On the Influence of Employment-Breaks on Pension Benefits

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Abstract

Workers may experience unemployment spells of varying durations through their working lifecycles. This has strong implications for their income during those periods out of work and this is well known. Less known are the consequences of employment-breaks for the acquisition of pension rights and, consequently, for future initial pensions. Anecdotal evidence, however, is overwhelming that employment-breaks may be both seriously detrimental or very limited for workers' future pension rights depending on the pension scheme and/or country where workers generate their retirement pensions. This paper provides simulations of the impact of employment-breaks on initial future pensions in Portugal and Spain. Given the differences and similarities of Social Security arrangements in both countries and worker and break types considered, we can show that some workers may suffer disproportionately from previous employment-breaks while others would hardly suffer any impact on their pensions.

Index

1. Introduction

The political debate about the future of public pension systems in Portugal, Spain and in most OECD countries has traditionally been focused on its financial sustainability. Over the last 20 years several waves of pension reforms planned to ensure the long-term financial sustainability of pension systems in the face of major demographic (population ageing) and economic changes (social and technological changes in labour markets) have brought and will continue to bring major changes in the living conditions for pensioners. Reforms also aspired to improve intra and intergenerational fairness, to promote stronger incentives to work and contribute and to ensure greater transparency. In countries as diverse as Italy, Sweden, Poland and Latvia pension reforms involved a complete transformation by moving to a Notional Defined Contribution (NDC) framework, in which benefits reflect the value of contributions made over a working life, even if the pension scheme continues to operate on a pay-as-you-go (PAYG) basis. Other countries, such as Portugal and Spain, adopted major parametric changes in their public pension schemes that, while remaining PAYG and retaining the classic elements of a defined benefit design, switched to more (longevity and career-break) risk bearing pension benefits and, taken together, have had a substantial impact on future pension entitlements and scheme's long term sustainability.

Despite differences between countries, adopted pension reforms include common elements such as: (i) an extension of the minimum contributory years necessary to be eligible to pension entitlements, (ii) tightening the link between contributory years and pension benefits, (iii) changes in the pensionable earnings reference, (iv) changes in the annual indexation of pensions in payment, (v) modifications in the rules for valorisation of past earnings or contributions, (vi) changes in the way accrual rates are determined, (vii) raising the number of qualifying years for a full pension from last or best years to longer period or lifetime earnings, (viii) increasing the age limits to receive a full pension, in some cases in automatic manner, (ix) introducing demographic/sustainability factors in pension benefit formulas, (x) tightening eligibility conditions, (xi) equalising pension ages of men and women, (xii) restricting access to early retirement, (xiii) introduction of automatic balancing mechanisms, (xiv) greater emphasis on pre-funding and/or (xv) cuts to pensions in payment (European Commission, 2015).

Although these reform measures may have contributed to address the fiscal sustainability problem, it is crucial to assess the effect of these reforms in terms of pension adequacy since social or political sustainability challenges will likely emerge in countries with a steep reduction in the generosity of pensions. According to the latest EU Commission projections (Ageing Report 2015), a substantial decline is projected in the public pension benefit ratio (to wages) for most of the Member States over the period 2013 to 2060, amounting to around -20 percentage points in the period in Spain and Portugal. More significantly, the projected expected decline in the gross replacement rate at retirement (which reflects the influence on benefit ratios of the newly awarded pensions) will be very significant in many OECD countries. For instance, between 2013 and 2060, the expected decline is 30.4% for Spain and 26.7% for Portugal. If projections confirm, in 2060 the gross replacement rate at retirement will be only 48.6% in Spain and 30.7% in Portugal.[1] Concerns over pension adequacy and foreseen old-age poverty in these countries are aggravated by the fact that the decline in the replacement rate for public pensions will not be offset by entitlements from 2nd and 3rd pillar schemes, unless significant pension reforms take place that shift pension accumulation from public first pillar schemes to second and third pillar schemes and/or people are encouraged to start saving privately for their retirement income.

The retirement income and the standard of living of pensioners depend on a variety of critical factors. They include individual and familial life routes (e.g., age of employment entry, children, life expectancy, employment-breaks, inactivity, consumption and saving patterns), the size and composition of retirement wealth (e.g., housing and financial wealth), and the existence (and generosity) of minimum income provisions for older people (e.g., universal flat-rate pensions, contributory minimum pensions, social assistance programmes). Additional factors like the access to services and non-pension benefits (e.g., health care, long-term care, heating allowances), the size of derived pension rights, the significance of private pensions in the overall retirement pot or the magnitude of labour earnings after full retirement age

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[1] At the EU aggregated level, the public pension replacement ratio would reach around 35% by 2060 (against close to 48% in 2013).

(where and when compatible with pension benefits) are also relevant in assessing the sufficiency of retirement income.

Pension systems have a central role in (almost entirely) replacing labour income after retirement, in securing adequate living standards in old age and in protecting people from poverty. In Bismarckian pension schemes, in which benefits are more or less closely linked to contributions, following a compulsory professional insurance principle, individual employment histories determine the level of pensions workers receive when they reach retirement age. Everything else constant, the higher a worker's individual pensionable earnings and the more continuous his career, the higher the pension benefits will be. This means that voluntary or involuntary career breaks due to, for example, unemployment, part-time employment, termination of fixed-term contracts, parental leave, childbearing, childrearing, illness/disability, studying, military service, housekeeping without raising children or general inactivity periods can affect the accrual of pension benefits and therefore be detrimental to pension benefit levels, and, in some cases, to incentives to work longer. Pension credits and pension accrual for periods out of labour market, derived pension rights (e.g., survivor's pensions) and other redistributive mechanisms in pension systems have the potential to partially offset the contribution gaps related to career breaks.

Career breaks are irrelevant in non-contributory schemes, and are implicitly ruled out in some pension plan designs.[2] With some typified exceptions (e.g., Sweden, Denmark, France), pension credits are rarely found in privately run personal or occupational pension schemes. Similarly, in voluntary private pension schemes, savers are entitled to pension credits only to the extent they have bought extra accrual periods by paying additional voluntary contributions into the system.

Most (public) earnings related pension systems of OECD countries grant pension rights through pension credits and pension accruals for periods spent outside the labour market for reasons that are considered commendable (maternity/paternity, care duties, military service, education, incapacity for work, or

unemployment). In some cases, the accrual of pension rights is made through contributions deducted from benefits received during career breaks or through the purchase of pension rights by means of voluntary contributions. Pension credits may be granted in the form of assumed career years (e.g., Portugal, Spain), pension points (e.g., France, Germany) or social security contributions credited to the individual (e.g., Sweden) or a combination of them (EU, 2015). To mitigate the effects of career breaks some countries have chosen to ease the rules on how past contributions on low income are accounted for in the pension benefit formula. For instance, in Canada, past earnings are ranked in descending order and the years with lowest earnings are excluded from the pension benefit calculation.

The effectiveness of pension credits in counteracting employment breaks depends on the duration of leave, the pensionable earnings base (e.g., earnings immediately prior to break, reference earnings, unemployment or childcare-related benefits, minimum wage), and the ways in which those parameters count towards pension entitlements (e.g., best years of earnings versus full career in benefit calculation formulae, specific redistributive features of pension schemes). In many cases, pension credits are linked to the receipt of unemployment or childcare benefits and are, thus, subject to time limits and/or other conditionality conditions such as participation in training and activation programs. Although pension credits and pension accrual during periods out of labour market are important, in earnings-related schemes they tend not to be sufficient to fully offset the impact of career breaks on pension benefits. Social security contributions credited to the individual tend to be at a low level when compared to labour income (as minimum pensionable wages are often used by default), resulting in smaller pension accruals during periods out of work.

Despite its relevance, little research has been done to estimate the impact of career breaks on pension benefits and on the probability of not complying with pension schemes eligibility conditions, particularly the minimum years of service required to qualify for a (full or partial) pension at ordinary retirement ages. In this paper, we aim to close this gap and estimate the impact of employment-breaks on pension benefits using a simulation approach based on actual pension rules, taking into consideration the timing and duration of non-employment spells, the existence of pension credit mechanisms to compensate the contribution gap, different lifecycle labour earnings profiles and the motive for the employment break.

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[2] For instance, in Portugal, for the reference earnings calculation purpose, whenever the number of calendar years with earnings registration is higher than 40, it will consider the best 40 annual adjusted earnings, which means any years out of work more than that duration do not affect public retirement income. Whereas in Spain, employment breaks where the obligation to contribute to the public pension scheme does not exist are integrated in the contribution record attributing the minimum pensionable wage at any time to the closest (to retirement age) 48 months and half this pensionable wage to the rest of the employment-break months.

Several layers of earnings profiles are considered to assess whether the redistributive features of pension schemes amplify or minimize the impact of contribution gaps on pension entitlements. In addition, to assess the effect of post-interruption wages on pension entitlements and the significance of restoration effects, we considered alternative (convergent, divergent) earnings profiles. The financial, economic and social implications of career breaks are discussed together with their policy implications. Detailed numerical results are presented using the current Portuguese public pension scheme benefit rules as an example, together with a simpler illustrative case for the Spanish public pension scheme. We analyse to what extent are the build-up of pension entitlements in contributory systems protected in the case of career breaks by simulating the effects on final pension benefits and pension wealth of sample cases with career breaks due to childcare, unemployment or inactivity.

The magnitude of the impact of shorter and more fragmented careers on pension entitlements is expected to depend on the type, timing and duration of non-employment spells, mainly because the on-the-job accumulation of human capital varies over the employment career and human capital accumulated on the job is one of the main determinants of an individual's wage rate. In fact, it is well known that the accumulation of human capital may be interrupted and the stock of human capital may be deteriorated because of discontinuities in the employment pattern, because of technical and organizational progress or since the employee's knowledge is not maintained and updated during absence. However, if the career interruption is due to training periods, positive wage effects are expected, i.e., the overall wage changes may be split into two components, a missing experience effect and an additional productivity related effect.

Additionally, the size of losses in pension benefits depends on the existence (and the design) of social security policies that mitigate earnings losses either by compensating directly for career interruptions or minimizing the reduction in the accumulation of human capital. If, on one hand, the adequacy of protection of pension entitlements during career breaks is important, on the other hand the protection must be balanced with the financial incentives for individuals to return to the labour market.

In recent years, there has been a trend away from the conventional employment relationships covered by social security systems towards more flexible work patterns, typically only partially (or not) covered, such as temporary employment, part-time jobs, self-employment, teleworking, and nomadic working. An increase in non-employment spells augments the turnover of workers between contributing and not contributing, and this is likely to have an impact on the access to contributory pensions since the fulfilment of the vesting period conditions is more difficult and social security administrations are increasing their capacity to monitor contribution careers. Even in countries with high coverage levels, there might be a considerable number of workers who would not ultimately be well protected by contributory systems despite of being registered as contributors in the case of having had mostly temporary and/or part-time work arrangements through their working lives.

