Finanz. polit. econ., ISSN: 2248-6046, Vol. 10, N.° 1, enero-junio, 2018, pp. 45-63
http://dx.doi.org/10.14718/revfinanzpolitecon.2018.10.1.2

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Received: *February 24, 2017*
Concept: *June 27, 2017*
Approved: *November 24, 2017*

Artículo de investigación

The reform of the Spanish public pension system: The sustainability factor

ABSTRACT

This paper analyzes the future impact of the implementation of the sustainability factor, introduced in the last reform of the Spanish public pension system. This factor aims to regulate the initial pension according to the evolution of life expectancy. Additionally, it examines what could have happened in case of an earlier implementation of the factor. The results show that the factor produces a progressive pension reduction if life expectancy continues to increase, and pension spending is adjusted to demographic evolution. Specifically, the initial pension could be reduced up to 23% in 2051 if the demographic trend does not change.

Keywords: intergenerational equality factor, sustainability factor, public pensions, reforms.

JEL: G11, G12, G23

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La reforma del sistema público de pensiones español: el factor de sostenibilidad*

RESUMEN

En este artículo se analiza el impacto que puede provocar la aplicación del factor de sostenibilidad introducido en la última reforma del sistema público de pensiones español, el cual pretende regular la pensión inicial según la evolución de la esperanza de vida. Adicionalmente, se analiza qué habría ocurrido si tal factor se hubiera aplicado anteriormente. Los resultados muestran que el factor produce una progresiva reducción de la pensión si la esperanza de vida continúa incrementándose y el gasto en pensiones se ajusta a la evolución demográfica. En concreto, la pensión inicial podría reducirse hasta un 23% en 2051 si la tendencia demográfica no cambia.

Palabras clave: factor de equidad intergeneracional, factor de sostenibilidad, pensiones públicas, reformas.

A reforma do sistema público previdenciário espanhol: o fator de sustentabilidade

RESUMO

Neste artigo, analisa-se o impacto que pode provocar a aplicação do fator de sustentabilidade introduzido na última reforma do sistema público previdenciário espanhol, o qual pretende regulamentar a pensão inicial segundo a evolução da expectativa de vida. Além disso, analisa-se o que teria ocorrido se esse fator tivesse sido aplicado anteriormente. Os resultados mostram que o fator produz uma progressiva redução da pensão se a expectativa de vida continuar aumentando, e o gasto em pensões se ajustar à evolução demográfica. Em específico, a pensão inicial poderia ser reduzida até 23% em 2051 se a tendência demográfica não mudar.

Palavras-chave: fator de equidade, fator de sustentabilidade, intergeracional, previdência pública, reformas.

INTRODUCTION

In recent decades, the population of Western countries has experienced great demographic changes, among which can be highlighted the increased life expectancy, population ageing, and increased dependency rate.. These changes are raising doubts about the future viability of public pension systems and, consequently, many Western countries—especially in Europe—have been implementing different reforms in their pension systems.

Over the last decade, the reforms carried out in the countries of the European Union have been parametric or structural; the first and most common ones are related to calculating public pension (delayed retirement age, change in base calculation); the second ones are those that modify the structure of the pension system, moving from pay-as-you-go systems (the quotes of workers finance current pensions) to capitalization systems (the quotes of each worker contribute to form their own pension) or mixed systems.

In the case of Spain, the reforms undertaken have been of a parametric nature on the current distribution system, including, among others, progressively delaying the retirement age to 67 years until 2027 and extending the number of years for pension calculation. Therefore, the Spanish public pension system is characterized by financing the retirement pensions of each generation with the contributions made by the generations that are active at that time (Jimeno, 2003). In addition, the amount of the public pension to be received at the time of retirement will depend on the contributions made to social security in the worker's working life over the last 35 years of the worker's working life; however, it should be clarified that in Spain there are also non-contributory pensions, such as orphanage and widowhood, whose purpose is to prevent poverty among the most disadvantaged people and among those who are not able to access stable jobs. This last type of benefit is in charge of the State budgets and is financed by taxes.

