensionsmyndigheten.se/other-languages/en/en/orange-kuvertet-visar-hur-mycket-du-far

35/ Individuals do not take out private mutual funds in their own name. The contract is between the fund and the Swedish Pension Agency, which acts as the intermediary. Both the agency and the funds are subject to financial oversight.

36/ World Bank, Sweden´s New FDC Pension System by Edward Palmer, page 20.

37/ 18.5 is the percentage calculated on the contribution base (worker's salary less contribution). If it is calculated on the salary, the total contribution is 17.21 percent (7 percent for them and 10.21 percent for the company).

38/ Uppsala Center for Fiscal Studies, working paper 2013:7, page 95 (6.1) by Johannes Hagen.

39/ The balance ratio for year t is used to calculate the balance number or the need to activate the balance mechanism in year t+2. An activated balance mechanism would mean lower replacement rates but would produce increases when the pension system recovers and the balance figure increases.

40/ https://www.pensionsmyndigheten.se/content/dam/pensionsmyndigheten/blanketter---broschyrer---faktablad/other-languages/presentations/The%20Swedish%20Pension%20System%20-%20presentation%20for%20senior%20citizen.pdf

41/ https://www.sns.se/en/archive/the-payout-decision-in-the-swedish-occupational-pension-system/

42/ https://www.svb.nl/int/en/aow/

43/ https://www.svb.nl/int/es/

44/ https://www.svb.nl/int/nl/aow/hoogte_aow/bedragen/

45/ http://euracs.eu/summaries/summary-the-netherlands/

46/ The Dutch Pension System. A. Lans Bovenberg and Lex Meijdam.

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