Family-related non-employment periods (for childbirth, child-raising or care-giving responsibilities) play a major part in women's employment biographies. The literature dealing with this subject highlights the specific situation of women (see, e.g., Arun *et al*. (2004) and Malo and Munoz-Bullon, 2008). Women that have children and give up their job lose their own income, and if they decide to re-join the labour force they frequently find themselves accepting lower wages and facing poor career development opportunities. Ultimately, they also face lower pension benefits. Pension crediting of these periods is therefore crucial in terms of the pension adequacy of women. Although they are not usually sufficient to fully offset the contribution gaps related to delayed, shorter or interrupted careers, they can contribute to mitigate the negative effects on pension benefits.[3]

Careers interrupted at different ages have different consequences in terms of pension benefits. Non-employment periods due to child-raising tend to have greater impact than care-giving periods, not only because of their longer duration, but also due to their early onset which more critically impacts on women's future working trajectories biographies. Additionally, empirical evidence suggests that the impact on pension benefits of discontinuous employment careers tend to be very different, in sign and in size, for women and men (Beblo and Wolf, 2002). While wage cuts for women are mainly triggered by parental leave and additional home time, men's wages seem to be negatively affected by unemployment and inactivity periods. Other reasons for earning losses that depend on the type of career

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[3] Spain has recently passed legislation that grants mothers eligible for old-age pensions up to a 15% increase in their pension accruals if they have three or more children.

interruption are potential stigma or signalling effects. Several studies suggest that past unemployment spells may raise negative expectations on the side of the employer regarding the actual productivity or motivation of the potential employee, translating into lower wages (see, e.g., Albrecht *et al*., 1999).

The structure of the remaining of this paper is as follows: Section 2 discusses the theory and empirical evidence about the effects of employment-breaks on retirees' incomes. As it turns out of this discussion, employment-breaks should and indeed influence retirement incomes. Section 3 contains a detailed simulation, for the Portuguese case, of the effects of employment-breaks in typical cases for workers at, above or below average earnings. This simulation, made considering the actual Portuguese retirement .

and pension rules, shows that breaks occurring early in working life have a negligible effect on future pensions (as compared to a baseline) if earnings profiles are recovered after the break. On the other extreme, breaks occurring at preretirement ages have more serious incidence on pensions. Section 4 is devoted to a much simpler illustration of the effects of employment-breaks in retirement incomes of typical workers in Spain, given existing rules. Again, simple as they are, significant effects may happen when breaks occur in the working life and whether breaks are due to covered unemployment or not. A final Section 5 summarizes major points and findings of this research. A series of Annexes containing details of the simulations for Portugal are also included.

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2. The influence of employment-breaks on pension benefits: Theory and empirical evidence

The differences in pension benefits depend on a variety of individual and familial life routes and can be determined by several factors. In pension schemes in which contributions are closely linked to benefits, the higher a worker's individual earnings and the more continuous is the contribution career, the higher the pension benefits will be. In other words, employment breaks like unemployment or parental leave shorten working lives and typically reduce lifetime earnings and contribution losses, thus reducing pension benefits in the future.[4]

These losses in pension benefits can be expected to depend on a number of factors such as when the employment-break occurs, on the duration of employment-breaks, on the wage effects of employment breaks and/or part-time periods, on the earnings profile of the individual, on the way pension rights accrue in the pension scheme (e.g., the benefit formula in DB schemes), or on the existence and significance of pension credits to plug the contribution gap (periods covered and pensionable earnings base). The specific rules regarding which earnings are considered in calculating pension benefits, the eligibility criteria for basic and minimum old-age pensions, the existence and significance of basic and minimum pension levels and the redistributive features of the pension scheme are also important in determining the size of the losses.

As a rule, the further back in time these breaks occur, the smaller their incidence on retirement incomes, and vice versa. Breaks occurring at mid working age or close to retirement time have a larger incidence due to the heavier weight these contribution periods have in standard pension formulae. Also, pension formulae including a significant component based on "X" best or last contribution years tend to protect pension entitlements from employment-breaks occurring outside the pension calculation reference period.

Human capital accumulated on the job is considered one of the main determinants of an individual's wage rate. Discontinuities in the employment profile are expected to cause wage cuts since they imply an interruption in the accumulation of human capital as well as a depreciation of the human capital stock built up in the past (Mincer and Polachek, 1974). This is because

technical progress and innovations in the work process may cause human capital acquired in previous years of employment to become obsolete after an employment-break, particularly if this know-how is not preserved and updated during the career break. On the job, workers often acquire firm-specific skills that are not necessarily transferable to other companies. Consequently, a new position where these skills are not valued will likely pay a lower wage, at least initially, until the worker acquires the skills that are valued by the new employer. Additionally, the longer a worker is out of work, the more his or her firm-specific skills depreciates, making the worker less valuable to a new employer. This situation again translates into receiving a lower initial wage at a new job.

According to the human capital theory, the higher is the concentration of human capital investment in early ages the higher will be lifetime earnings and the lower will be both the risk and the duration of unemployment spells (Becker, 1975, 1985; Mincer, 1974; D'Addio, 1998, 2000). The duration of unemployment is determined by individuals' search effort and job acceptance decisions, the random arrivals of job offers as well as the generosity of unemployment benefit and assistance programmes. An individual who is unemployed longer is expected to face different labour demand (aka receive less and potentially different job offers) the longer the duration of unemployment, because of skill depreciation or stigma (Machin and Manning, 1999). In addition, workers may accept different jobs and lower wages the longer they are unemployed, i.e., they may have a declining reservation wage the longer they have been out of work.

Cooper (2014) investigated the relationship between unemployment duration and workers' future earnings using data from the United States by comparing the earnings trajectories over time of displaced and non-displaced workers as well as differences in earnings paths for workers that experience short-duration versus long-duration unemployment. The author concludes that there is a negative relationship between a worker's most recent unemployment spell and his or her current earnings, that the earnings of displaced workers do not catch up to those of their non-displaced counterparts for nearly 20 years and that the effect of unemployment on earnings is more significant the longer the duration of unemployment. Schmieder et al. (2014) estimate the causal effect of unemployment duration on re-employment wage offers using social security data in

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Germany from 1975 to 2008 and conclude that the negative impact of unemployment duration on wages is of 0.8% per month.

Some authors find a catch-up effect (also called "restoration effect") of human capital following an unemployment-break (particularly between formerly part-time employees who take up a full-time position again) that may partly offset the depreciation of human capital and mitigate re-employment wage cuts (Galler, 1991; Licht and Steiner, 1992). Workers can recover earnings and subsequently pension losses resulting from career breaks if they can prolong their working lives afterwards. The restoration effect might be stronger in the early and middle compared to the late employment period as predicted by human capital theory.

The timing of employment breaks on the individual income profile matters because skills, knowledge and experience change over time and they are valued differently on the labour market. If there is a depreciation of accumulated human capital during employment breaks and part-time periods, the timing of these events becomes a crucial determinant of the resulting wage effects. These effects directly concern pension benefits because they interact with earnings and thereby individual qualifications during the employment period. Potrafke (2007) and Potrafke and Steiner (2007) examined how the timing of employment breaks affects pension benefits in Germany and concluded that the losses due to career interruptions in the early and middle employment periods differ.[5] However, the negative effects due to unemployment in the late employment period were found weak. Similar results were obtained by Beblo and Wolf (2002) that concluded that while the three-year break right at the beginning of the employment career may have minor impact on re-employment wages, postponing the interruption by ten years raises the re-employment wage penalty significantly. Arulampalam et al. (2001) claim, for the contrary, that unemployment early in a worker's career might endanger young workers' future labour market possibilities.

El Mekkaoui et al. (2011) evaluated the impact of different employment-breaks on pension benefits for French private sector workers and concluded that by compensating for some career accidents, the French legislation allows individuals to receive, in some cases, the same level of social security pension that they would have received with a smooth professional path. In an assessment of the impact of shorter and more

fragmented careers on mandatory public and private pension entitlements in OECD countries, considering pension credits, OECD (2015) concludes that pension credits in earnings-related pension systems mitigate the effects on pension benefits of workers with interrupted work histories, but are not sufficient to fully offset their contribution shortfalls. The investigation assumes, however, that pension entitlements are forward-looking in the sense that pension rules of the base year (2014) will apply throughout the career until workers reach the standard pension age in their country.

The literature dealing with this subject highlights the specific situation of women (see, e.g., D'Addio, 2012, 2015 and references therein). Employment-breaks due to child-raising have greater policy relevance than care-giving periods, not only because of their longer duration, but also due to their early onset which more critically impacts on women's future labour market biographies and pension entitlements. As the number of children rises, so does the overall duration of employment breaks. Empirical studies show that apart from the number of children, the level of qualification also influences the duration of family-related employment breaks. The higher the vocational qualification, the shorter the career breaks. Child-related employment breaks tend to be 'game-changing' biographical events. While most women worked (full-time) right up to their first child-raising period, the situation afterwards is more heterogeneous and uncertain. Employment continuity at near full-time level strengthens women's own pension entitlements, which combined with derived pension rights is likely to secure adequate income in retirement. The longer the 'non-active' periods due to care-giving the lower will be the personal pension rights of women. The increase in minimum contributory years put forward by recent pension reform could exclude from benefit claim people with interrupted employment careers and shorter insurance periods, among whom women are overrepresented, as they are more likely to hold part-time jobs and take career breaks due to family responsibilities.

The tightening of the relationship between contributions accumulated and pension benefits and the fact that pension benefits will increasingly depend upon the workers' entire career is likely to have different gender effects, depending on gender differences in earnings profiles and employment patterns. As for the benefit weighting formula, since women exhibit more irregular and interrupted career patterns, they may suffer greater reductions in benefits when lifelong earnings are considered. For the contrary, since men's earnings typically exhibit higher dynamism in the late career and the gender gap tends to be wider in old age, recent

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[5] The results showed that, regarding men, unemployment in the middle employment period reduced pension benefits more severely than when occurred in the early employment period. Unemployment was not that important regarding women.

pension reforms are likely to proportionally penalise men more than women, who on average have less steep careers.

In earnings-related pension schemes, whether DB or DC, the accumulation of pension entitlements is usually linked to an individual's contributory record when working, if vesting periods have been completed. Nevertheless, pension entitlements can also be granted for periods out of the labour market when people have responsibilities (e.g., childbirth, child-rearing), or are undertaking invaluable social activities (e.g., military service) which are rewarded by the scheme, or simply to achieve gender equity. Accrual of pension entitlements for periods out of the labour market available in OECD countries takes three main forms: pension credits, contributions deducted from (unemployment, sickness) benefits received during career breaks or the purchase of pension rights through voluntary contributions (see Table 1).