Therefore, the Spanish social security system is based on the principle of solidarity, where contributions from workers are not used to finance their own future retirement benefit, but to remunerate current pensions. This system depends to a large extent on demographics, that is why, as indicated by Bandrés and Cuenca (1998), it might not be able to guarantee benefits for future generations if the number of contributors is less than the number of retirees. Over the last few years, these demographic changes have become more evident, and the Spanish state has recurrently used the resources of the reserve fund to make timely payments of public pensions.

Consequently, the Spanish public pension system is currently facing two structural problems of great relevance: on the one hand, the progressive ageing of the population and, on the other, the considerable increase that is taking place in the dependency rate, understood as the relationship between the population susceptible of receiving a retirement pension and the active population.

Although these incidents are common in European countries, they are more pronounced in the Spanish case (Ayuso, Guillén & Valero, 2013). Specifically, predictions for 2049 (National Institute of Statistics [INE], 2009) indicate that most of Spanish society will be between 70 and 75 years old at this time, since the population over 64 years old will double in the next 40 years. This means that people of retirement age or very close to it will represent around 32% of Spanish society and the working age population will only be 18% of the current amount (Conde-Ruiz & Alonso, 2006, Domínguez *et al*., 2011).

Additionally, Spain will also face an exceptional circumstance in coming years (included in the preamble of the Law 23/2013): the access to retirement of the so-called baby boomer generation from the period 1958-1977, which will mean a considerable increase in the number of pensions during a prolonged period, from 2025 to 2060. Another problem faced by the Spanish model is the negative contribution of the labor market to sustainability. The latest financial crisis has had a harsh effect on the Spanish labor market, destroying millions of jobs, with a total unemployment rate of 26% and long-term youth unemployment rates above 50% (Cano, 2014). Likewise, people increasingly access the labor market with greater age and social security contributions are made for a shorter number of years, which has created a serious problem for the financial system.

Additionally, the situation of budget deficit has raised doubts about the state´s capacity to finance public pensions in the near future. According to Eurostat data, Spain is one of the countries of the European Union with the highest public deficit; in 2014, the Spanish public deficit reached 5.80% of the gross domestic product (GDP), a percentage that placed the country in the 149th place out of 181 countries, despite improving its position with respect to 2013, when Spain was the 158th, with a GDP deficit of 6.80%.

As a result of this situation, in 2011, Spain decided to undertake one of the most ambitious reforms of the last twenty years, which partially came into force in 2013. The most important measures taken included the delay of the retirement age, placing it at 67 years old, and the introduction of two factors that seek to ensure the future sustainability of the system: the sustainability factor (applicable to retirement pensions starting on January 1st, 2019) and the annual revaluation index (applied starting on January 1st, 2014), aiming to adjust pension benefits to life expectancy and to the economic situation of the country, respectively.

These measures have not yet shown their joint effectiveness, given their different dates of entry into force; therefore, this work aims to study and analyze the effects and consequences of the future implementation of the sustainability factor (SF). Thus, the fundamental objective of this study is to analyze how the application of SF will influence pensions in the next 35 years and to what extent pensions will be adjusted to demographic evolution, seeking to ensure the future sustainability of the public pension system.

This paper also analyzes what would have been the effect of applying an alternative sustainability measure that was initially proposed in the 2011 reform: the intergenerational equity factor (IEF), which was replaced by the aforementioned sustainability factor in 2013 with Law 23/2013, currently regulated by Royal Legislative Decree 8/2015. It is important to clarify that the calculations of these factors use life expectancy numbers both at 65 and 67 years old, since this latter will be the legal retirement age in Spain from 2027.

Having into account that different European countries had already begun to introduce sustainability measures in the 1990s, (1991) until 2013, when the latest reform was implemented.

The results show that if a sustainability factor had been implemented earlier, being it IEF or SF, the pension expenditure would not have increased so much; nevertheless, it would have been detrimental to the purchasing power of pensioners. Regarding the comparison of the two factors, the intergenerational equity factor shows that pension reduction would have been lower than in case of applying SF. Specifically, if this factor (IEF) had been applied from 1991 to 2013, using 1991 as the base year, the initial pension would have been reduced by 16.5% in 2013, considering a 65 years old life expectancy. Likewise, when projecting the IEF calculation results for the time period between 2014 and 2051, and considering a 67 years old life expectancy, pension reduction would reach 24.4%, with annual index revaluations or 1.8% if revaluations were made every five years.