Depending on the eligibility and entitlement conditions in the respective pension system, credits may be granted in the form of assumed career years, pension points, social security contributions credited to the individual or a combination of them (EU, 2015). Social security contributions credited to the individual tend to be at a low level when compared to labour income - equivalent to the minimum wage or a fraction of the last individual or average wage, resulting in smaller pension accruals during periods out of work. Where pensions are universal (based, for example, on residency), credits for periods outside the labour market are implicit (automatically covered) in the system.

Table 1. Explicit credits in earnings-related pension systems for unemployment and childcare

	Childcare		Unemployment			Childcare		Unemployment	
	Explicit	Implicit	Explicit	Implicit		Explicit	Implicit	Explicit	Implicit
Australia	..	x	..	x	Israel	..		..	
Austria	x		x		Italy	x		x	
Belgium	x		x		Japan	x		x	
Canada	x		x		Korea	x		..	x
Switzerland	x	x	x	x	Luxembourg	x		x	
Chile	x		..		Mexico	..	x	..	x
Czech Republic	x		x		Netherlands	..	x	..	x
Germany	x		x		Norway	x		x	
Denmark	x		x		New Zealand	..	x	..	x
Estonia	x		..	x	Poland	x		x	
Spain	**x**		**x**		**Portugal**	**ft/pt**		x	
Finland	x		x		Slovak Republic	x		x	
France	x		x		Slovenia	pt		x	
Greece	x		x		Sweden	x		x	
Hungary	x		x		Turkey	x		..	
Ireland	x		..	x	United Kingdom	x		..	x
Iceland	..	x	x		United States	..	x	..	x

Note: The abbreviations denote: x = Explicit pension credits exist in the earnings-related pension system; .. = Not available; ..* = Not available in the earnings-related pension scheme; Implicit refers to mechanisms not explicitly designed to cover periods of interruptions but that implicitly exert that same function either thanks to pension rules or first-tier components; pt = Credit only exists for part-time workers.

Source: OECD (2015) with author's additions.

In Portugal and Spain, workers acquire pension rights for some types of career interruptions (unemployment, maternity/paternity illness or disability periods). In most cases, this protection is linked to receipt of an unemployment benefit and is thus subject to time limits and/or other conditionality conditions such as participation in training and activation programs. In addition, the amount of pension is often calculated from a smaller reference wage, resulting in lower future pension entitlements. For instance, in Spain the entitlement to pension credits during unemployment is linked to the family situation of the unemployed. Inactivity could be also compensated by allowing insurance periods but only in the case of children's education.

3. Impact of career breaks on pensions: A detailed illustration for Portugal

3.1 Methodological approach

In this section, we investigate the impact of employment-breaks on old-age pension entitlements of private sector workers using the Portuguese Social Security System current rules as an illustrative benchmark. The main goal is to assess how different is the pension entitlement of a worker who has a history of (single, multiple, short or long duration) career breaks from that of a baseline retiree who has worked a full, uninterrupted career, taking into the consideration the existence of pension credit mechanisms to compensate the contribution gap, the timing of employment breaks, the motive for the employment break, alternative earnings profiles and the overall effect of retirement income taxation regimes. First, we present the typical cases considered in the simulation study together with the assumptions. Then, we will present the pension entitlements for working life courses that are not affected by employment breaks, allowing us then to analyse the impact of different types of career breaks on initial benefits, replacement rates and pension wealth.

To assess the impact of career breaks on pension entitlements we use the "typical cases" method and define sample cases of a private sector worker's career path which deviates from a full-time continuous career because of unemployment or childcare breaks. Sample or typical cases are often used for the assessment of public policies. Since our goal is to provide an accurate description of real pension schemes, sample cases were chosen to represent as closely as possible the most frequent individual career breaks. Survey (SHARE survey) and administrative data were used to capture the key pattern of employment breaks in Portugal and Spain and to assist in the design of typical employment breaks.

In our study, the baseline full-career case refers to a 27-year-old childless individual born on January first 1948, entering the labour market on January first 1975 and retiring on January first, 2015 at the current statutory retirement age of 66 after completing a 40-year continuous contributions career without breaks or reduced activity periods, having received during his whole career the observed minimum wage. The computed pension entitlements are based on parameters and rules set out by Portuguese Social Security System governed by legislation in force, as detailed in Appendix A.

Pension credits for unemployment and childcare career interruptions were explicitly taken into consideration in the calculation of pension entitlements (see Appendices B and C for details). As in most OECD countries, Portugal offers protection of pension accruals in the public pension schemes in the event of unemployment, layoff, maternity, paternity and parenthood, temporary incapacity for work, sickness, partial or absolute temporary incapacity for work due to occupational disease or work accident, military service (or civilian service where applicable) and jury service fulfilment through the attribution of pension credits. The coverage of pension credits is linked to the receipt of an unemployment, childcare or sickness benefit and is, thus, subject to time limits and/or other conditionality conditions such as participation in training and activation, and on not having received all benefits as a lump sum payment. For instance, unemployment benefits are granted only to those involuntarily unemployed that are not working, registered as job seeker with the job centre, fully capable of working, available and actively looking for work, are not in receipt of an invalidity or old-age pension and reside in Portugal.[6] Moreover, the pensionable earnings base of pension credits is determined by the existing rules for the calculation of unemployment and childcare benefits. In Portugal, the entitlement to pension credits during unemployment is not linked to the family financial situation of the unemployed. In considering the impact of pension credits on pension entitlements we adopt a backward-looking approach and assume that existing rules and parameters of the year 2015 were applied throughout the career until workers reach the statutory retirement age.

We conducted a systematic analysis on the effect of unemployment spells on pension entitlements and simulated the influence of: (i) single or multiple breaks; (ii) short and long duration breaks; (iii) Employment breaks occurring at the beginning, at the middle and at the end of the contribution career; (iv) Breaks for low, average and high earners; (v) Breaks for flat and ascending earnings profiles; (vi) post-interruption convergent and divergent earnings profiles.

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[6] There are special rules applying to people in long-term unemployment. People aged 57 or over who are long-term unemployed can retire at age 62 with full pension without decrement. It is required that the minimum contribution conditions are met and unemployment-benefit entitlement is exhausted. Early retirement is also possible from age 57 with at least 22 years contributions for individuals who become unemployed at age 52 or more. In these cases, the pension is reduced with a 0.5% monthly decrement, with a maximum of 5 years reduction applied. Whenever unemployment is due to an agreed work contract cessation, the pension amount will be subject to an additional reduction rate that will last until the pensioner is 65 years old. Means-tested unemployment assistance subsidy is provided if registered contribution is more than 180 days in the 12 months prior to unemployment and monthly earnings before unemployment is less than 80% of the minimum wage. This allowance can be extended until beneficiaries meet the conditions for early retirement if they are 50 years of age.
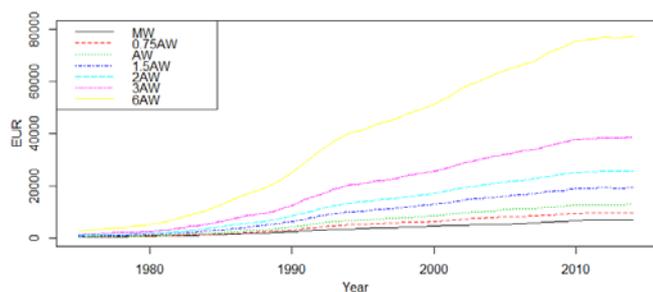
In assessing the influence of the timing employment breaks on pension benefits, three different career phases (early, middle and late) are distinguished. We considered the possibility of single breaks at the beginning (between ages 30 and 35), at the middle (between ages 40 and 45) and late in contribution career (between ages 62 and 66), together with combined multiple breaks. In distinguishing between single short and long duration employment breaks, we specify five durations for the unemployment and childcare spells, from one to five consecutive years.

Seven layers of earnings profiles are considered to assess the redistributive features of the pension scheme:

— A "low earnings" flat profile earning the observed national nominal minimum wage (MW) throughout the entire contribution career. The annual MW in Portugal amounted to 7070 EUR in 2015;
— A "low to middle earnings" profile earning 75% of the observed national annual nominal average wage (AW) in Portugal throughout the entire contribution career.
— An average wage worker profile earning the AW throughout the entire contribution career. The annual AW in Portugal amounted to 12795 EUR in 2015;
— Two "middle to high earnings" workers earning 1.5 times or 2 times the AW;
— Three "high earnings" workers earning 2, 3 or 6 times the AW.

Additionally, for all of the above earnings profiles, an ascending wage profile has been simulated assuming the worker starts with the minimum or one of the six multiples of the average wage and experiences an annual salary raise of 2% above the reference earning profiles. To simplify, we assume in this case that the earnings progress is linear and not concave as it is generally observed. In Figure 1 we represent the six layers of annual earnings profiles considered in this study over the period 1975-2014.

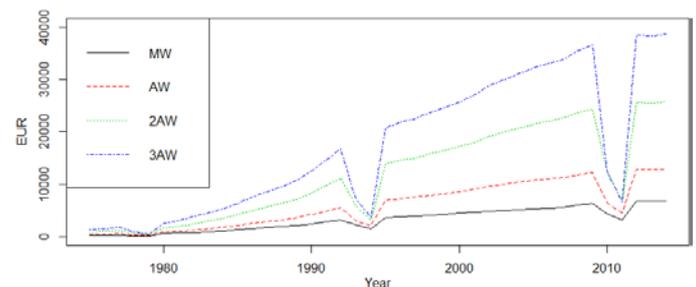**Figure 1: Annual Earnings Profiles in Portugal, 1975-2014**

Source: Author's preparation based on Statistics Portugal data.

To assess the effect of post-interruption wages on pension entitlements and the significance of restoration effects, we considered three alternative profiles:

— a baseline scenario in which we assume that after an employment break the earnings path resume to that of a worker who has not suffered a career break (Figure 2);
— a "divergent earnings" profile in which we assume that after an employment break earnings are reduced by 10% per year of job displacement when compared to those of a worker who has not suffered a career break (Figure 3);
— a "convergent earnings" profile in which we assume that after an employment break earnings are reduced by 10% per year of job displacement when compared to those of a worker who has not suffered a career break but then catch-up with the baseline scenario in five years;

Figure 2: Baseline earnings profiles with 2 years unemployment breaks during career

Source: Author's preparation.

To isolate the empirical results from penalties or bonuses due to early or late retirement, respectively, we assume individuals retire at the statutory retirement age so that pension entitlements are computed at the full accrual rate. Other studies frequently combine early or late retirement with compensated and uncompensated unemployment or inactivity spells, a methodological option that does not allow discerning the specific effect of pension entitlements for periods out of the labour market, even if breaks and expected pensions losses could induce a change in labour supply behaviour. The rate of payroll contributions is assumed constant in the calculations, as observed in the Portuguese pension system. In the calculation of initial pension benefits, the revalorization of past wages is done using the current index as defined by law (consumer price index excluding housing prices).[7]

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[7] Portaria n.º 266/2014 de 17 de Dezembro.

Figure 3: Divergent earnings profiles with 2 years unemployment breaks during career

Source: Author's preparation.

3.2 Results and analysis

The preferred indicator used to study the impact of employment breaks on pension entitlements is the ratio between the gross pension benefit of a worker who has interrupted his career for some time and that of a worker who has contributed uninterruptedly from the age of entry into the labour market to normal statutory pension age. The benchmark is a full-career entitlement. Instead of using the relative gross pension entitlements of interrupted versus full-career profiles, we could have used deviations in replacement rates (El Mekkaoui et al., 2011).

The replacement rate is, however, a partial indicator since it only assesses how well older people can maintain their pre-retirement levels of consumption once they stop working, i.e., concentrates on how benefits compare with previous income (in a narrow sense because income other than wages and pensions is not considered). Although replacement rates are consistent with lifetime consumption smoothing, i.e., the notion that pensions should replace a reasonable fraction of pre-retirement income, this direct measure of adequacy has its limitations. First, they do not consider the contributory effort made by employees (and employers) and/or differential life expectancy, i.e., intra-generational fairness and equity considerations between individuals are ignored. Second, it is a historical measure since one needs to wait until retirement to be able to assess replacement rates. Third, it is not a prospective measure since it does not give information on the impact of future changes in pension system rules. Fourth, it is an individual measure and thus may not be representative of the whole population. Fifth, replacement rates have no direct link with poverty in the sense that a pension system may replace 100% of previous income and yet not be enough to reduce the risk-of-poverty. Sixth, the replacement rate may not be representative for the

analysis, for instance in those cases where the individual goes through a non-employment period just before retirement. Finally, replacement rates are a single point-in-time indicator, they do not take longevity into account and how it affects lifetime transfers to the individual.

In Tables 2, 3 and 4 we represent the impact of single unemployment spells of different duration occurring, respectively, at the beginning, middle or end of the contribution career on the relative gross pension entitlements of a representative worker who has a history of career breaks and might have been granted pension credits, compared to that of a baseline retiree who has worked a full, uninterrupted career. Unemployment spells are here defined as uninterrupted years in which an individual was unemployed. Panels A and B represent the relative gross pension entitlements for the scenarios in which we assume post-interruption earnings resume to that of a worker who has not suffered a career break, for both the baseline and ascending wage profiles, respectively. Panels C and D represent the relative gross pension entitlements for the scenarios in which we assume post-interruption divergent wage paths, for both the baseline and ascending wage profiles, respectively. In every Table and Panel, column 2 exhibits the initial pension benefit for the seven alternative earnings profiles, column 3 shows the full-career relative gross pension entitlements index and columns 4 to 8 represent the relative gross pension entitlements for interrupted careers of different duration (one to five-years).

The impact of single unemployment spells of different duration occurring early in the contribution career on the gross pension entitlements of low-, average-, and high-earning workers is not very significant if we assume that when the unemployed worker finds a job again, relative pay is the same as in their old position. The gross pension of a worker who earns the baseline average wage throughout life and interrupts his career for one to five years would drop by an amount ranging between 0.22% and 1.51% relative to a worker who has not interrupted his career (Table 2, Panel A). For the same representative average wage worker but with an ascending wage profile, the gap decreases by an amount ranging between 0.13% and 0.89% for one to five-year unemployment breaks (Table 2, Panel B). The pension drops slightly less for minimum wage workers and is increases marginally for medium to high-income levels.

Table 2. Initial gross pension benefits and relative gross pension entitlements for single unemployment spells occurring at the beginning of the contribution career

Panel A: No post-interruption wage penalty; Baseline earnings profile

Earnings profiles	Baseline		Duration of Unemployment				
	Pension EUR	Index	1	2	3	4	5
MW	383.72	100	99.77	99.37	98.90	98.78	98.78
0.75 AW	548.75	100	99.83	99.59	99.30	98.95	98.59
AW	731.03	100	99.78	99.52	99.21	98.85	98.49
1.5 AW	1,094.26	100	99.77	99.49	99.18	98.83	98.47
2 AW	1,457.28	100	99.77	99.49	99.18	98.83	98.47
3 AW	2,177.90	100	99.76	99.46	99.14	98.80	98.44
6 AW	4,326.35	100	99.68	99.36	99.03	98.68	98.34

Panel B: No post-interruption wage penalty; Ascending wage profile

Earnings profiles	Baseline		Duration of Unemployment				
	Pension EUR	Index	1	2	3	4	5
MW	724.45	100	99.87	99.64	99.37	99.07	98.81
0.75 AW	1,040.82	100	99.91	99.77	99.60	99.40	99.18
AW	1,386.02	100	99.87	99.72	99.54	99.33	99.11
1.5 AW	2,075.25	100	99.87	99.72	99.55	99.35	99.14
2 AW	2,760.79	100	99.87	99.72	99.54	99.34	99.13
3 AW	4,129.51	100	99.87	99.70	99.52	99.32	99.12
6 AW	8,213.58	100	99.82	99.63	99.44	99.24	99.02

Panel C: Post-interruption wage penalty; Baseline earnings profile

Earnings profiles	Baseline		Duration of Unemployment				
	Pension EUR	Index	1	2	3	4	5
MW	383.72	100	98.78	98.78	98.78	98.78	98.78
0.75 AW	548.75	100	90.17	81.30	73.46	69.39	69.07
AW	731.03	100	90.02	81.03	72.95	65.67	59.19
1.5 AW	1,094.26	100	90.02	81.04	72.97	65.67	59.12
2 AW	1,457.28	100	90.01	81.02	72.93	65.66	59.13
3 AW	2,177.90	100	90.04	81.06	73.00	65.69	59.13
6 AW	4,326.35	100	89.97	80.98	72.91	65.60	59.04

Panel D: Post-interruption wage penalty; Ascending wage profile

Earnings profiles	Baseline		Duration of Unemployment				
	Pension EUR	Index	1	2	3	4	5
MW	724.45	100	90.02	80.99	72.84	65.51	58.94
0.75 AW	1,040.82	100	90.06	81.11	73.02	65.74	59.25
AW	1,386.02	100	90.02	81.04	72.96	65.67	59.10
1.5 AW	2,075.25	100	90.05	81.05	72.95	65.66	59.10
2 AW	2,760.79	100	90.05	81.09	73.03	65.74	59.17
3 AW	4,129.51	100	90.06	81.06	72.96	65.68	59.13
6 AW	8,213.58	100	89.98	80.97	72.87	65.60	59.05

Source: Author's calculations; *Notes*: Duration of unemployment spells measured in years; The baseline denotes normalisation to full career.

The reduced impact of unemployment spells occurring early in the contribution career is explained by both the DB pension formula and the mitigating effect of pension credits. The pension formula effect stems from the fact that, for generations retiring up to December 2016, a more generous transitional rule is to be applied by which pensions are calculated by a weighted average (pro rata) of the previous method (average earnings for the best 10 out of the last 15 years contribution years) and the current lifetime (40-year) reference earnings method. The mitigating effect of pension credits (limited to periods of benefit recipiency and capped by a relatively low amount - 2.5 IAS) results from the fact that time spent in unemployment is credited as insured period and considered as equivalent to paid employment. The effect of early contribution years on initial pension benefits is also highly dependent on the rules used for valorisation of past wages when averaging.

As expected, our simulation results show that the assumption of no post-interruption penalty for wages is more relevant for ascending wage profiles compared to the baseline benchmark career. The impact of single unemployment spells on pension entitlements becomes much more significant when we assume that job displacement is followed by a lower trajectory for future earnings after re-engagement, and the earnings scarring of unemployment is more significant for longer unemployment periods. The gross pension of a worker earning the baseline AW throughout life and interrupting

his career for one to five years would in this case drop by an amount ranging between 9.98% and 40.81% relative to a worker who has not interrupted his career (Table 2, Panel C). For AW workers with an ascending wage profile the gap is almost indistinguishable and ranges between 9.98% and 40.90% for one to five-year unemployment breaks, respectively (Table 2, Panel D).

Not surprisingly, for baseline MW earners unemployment spells have little marginal effect on gross pension entitlements when we assume that job displacement is followed by a lower trajectory for future earnings. This is both a result of minimum wage legislation preventing wages to fall below a certain threshold, of the way unemployment insurance benefits are computed in Portugal, namely the existence of a lower bound that approximates the minimum wage, and of the existence of minimum pension levels for contributory pensions (€379.04 for workers with at least 31 contribution years).

Moving now to the impact of single unemployment spells of different duration taking place at the middle of the contribution career (between ages 40 and 45), drops in old-age pensions continue not to be very significant when unemployed workers are able to re-enter the job market few years later at the then corresponding average wage, i.e., when earnings scarring effects are insignificant.

Table 3. Initial gross pension benefits and relative gross pension entitlements for single unemployment spells occurring at the middle of the contribution career

Panel A: No post-interruption wage penalty; Baseline earnings profile

Earnings profiles	Baseline		Duration of Unemployment				
	Pension EUR	Index	1	2	3	4	5
MW	383.72	100	99.84	99.57	99.23	98.84	98.78
0.75 AW	548.75	100	99.82	99.53	99.19	98.79	98.36
AW	731.03	100	99.76	99.43	99.05	98.64	98.20
1.5 AW	1,094.26	100	99.76	99.43	99.06	98.65	98.21
2 AW	1,457.28	100	99.76	99.40	99.01	98.58	98.14
3 AW	2,177.90	100	99.73	99.36	98.98	98.56	98.13
6 AW	4,326.35	100	99.66	99.27	98.87	98.45	98.03

Panel B: No post-interruption wage penalty; Ascending wage profile

Earnings profiles	Baseline		Duration of Unemployment				
	Pension EUR	Index	1	2	3	4	5
MW	724.45	100	99.86	99.64	99.36	99.04	98.69
0.75 AW	1,040.82	100	99.82	99.57	99.28	98.95	98.59
AW	1,386.02	100	99.82	99.57	99.28	98.95	98.59
1.5 AW	2,075.25	100	99.82	99.56	99.26	98.94	98.58
2 AW	2,760.79	100	99.80	99.53	99.22	98.89	98.54
3 AW	4,129.51	100	99.77	99.48	99.18	98.85	98.49
6 AW	8,213.58	100	99.73	99.42	99.10	98.76	98.41

Panel C: Post-interruption wage penalty; Baseline earnings profile

Earnings profiles	Baseline		Duration of Unemployment				
	Pension EUR	Index	1	2	3	4	5
MW	383.72	100	99.84	99.57	99.23	98.84	98.78
0.75 AW	548.75	100	90.65	82.21	74.60	70.68	70.36
AW	731.03	100	90.58	82.09	74.45	67.58	61.41
1.5 AW	1,094.26	100	90.59	82.10	74.47	67.60	61.44
2 AW	1,457.28	100	90.58	82.05	74.39	67.50	61.32
3 AW	2,177.90	100	90.57	82.04	74.39	67.51	61.33
6 AW	4,326.35	100	90.49	81.92	74.24	67.35	61.15

Panel D: Post-interruption wage penalty; Ascending wage profile

Earnings profiles	Baseline		Duration of Unemployment				
	Pension EUR	Index	1	2	3	4	5
MW	724.45	100	90.47	81.87	74.12	67.15	60.91
0.75 AW	1,040.82	100	90.36	81.64	73.79	66.73	60.38
AW	1,386.02	100	90.35	81.64	73.81	66.76	60.42
1.5 AW	2,075.25	100	90.39	81.64	73.77	66.70	60.34
2 AW	2,760.79	100	90.34	81.62	73.77	66.72	60.36
3 AW	4,129.51	100	90.33	81.56	73.68	66.59	60.23
6 AW	8,213.58	100	90.24	81.45	73.56	66.47	60.10

Source: Author's calculations; *Notes:* Duration of unemployment spells measured in years; The baseline denotes normalisation to full career.

The gross pension of a worker who earns the baseline AW and interrupts his career for one to five years would now drop by an amount ranging between 0.24% and 1.80% relative to a full-career worker (Table 3, Panel A), a drop which is slightly higher when compared to equivalent unemployment periods occurring early in the contribution career (Table 2, Panel A).

For AW workers with an ascending wage profile, the gap relative to full-career workers continues to be lower when compared to baseline earnings profiles but now with by a smaller amount when compared to that computed for early in life unemployment spells. Unemployment breaks reduce gross pensions by an amount ranging between 0.18% and 1.41% for one to five-year unemployment periods (Table 3, Panel B). The effect of unemployment breaks on pension entitlements continues to be higher for medium to high-income earners and lower for low (minimum wage) earners, and is positively correlated with the duration of unemployment periods.

The impact of unemployment spells occurring at the middle of the contribution career increases dramatically when earnings scarring effects become relevant, particularly for longer unemployment breaks (Table 3, Panel C and D). The gross pension of a worker earning the baseline AW throughout life and interrupting his career for one to five years would in this case drop by an amount ranging between 9.42% and 38.59% relative to a worker who has not interrupted his career (Table 3, Panel C), or by an amount ranging between

9.65% and 39.58% for AW workers with an ascending wage profile (Table 3, Panel D). Scarring effects have a slightly lower impact on gross pensions when compared to unemployment spells taking place early in the contribution career because the lower trajectory for future earnings after re-engagement will affect a smaller number of contribution years at the time of computing initial pension benefits.

Moving finally to the impact of single unemployment spells of different duration taking place late in the contribution career, in pre-retirement ages (between ages 62 and 66), drops in old-age pensions become comparatively higher than those estimated for breaks occurring early or at the middle of the contribution career, particularly for those cases where unemployed workers can re-enter the job market few years later at the then corresponding average wage. For instance, the gross pension of a worker who earns the baseline AW and interrupts his career for one to five years would in this case drop by an amount ranging between 0.94% and 4.95% relative to a full-career worker (Table 4, Panel A), or by an amount ranging between 1.91% and 12.97% for AW workers with an ascending wage profile (Table 4, Panel B). For one-year unemployment breaks this pension drop is more than four (fifteen) times higher than that of an equivalent break taking place at the beginning of the contribution career for a baseline (ascending) earnings profile.

Table 4. Initial gross pension benefits and relative gross pension entitlements for single unemployment spells occurring at the end of the contribution career

Panel A: No post-interruption wage penalty; Baseline earnings profile

Earnings profiles	Baseline		Duration of Unemployment				
	Pension EUR	Index	1	2	3	4	5
MW	383.72	100	98.78	98.78	98.78	98.78	98.78
0.75 AW	548.75	100	99.07	98.19	97.36	96.30	95.09
AW	731.03	100	99.06	98.17	97.32	96.27	95.05
1.5 AW	1,094.26	100	99.06	98.13	97.26	96.18	94.96
2 AW	1,457.28	100	99.05	98.11	97.24	96.17	94.94
3 AW	2,177.90	100	98.97	98.00	97.11	96.03	94.81
6 AW	4,326.35	100	98.89	97.89	96.99	95.90	94.68

Panel B: No post-interruption wage penalty; Ascending wage profile

Earnings profiles	Baseline		Duration of Unemployment				
	Pension EUR	Index	1	2	3	4	5
MW	724.45	100	97.59	94.89	92.12	88.98	85.44
0.75 AW	1,040.82	100	98.09	95.88	93.43	90.46	87.03
AW	1,386.02	100	98.09	95.87	93.42	90.46	87.03
1.5 AW	2,075.25	100	98.00	95.75	93.27	90.29	86.83
2 AW	2,760.79	100	97.95	95.67	93.17	90.20	86.75
3 AW	4,129.51	100	97.92	95.63	93.12	90.12	86.66
6 AW	8,213.58	100	97.86	95.54	93.01	90.01	86.55

Panel C: Post-interruption wage penalty; Baseline earnings profile

Earnings profiles	Baseline		Duration of Unemployment				
	Pension EUR	Index	1	2	3	4	5
MW	383.72	100	98.78	98.78	98.78	98.78	98.78
0.75 AW	548.75	100	96.60	96.14	95.74	95.42	95.09
AW	731.03	100	96.59	96.11	95.70	95.35	95.05
1.5 AW	1,094.26	100	96.59	96.08	95.64	95.27	94.96
2 AW	1,457.28	100	96.58	96.06	95.62	95.25	94.94
3 AW	2,177.90	100	96.50	95.95	95.50	95.12	94.81
6 AW	4,326.35	100	96.41	95.84	95.38	95.00	94.68

Panel D: Post-interruption wage penalty; Ascending wage profile

Earnings profiles	Baseline		Duration of Unemployment				
	Pension EUR	Index	1	2	3	4	5
MW	724.45	100	93.70	89.34	86.80	85.80	85.44
0.75 AW	1,040.82	100	94.28	90.42	88.18	87.40	87.03
AW	1,386.02	100	94.27	90.40	88.17	87.39	87.03
1.5 AW	2,075.25	100	94.19	90.29	88.02	87.21	86.83
2 AW	2,760.79	100	94.13	90.19	87.92	87.13	86.75
3 AW	4,129.51	100	94.09	90.15	87.85	87.04	86.66
6 AW	8,213.58	100	94.01	90.03	87.73	86.93	86.55

Source: Author's calculations; *Notes*: Duration of unemployment spells measured in years; The baseline denotes normalisation to full career.

The main explanation for this effect lies in the old-age pension benefit formula which for cohorts retiring until the end of 2016 assigns considerable more weight to the best 10 out of the last 15 contribution years, i.e., those affected by unemployment breaks. In upward sloping continuous earnings profiles the last contribution years will be the ones with higher salaries. In the event of a late unemployment spell, those years are likely to be excluded in the computation of initial pension benefits once they are not likely to be part of the 10 best out of the last 15 contribution years, despite the mitigating effect of pension credit mechanisms that consider unemployment benefits as labour income.

The importance of scarring effects on gross pension entitlements is comparatively less severe for unemployment spells occurring late in the contribution career since the number of earning and contribution years affected (and the subsequent compounding effect) is, in this case, marginal and the current Portuguese old-age pension formula is likely to exclude them at the time of calculating the initial pension. The gross pension of a worker earning the baseline AW and interrupting his career for one to five years would in this case drop by an amount ranging between 3.41% and 4.95% relative to full-career worker (Table 4, Panel C), or by an amount ranging between 5.73% and 12.97% for AW workers with an ascending wage profile (Table 4, Panel D). Scarring effects have a much lower impact on gross pensions when compared to unemployment spells taking place early or at the middle of the contribution career as can be seen by comparing Panels C and D in Table 4 with their counterparts in Tables 2 and 3. The effect of unemployment breaks on pension entitlements continues to be higher for medium to high-income earners and lower for minimum wage earners, and the higher the duration of unemployment periods. For low earners, minimum pension clauses significantly reduce the effect of unemployment breaks on gross pension benefits.

In Table 5 we represent the impact of multiple unemployment spells occurring «simultaneously» at the beginning, middle and end of the contribution career on gross pension entitlements for representative workers with alternative earnings levels and profiles. In every Panel, columns 4 to 8 now represent the relative gross pension for a worker whose contribution career was interrupted for a period of one to five years three times during his working life. This means the duration of unemployment spells ranges now between a minimum of three years (column 4) and a maximum of fifteen years (column 8). For instance, column 4 refers to relative gross pension entitlements of workers who were unemployed for one year three times during the career: one at the beginning, another one at the middle and the last one just before retiring.

Table 5. Initial gross pension benefits and relative gross pension entitlements for multiple unemployment spells of different duration

Panel A: No post-interruption wage penalty; Baseline earnings profile

Earnings profiles	Baseline		Duration of each one of unemployment spells				
	Pension EUR	Index	1	2	3	4	5
MW	383.72	100	98.78	98.78	98.78	98.78	98.78
0.75 AW	548.75	100	98.72	97.31	95.84	94.05	92.03
AW	731.03	100	98.60	97.11	95.58	93.76	91.73
1.5 AW	1,094.26	100	98.59	97.05	95.50	93.67	91.64
2 AW	1,457.28	100	98.58	97.01	95.43	93.58	91.55
3 AW	2,177.90	100	98.46	96.83	95.23	93.39	91.35
6 AW	4,326.35	100	98.24	96.52	94.89	93.04	90.99

Panel B: No post-interruption wage penalty; Ascending wage profile

Earnings profiles	Baseline		Duration of each one of unemployment spells				
	Pension EUR	Index	1	2	3	4	5
MW	724.45	100	97.31	94.17	90.85	87.09	82.93
0.75 AW	1,040.82	100	97.81	95.21	92.28	88.77	84.75
AW	1,386.02	100	97.78	95.16	92.23	88.74	84.73
1.5 AW	2,075.25	100	97.70	95.01	92.02	88.49	84.45
2 AW	2,760.79	100	97.62	94.91	91.94	88.43	84.41
3 AW	4,129.51	100	97.55	94.78	91.76	88.21	84.17
6 AW	8,213.58	100	97.40	94.59	91.55	88.01	83.99

Panel C: Post-interruption wage penalty; Baseline earnings profile

Earnings profiles	Baseline		Duration of each one of unemployment spells				
	Pension EUR	Index	1	2	3	4	5
MW	383.72	100	98.78	98.78	98.78	79.02	79.02
0.75 AW	548.75	100	79.07	69.07	69.07	64.98	63.47
AW	731.03	100	78.79	64.09	53.08	49.55	48.16
1.5 AW	1,094.26	100	78.79	63.98	52.02	42.46	34.68
2 AW	1,457.28	100	78.76	63.93	52.03	42.36	34.59
3 AW	2,177.90	100	78.77	63.96	51.94	42.27	34.49
6 AW	4,326.35	100	78.53	63.61	51.62	42.00	34.26

Panel D: Post-interruption wage penalty; Ascending wage profile

Earnings profiles	Baseline		Duration of each one of unemployment spells				
	Pension EUR	Index	1	2	3	4	5
MW	724.45	100	76.36	59.48	52.32	41.86	41.86
0.75 AW	1,040.82	100	76.72	59.98	47.71	38.94	33.56
AW	1,386.02	100	76.69	59.87	47.56	38.41	31.24
1.5 AW	2,075.25	100	76.66	59.83	47.51	38.38	31.16
2 AW	2,760.79	100	76.64	59.82	47.52	38.36	31.15
3 AW	4,129.51	100	76.52	59.65	47.37	38.26	31.07
6 AW	8,213.58	100	76.35	59.44	47.14	38.00	30.81

Source: Author's calculations; *Notes*: Duration of each one of the three unemployment spells measured in years; The baseline denotes normalisation to full career.

As expected, the impact of multiple unemployment breaks on old-age pensions is more significant than its single-break counterparts, especially for baseline earnings profiles, even when unemployed workers are able to re-enter the job market few years later at the then corresponding average wage. The gross pension of a worker who earns the baseline AW and interrupts his career for three to fifteen years would now drop by an amount ranging between 1.40% and 8.27% relative to a full-career worker (Table 5, Panel A), or by an amount ranging between 2.22% and 15.27% for AW workers with an ascending wage profile (Table 5, Panel B).

The initial pension of low earners is, in this case, less protected by minimum wage clauses in the event of longer total unemployment periods (12 and 15 years). This is because according to the Portuguese pension system rules the minimum contributory pension for contribution periods between 21 and 31 years is only 303.23 EUR, a significant drop from the 379.04 for contribution periods exceeding 31 years. As a result, the relative pension of workers earning the MW and facing several unemployment spells of 4 or 5 years every time will be 20.98% lower than their full-career counterparts. The effect of unemployment breaks on pension entitlements continues to be higher for medium to high-income earners and lower for low (minimum wage) earners and the higher the duration of unemployment periods.

The impact of unemployment breaks on gross pensions increases substantially when scarring effects are taken into consideration, particularly for baseline medium and high earners. The gross pension of a worker earning the baseline AW throughout life and interrupting his career for three to fifteen years would in this case drop by an amount ranging between 21.21% and 51.84% relative to a worker who has not interrupted his career (Table 5, Panel C), or by an amount ranging between 23.31% and 68.76% for AW workers with an ascending wage profile (Table 5, Panel D).

The effect of unemployment breaks on relative gross pensions is generally less severe for low income earners. This is because implicit redistributive mechanisms such as those beyond pension benefit calculation rules, minimum pensions and, in some cases, resource-tested schemes play a key role in guaranteeing adequate pensions. In the typical cases under consideration, redistribution essentially plays a role for low earnings profiles. For medium and high labour income earners, the empirical evidence of redistributive mechanisms in the pension calculation rules is less significant when we compare interrupted career and full-career profiles.

4. An illustrative simulation for Spain

The Spanish Social Security pensions scheme offers comprehensive retirement and derived contingencies benefits to virtually all private sector workers (salaried and self-employed workers) and public officials not covered by the General Government Public Servants scheme (Bravo and Herce, 2014).

Receiving a "full" old-age pension requires long contribution careers (around 35 years) but only the last 20 years pensionable wages, prior to retirement day, are taken for the computation of pension rights.[8] This implies that unemployment or inactivity periods occurred before the computation period starts biding have no effect on pensionable wages actually entering the pension formula even if they do have an effect in the length of the contributions career that also determine the retirement benefits amount (see Section 4.1 below for an explanation of the Spanish pension formula).

The Spanish public pension system, however, has clear provisions for granting contribution credits to workers that have suffered employment breaks during the above mentioned computation period. In the first lieu, if these employment breaks happen because of unemployment, and during these unemployment spells workers are effectively under unemployment insurance or assistance schemes, their contributions are taken in charge by the unemployment programme.[9] Secondly, when these breaks are due to general inactivity or out of benefits unemployment, workers are credited with imputed contributions amounting to the minimum contribution wage for the closest (to retirement) 48 months and half that minimum contribution wage for the remaining.[10] Actually, this amounts to a "gift" that the Social Security system makes to salaried workers that have temporarily interrupted their labour careers.

4.1 Assumptions and basic data

In what follows the cases of typical workers that have suffered employment breaks are simulated. These cases are built upon the following assumptions:

o Typical workers are affiliated to the "*Régimen General*" of the Social Security scheme. These are salaried workers both in the private and public sectors and are the large majority of those in employment in Spain.

o Typical workers' cases include average wage (AW), minimum wage (MW), and 0.5, 2x and 4x average wage earners.

o These workers (in the baseline) have a full contribution career of 35 years started in 1997 and retire at 65 the first of January 2016 (or 31st December 2015, for the sake or applicable law).

o In the "employment-breaks" scenarios, their contribution careers are impacted by unemployment spells of 2 and 5 years' duration. They all may have 1 unemployment spell at early career time, 1 unemployment spell later, or both. Earlier or later meaning before or after the current "computation period" mark of 19 years before retirement.[11]

o All retirement pensions computations are based on the current pension formula that works in the following manner in the baseline case (no employment-breaks):

(i) Pensionable wages (limited by a floor and a roof) of the last 19 years prior to retirement (i.e. from 1997 to 2015) enter the formula. These pensionable wages coincide with actual wages that are above the minimum pensionable wage or below the maximum pensionable wage (see Figure 4 below).

(ii) Pensionable wages for the last two years are taken at nominal value, whereas pensionable wages for the previous years are brought to present value (as of 2015) using the official (CPI) inflation rate.

(iii) The average present value pensionable wage (the "*Base Reguladora*", in Spanish) is then computed.

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[8] As of 2017 this "computation period" is set at 20 years and is gradually increasing one year every year until 2022 when it will stay at 25 years. Debate is emerging in Spain about bringing this period up to the whole contributions career whatever its length.

[9] Unemployment insurance benefits can be received for up to 24 months. Once these benefits terminated, and if the worker has dependent persons in his/her household, and passes an earnings test, an unemployment subsidy may be granted for up to another 30 months.

[10] Self-employed workers however cannot use this rule to fill employment breaks into their contribution records if out of activity. For them, contribution wages for these periods are set to cero in the pension formula.

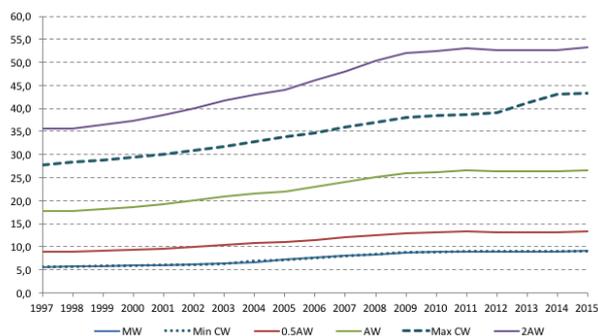[11] 20 years as of 2017, and increasing one year every year to reach 25 years in 2022.

(iv) Full retirement pension is computed as 100% of the *Base Reguladora* as no early retirement or shorter than full contributions careers, nor delayed retirement are considered. Had these situations be taken, they would imply actuarial penalties per quarter in which retirement had been advanced and/or full contribution career shortened and premiums would have accrued to retirees who delayed their retirement beyond the reference retirement age.

(v) Initial retirement pensions on yearly bases are computed considering legal provisions concerning minimum and maximum limits for the scheme's standard case as of 2015 (see Figure 5 below).

o Employment-breaks are treated following the current law so that, when they happen, workers receive contribution credits based on the minimum contribution wage if breaks happen during the closest (to retirement) 48 months and half the contribution wage otherwise. When breaks happen before the 19 (before retirement) years mark for the pension "computation period", that is, at earlier times in the contribution career, they have no impact on initial pensions at all. For tis breaks integration to be possible they must happen "in-between" ordinary contributions spans and within the computation period prior to retirement.

In Figure 4 below, the evolution of the wage categories considered as well as of contribution wages (CW) is pictured. It's immediately identifiable that minimum contribution wage is very close to minimum wage whereas maximum contribution wages are sensibly lower than 2x average wage by 18,8% (in 2015), notwithstanding the fact that contribution wages have been growing faster than actual wages in recent years.
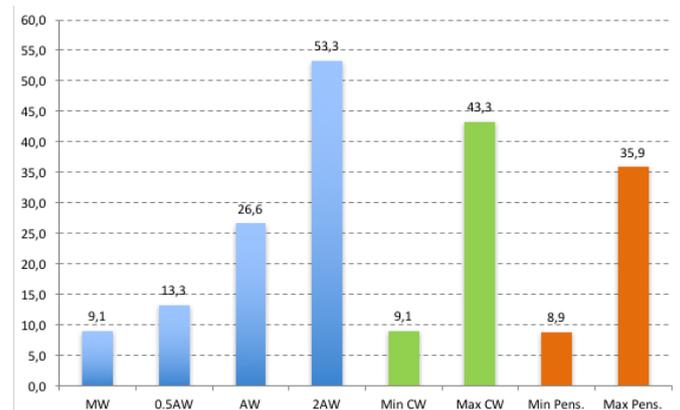
Figure 4. Wages and Contribution Wages in Spain 1997 - 2015 (in EUR 10³)

Source: Author's calculations based on Spanish Social Security data;
Legend. MW: minimum wage; Min/Max CW: minimum/maximum contribution wage; AW: average wage.

Figure 5, below, presents, as of 2015, the minimum wage, average wage (and multiples), contribution wage and initial retirement pension (minimum and maximum limits for both) applicable for this illustrative exercise.

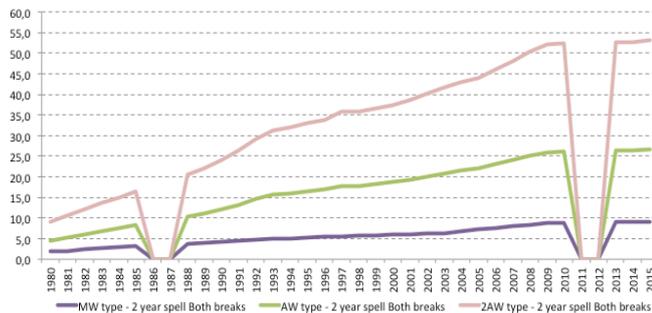**Figure 5. Wages and Contribution Wages in Spain 2015** (in EUR 10³)

Source: Author's calculations based on Spanish Social Security data;
Legend. MW: minimum wage; AW: average wage; Min/Max CW: minimum/maximum contribution wage; Min/Max Pens.: minimum/maximum initial retirement pension.

It's also immediately clear that minimum wage, minimum contribution wage and initial retirement pensions are very close, not being this the case between 2x average wage and maximum contribution wage. It's however interesting to note that minimum pension is only 2,2% lower than minimum contribution wage (and minimum wage) whereas maximum pension is 17,1% lower than maximum contribution wage. Very clearly, this shows the redistributive part of the Spanish Social Security pensions system.

Finally, Figure 6 presents wage profiles for the types of workers and employment-breaks considered in this exercise. For the sake of simplicity only earnings profiles with both employment breaks are shown. In fact, both the early and the late career breaks can be singled out easily from the graphs. It is assumed that these contribution gaps are caused by unemployment if the worker is not entitled to receive unemployment insurance or assistance benefits. Were this the case, they would receive benefits that would replace lost wages at around 70% or more and, at the same time, the unemployment programme would pay social security contributions on their behalf throughout all the unemployment spell provided the unemployment duration is shorter than two years (in the general case, as there are exceptions to this rule) so that no severe impact on their future pensions would result.
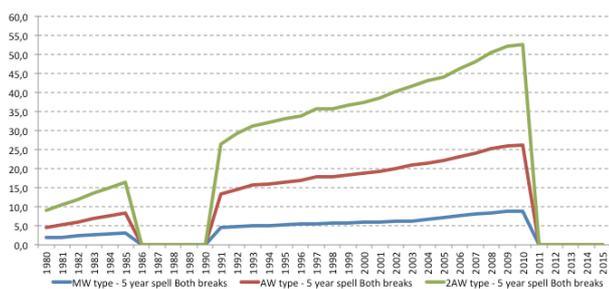
Figure 6
A. Earnings profile of typical workers that experience one early and one latter 2 years' employment-break (being this out of benefits unemployment)

Source: Author's calculation based on data from the Spanish Statistical Office
Legend: MW, minimum wage; AW, average wage.

B. Earnings profile of typical workers that experience one early and one latter 5 years' employment-break (being this out of benefits unemployment)

Source: Author's calculation based on data from the Spanish Statistical Office
Legend: MW, minimum wage; AW, average wage.

Earnings profiles shown in Figure 6 convey the message that in the absence of a contribution credit rule, that somehow compensates for lack of contributions during employment breaks, future initial retirement pensions could suffer significant reductions with respect to those of workers that have completed their contribution careers without interruption.

4.2 Results and discussion

If a Spanish worker experiences employment breaks within his or her contributions career but out of the "computation period" used to form the Base Reguladora, or average present value pensionable wage, there is no way to fill this up. If, however, one or more employment breaks occur within this period, there is a contribution

credit rule that partially fills the break period with imputed contributions that amount to the minimum pensionable wage for the first 48 month and half this amount for the rest. As we have seen before, minimum pensionable wage has been very close to minimum wage, but has evolved far below earnings at even average wage. So, it should be expected that, for a large majority of workers, employment breaks may have significant impact on their future initial retirement pensions.

Table 6 below exhibits the main results obtained for the simulations explained in the previous section. Panel A presents the amount in euros per year for minimum wage, average wage and 2x average wage earners and for workers that have not experienced breaks (full career) or have experienced one or two breaks of 2 or 5 years' duration. Panel B, while keeping the same structure of the data, presents initial pension for all categories of workers that experience breaks relative to the corresponding wage category of worker that has not experienced labour-breaks during his or her contribution career.

Table 6
A. Initial retirement pension (euros) - 2016

	Earnings category		
	MW	**AW**	**2AW**
Full career	9.265	28.303	35.942
Early break (2y)	8.950	27.341	34.720
Late break (2y)	9.245	28.267	35.942
Both breaks (2y+2y)	8.930	27.305	34.720
Both breaks (5y+5y)	8.300	21.210	31.516

B. Initial retirement pension relative to no breaks case - 2016

	Earnings category		
	MW	**AW**	**2AW**
Full career	100,00	100,00	100,00
Early break (2y)	96,60	96,60	96,60
Late break (2y)	99,78	99,87	100,00
Both breaks (2y+2y)	96,39	96,48	96,60
Both breaks (5y+5y)	89,58	74,94	87,69

Source: author's computations

First thing to be noted is that the existence of contribution credits arrangements significantly protects workers from losing pension entitlements even if average wage earners that experience longer duration breaks may suffer disproportionately. But, for workers earning well above or below average wages, the impact of labour breaks on initial future pensions is greatly reduced because of the role played by lower and upper retirement pension limits.

5. Conclusions

Ample literature shows that workers may experience several unemployment spells of varying durations through their working lifecycles. This, of course, has strong implications for their income during those periods out of work. Most countries have unemployment protection that replaces to a certain extent lost labour income for average duration spells. Less known, even if a series of reference papers have been written providing the basis for this analysis, are the consequences of employment-breaks (due to unemployment or inactivity) for the acquisition of pension rights and, consequently, for future initial pensions. Anecdotal evidence is also overwhelming that employment-breaks may be both seriously detrimental or very limited for workers' future pension rights depending on the pension scheme and/or country where workers generate their retirement pensions, as some countries lack or have Social Security rules for filling up contribution gaps due to employment-breaks if or while workers are protected by unemployment insurance. Also, given accrual periods and pension formulas, early in life unemployment spells may not end up having consequences for future pensions.

This paper assessed the impact of shorter, more fragmented careers on the initial pension benefits from public mandatory schemes in Portugal and Spain, taking into account the timing and duration of non-employment spells, the existence of pension credit mechanisms to compensate the contribution gap, alternative lifecycle labour earnings profiles, the significance of restoration effects, several layers of earnings profiles and other redistributive mechanisms in pension systems. We provide detailed simulations results for Portugal and more illustrative benchmark cases for Spain.

The empirical results show that the impact of single unemployment spells of different duration occurring early in the contribution career on the gross pension entitlements of low-, average-, and high-earning workers is small if unemployed workers are able to find a new job maintaining their relative pay. The importance of no post-interruption penalty for wages is more relevant for ascending wage profiles compared to the baseline benchmark career. The impact of single unemployment spells on pension entitlements is more significant when job displacement is followed by a lower trajectory for future earnings after re-engagement, and the higher the longer the duration of unemployment periods. Not surprisingly, for baseline minimum wage earners career-

breaks have little marginal effect on gross pension entitlements irrespectively of the magnitude of scarring effects. This is because of both minimum wage legislation, pension credit mechanisms and the way unemployment insurance benefits are computed.

The impact of single unemployment spells of different duration taking place at the middle of the contribution career continue not to be very significant when unemployed workers are able to rejoin the labour market with minor wage penalties, but increase substantially when earnings scarring effects become relevant, particularly for longer unemployment breaks. Single unemployment spells of different duration taking place in pre-retirement ages have a higher impact on pension benefits when compared to those occurring early or at the middle of the contribution career. The importance of scarring effects on gross pension entitlements is comparatively less severe for unemployment spells occurring late in the contribution career due to the number of earning and contribution years affected and DB pension formulas.

The impact of multiple contribution gaps on old-age pensions is more significant than their single-break counterparts, especially for baseline earnings profiles, even when unemployed workers are able to re-enter the job market few years later at the then corresponding average wage. The initial pension of low earners can, in this case, be less protected by minimum wage clauses in the event of longer total unemployment periods if minimum pensions are directly linked to contributory periods. The impact of multiple unemployment-breaks on pensions increases substantially when scarring effects are taken into consideration. The existence of contribution credits arrangements significantly protects workers from losing pension entitlements even if average wage earners that experience longer duration breaks may suffer disproportionately.

Given the differences and similarities of Social Security arrangements in both countries, and the span of the assumptions made to represent typical cases, we can show that indeed some workers may suffer disproportionately from previous employment-breaks while others would hardly have any impact. This depending on when breaks occurred, their duration, which earnings bracket the worker was in and whether workers were protected by imputed contributions rules during unemployment spells and/or their pensions were affected by binding minimum and maximum limits.

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Appendix: Old age, unemployment and parenthood schemes in Portugal

Old-age Pension Benefit calculation in Portugal

The calculation of pension benefits (P) in the Portuguese earnings related public pension schemes is based on the following general defined benefit formula:

$$P = RE \times A \times SF \times (1 \pm \pi) \qquad (1)$$

where RE denotes the Reference Earnings, A the Accrual Rate, SF the (demographic) Sustainability Factor and π represents a bonus (penalty) for late (early) retirement.

The reference earnings are calculated by averaging monthly earnings for all years of coverage up to 40 years[12], adjusted according to the consumer price index (CPI) without considering the housing prices[13]. The accrual rate is 2% of the earnings base for each year of contributions for 20 or fewer years' contributions, with a lower limit of 30%. For beneficiaries with 21 or more years of contributions, the accrual rate ranges between 2% and 2.3% depending on individual earnings relative to the value of the IAS (Indexante dos Apoios Sociais – Social Support Index; EUR 419.22 in 2015), as follows

Reference Earnings/IAS	≤1.1	]1.1,2.0]	]2.0,4.0]	]4.0,8.0]	>8.0
Accrual rate (%)	2.3	2.25	2.2	2.1	2.0

For a given value of RE, the corresponding pension formula is then:

RE/IAS	Pension Formula
≤1.1	$P = RE \times 2{,}3\% \times N \times SF \times (1 \pm \pi)$
]1.1,2.0]	$P = (1{,}1IAS \times 2{,}3\% \times N) + [(RE - 1{,}1IAS) \times 2{,}25\% \times N] \times SF \times (1 \pm \pi)$
]2.0,4.0]	$P = (1{,}1\,IAS \times 2{,}3\% \times N) + (0{,}9\,IAS \times 2{,}25\% \times N) + [(RE - 2IAS) \times 2{,}2\% \times N] \times SF \times (1 \pm \pi)$
]4.0,8.0]	$P = (1{,}1IAS \times 2{,}3\% \times N) + (0{,}9IAS \times 2{,}25\% \times N) + (2IAS \times 2{,}2\% \times N) + [(RE - 4IAS) \times 2{,}1\% \times N] \times SF \times (1 \pm \pi)$
>8.0	$P = (1{,}1IAS \times 2{,}3\% \times N) + (0{,}9IAS \times 2{,}25\% \times N) + (2IAS \times 2{,}2\% \times N) + (4IAS \times 2{,}1\% \times N) + [(RE - 8IAS) \times 2\% \times N] \times SF \times (1 \pm \pi)$

Note: N = number of contributions years

The pensionable earnings measure was the best 10 of the final 15 years. This measure is being extended and will be lifetime average earnings from 2017. For a transitional period, pensions are calculated by a weighted average *(pro rata)* of the previous method (2% of average annual earnings for the best 10 calendar years out of the last 15 years multiplied by the total number of qualifying calendar years) and the current lifetime reference earnings method. This means for individuals retiring up to this date the former more generous pension formula will have a greater weight on the calculation of initial pension benefits.

Those already paying contributions by 31 December 2001 and who meet the eligibility conditions for old-age pension at that date will have their pension calculated on the basis of the most favourable of three possible formulas:

1. applying the previous rules (2% accrual for each year of contributions and earnings being those of the best ten years of the final 15 years);

2. applying the new rules described above to the entire contributory career;

3. *pro rata* application of both rules according to the contributory career.

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[12] Whenever the number of calendar years with earnings registration is higher than 40, only the best 40 annual earnings years will be considered in the calculation of the reference earnings.

[13] In calculating lifetime reference earnings, the annual earnings registered after 1 January 2002 are adjusted by applying an index resulting from the weighting of 75% of the CPI, and 25% of the average evolution of the earnings which underlie the contributions stated to the social security, whenever this evolution is higher than the CPI. The annual adjustment index cannot, however, be higher than the CPI, plus 0.5%.

Those already paying contributions by 31 December 2001, but who have not met the eligibility conditions for old-age pension at that date, will have their pension calculated from the most favourable of the three formulas, if they retire between 2002 and 2016; or by the most favourable of formulas (2) and (3), if they retire after 31 December 2016. People who joined the system after 2002 will be fully covered by the new rules.

The sustainability factor is a demographic factor designed to adjust pension benefits to longevity changes. This factor is calculated on an annual basis by dividing overall population life expectancy at age 65 in 2000 (previously 2006) and the one recorded in the year before the pension claim, i.e.,

$$SF_t = \frac{e_{65,2000}}{e_{65,t-1}} \qquad (2)$$

The sustainability factor is now taken into account in the benefit formula only in the case of early retirement or (except for some particular cases) when disability pensions are converted into old-age pensions (currently at age 65).

The statutory retirement age was 66 years in 2014 and 2015 and has increase to 66 years and two months in 2016. This development follows the automatic process of adjusting the normal age of retirement by two-thirds of gains in life expectancy from age 65 measured as the average of the previous two years. The statutory retirement age can be reduced by four months for each year of contributions exceeding 40 years when the beneficiary turns 65 years of old.

Early pensions are penalized by the sustainability factor plus an additional penalty of 0.5% for each month in anticipation of the statutory retirement age. Deferred pensions are increased for each additional calendar month of contributions from the statutory retirement age to age 70 by a monthly bonus rate, given that the insured person claims the old-age pension when he/she is older than the statutory retirement age and has at least 15 calendar years with earnings registration relevant to the pension calculation. The monthly bonus rate varies according to the number of calendar years with earnings registration completed by the insured person at the time of pension claim, as follows:

Contributory career (years)	Monthly bonus rate (%)
15 to 24	0.33
25 to 34	0.5
35 to 39	0.65
≥ 40	1.00

The *minimum pension* is either 30% of the reference earnings used for pension calculation or a fixed monthly amount according to the number of contribution years (as detailed in the following table), whichever is greater

Contributory career (years)	Monthly pension (EUR)
< 15	261.95
15 to 2	274.70
21 to 30	303.23
≥ 31	379.04

The maximum pension is 92% of the reference earnings.

Unemployment insurance and assistance benefits in Portugal

In Portugal *unemployment insurance benefits* are granted only to those involuntarily unemployed that are not working, registered as job seeker with the job centre, fully capable of working, available and actively looking for work, are not in receipt of an invalidity or old-age pension and reside in Portugal. The unemployment insurance benefit (*subsídio de desemprego*) corresponds to 65% of reference wage, reduced by 10% after 180 days. The amount is increased by 10% in situations where both spouses (or both persons living in a de facto relationship) draw unemployment benefits and have dependent children, or when the unemployment-benefit recipient is the head of a single-parent household and fails to receive alimony.

The benefit cannot be higher than 75% of the net value of the reference wage taken into account for the purposes of calculating the benefit or the equivalent of 2.5 times the indexing reference of social support IAS (*indexante dos apoios sociais* = €419.22) and lower than the IAS unless the net value of the reference wage is below that level. In this case, the benefit amount corresponds to the reference wage. Unemployment allowance (*subsídio social de desemprego*) corresponds to 100% of the IAS for the unemployed with dependants and 80% for those living alone. Unemployment benefits are not automatically indexed by law.

The duration of unemployment insurance benefits is proportional to age and length of contribution as follows:

Age in Years	Contribution period	Duration of unemployment insurance benefit
< 30	< 15 months	150
	≥ 15 months and < 24 months	210
	≥ 24 months	330 days; 30 extra days every 5 years of registered income during the last 20 years preceding unemployment.
[30,40[	< 15 months	180
	≥ 15 months and < 24 months	330
	≥ 24 months	420 days; 30 extra days every 5 years of registered income during the last 20 years preceding unemployment.
[40,50[	< 15 months	210
	≥ 15 months and < 24 months	360
	≥ 24 months	540 days; 45 extra days every 5 years of registered income during the last 20 years preceding unemployment.
≥ 50	< 15 months	270
	≥ 15 months and < 24 months	480
	≥ 24 months	540 days; 60 extra days every 5 years of registered income during the last 20 years preceding unemployment.

Source: Author's preparation based on current legislation.

The duration of *unemployment assistance benefits* is according to age and length of contribution period, with the same periods as for unemployment insurance. If unemployment assistance is granted after the exhaustion of unemployment benefit, the duration of payment is halved for beneficiaries aged under 40. For other types of beneficiaries, same periods as for unemployment insurance.

Maternity, paternity and parenthood benefits in Portugal

In Portugal, Maternity, paternity and parenthood benefits include initial and extended parental and adoption leaves, exemption from work to protect the health and safety of pregnant women, women who have just given birth and women breastfeeding and leave for the care of grandchildren.

The duration of paid maternity/paternity leave is:

Initial parental leave (licença parental inicial): 120 or 150 consecutive days of leave, according to the parents' choice, which can be divided between them after birth, except for the leave reserved for the mother. The duration of the leave is extended by 30 days in case of shared leave, provided each parent takes a leave of 30 consecutive days, or two periods of 15 consecutive days, after the compulsory leave reserved for the mother; in case of multiple births, 30 days extra per child.

Initial parental leave reserved for the mother (licença parental inicial exclusiva da mãe): Up to 30 days of voluntary leave prior to childbirth and 6 weeks of compulsory leave after childbirth. These periods form part of the initial parental leave.

Initial parental leave in the event of one of the parents being prevented from taking leave (licença parental inicial de um progenitor em caso de impossibilidade do outro): In case of death or physical or mental incapacity of one of the parents: until the end of the initial parental leave to which that parent was still entitled; in case of mother's death or incapacity: a minimum of 30 days of initial parental leave for the father; in case a non-working mother dies or becomes incapacitated during the 120 days following the birth, the father has the same entitlement.

Initial parental leave reserved for the father (licença parental inicial exclusiva do pai): Compulsory leave of 10 days, of which 5 days must be taken consecutively immediately after birth and 5 days during the subsequent 30 days. After this period, voluntary leave of 10 days, consecutive or not, to be taken during the initial parental leave of the mother.

Extended parental leave (licença parental alargada): to take care of children, granted either to the mother or to the father or to both parents alternately, in the 3 months immediately following the expiry of the initial parental leave or the extended parental leave of the other parent.

Adoption leave (licença por adopção): corresponds, mutatis mutandis, to the initial parental leave and the extended parental leave; in case of death or physical or mental incapacity of the adoptive parent: until the end of the leave to which that parent was still entitled, with a minimum of 14 days, towards the spouse (if insured) (extended by 30 days for each adopted minor child).

Leave for clinical risk during pregnancy (licença em situação de risco clínico durante a gravidez): for the time necessary to prevent the occurrence of the risk.

Leave for termination of pregnancy (licença por interrupção da gravidez): for a period varying from 14 to 30 days.

Exemption from work to protect the health and safety of pregnant women, women who have just given birth and women breastfeeding (Dispensa da prestação de trabalho por parte de trabalhadora grávida, puérpera ou lactante, por motivo de protecção da sua segurança e saúde): granted if the woman works in dangerous health/security conditions or in the case of night-shifts.

Leave for the care of grandchildren (faltas para assistência a netos): granted to the grandparents for up to 30 consecutive days following the birth of grandchildren living in the same household and whose father or mother are less than 16 years old; or in lieu of the parents in case one of them is sick: until the end of leave to which that parent was still entitled.

The amount of the initial parental benefit (subsídio parental inicial) corresponding to a 120 days' leave, initial parental benefit reserved for the father (subsídio parental inicial exclusivo do pai), adoption benefit (subsídio por adopção), benefit for clinical risk during pregnancy (subsídio por risco clínico durante a gravidez), benefit for termination of pregnancy (subsídio por interrupção da gravidez) is provided as a daily allowance of 100% of the average daily wage (Christmas and holiday bonuses excluded), with a minimum amount of 50% of the IAS.

The initial parental benefit if a leave of 150 days was opted is provided as a daily allowance of 80% of the average daily wage. In case of opting for shared leave of 150 or 180 days, the daily allowance corresponds to 100% or 83% of the average daily wage, respectively. Extended parental benefit (subsídio parental alargado) provides a daily allowance of 25% of the average daily wage. Benefit payments in case of particular risks during pregnancy (subsídio por riscos específicos) provides a daily allowance of 65% of the average daily wage. Benefit for the care of grandchildren (subsídio para assistência a netos) is provided as a daily allowance of 100% or 65% of the average daily wage, according to whether it concerns care connected with birth or care for a disabled or chronically ill grandchild, respectively. The minimum amount of these allowances is 80% of 1/30 of the IAS, except for the extended parental benefit which is 40% of 1/30 of the IAS.