Regarding the repercussions of an early application of the sustainability factor, results show that the initial pension would have been reduced by more than 12% from 1998 to 2013. With reference to its future impact, from 2019 to 2051, results indicate that the initial pension will be slowly reduced during the first years (0.9% in 2019), but it could reach a reduction of 23% in 2051 if life expectancy of the Spanish population continues to increase.

The rest of the article is organized as follows: the second section presents an updated literature review; the third section examines the Spanish model and the significance of the public pension system reform in Spain; the fourth section explains the methodology used in the study; the fifth section is dedicated to an empirical analysis that explains the results obtained in detail; finally, the last section presents the conclusions.

LITERATURE REVIEW

At present, one of the main problems that Western societies face are demographic changes that have exposed the uncertain financial capacity of public pension systems in the coming years. Spain, as indicated by Peláez (2008), is a country in which the number of births is very low and generational replacement is not guaranteed; other authors, such as Zubiri (2009), Varela, (2012), Quílez (2012) and Meneu *et al*. (2013), highlight increased life expectancy and population ageing as the most important causes of sustainability problems. Conde-Ruiz and González (2012) claim that the fact that young people take longer to join the workforce and spend less time contributing to social security will be the reason why many citizens will not reach the minimum contribution required to receive retirement benefits in the future.

In order to combat the effects of these changes, many countries, including Spain (Law 28/2003 and Royal Decree 337/2004), have created public reserve funds as a means of saving and resource against possible future financing problems. In this regard, several authors, such as De Guindos (2008) and Moral-Arce, Patxot and Souto (2008), affirm the need to incorporate this type of instruments to compensate low levels of income, especially important in times of crisis when social security might have problems to meet the needs of society (Aldecoa & Valero, 2013; Anido, Mareque & López-Corrales, 2014).

In the face of a possible reserve fund deficiency, many Western countries are undertaking different public pension system reforms in order to introduce different sustainability mechanisms. Two of the most applied measures have been adjusting the initial pension or the retirement age of new pensioners according to the evolution of life expectancy (Social Security, 2013).

Although these measures were not implemented in Spain until 2013, several other countries had opted for their introduction since the midnineties. In Canada, starting in 1997, the Chief Actuary's Office of the Canada Pension Plan evaluates the financial situation of the system every three years, and in case the system had sustainability problems, the Parliament must propose adjustment measures; if these measures are not carried out, a quasi-sustainability factor that freezes pensions and raises contributions comes into play for three years until the next review.

In 1999, Poland approved and implemented the calculation of the initial pension (notional accounts) as a life annuity that takes into account life expectancy at 62 years. In 2005, Finland approved a sustainability factor that has been applied since 2010, which adjusts the initial pension according to life expectancy, calculating the coefficient of survival of a cohort that is 62 years old in the year in question and making a life annuity with a discount rate of 2%; the pension is multiplied by the coefficient between the base year (cohort aged 62 years in 2009, to the fifth decimal point) and the year in question. In 2007, Portugal approved the modification of the initial pension starting in 2010, multiplying it by the relation between life expectancy at 65 at the time of calculation and the base year in 2006.

Regarding measures pending implementation, in 2010, Greece approved the adjustment of retirement age, so that it will be indexed to life expectancy starting in 2021. Denmark approved, in 2011, a semi-automatic factor, since its application requires the approval of the Parliament; in particular, it is expected that starting in 2022 (year in which retirement age will be 67 years), retirement age will be adjusted according to life expectancy, using the difference between life expectancy at 60 years each year (with a shift of five years) and that of the same cohort in 2020 (life expectancy is recalculated every five years, starting in 2015).

Among non-European countries, Japan stands out, which approved the Employment Measures Act in 2001, which stipulates that both defined benefit plans and defined contribution plans of private systems will be part of the public system. Currently, 90% of Japanese companies offer a pension system to their workers, according to Martínez-Aldama (2013).

In Spain, the reform—started in 2011 and extended in 2013—aims to guarantee adequate, sustainable, and safe pensions in the future, making expenditure/GDP levels stay closer to the EU average; however, according to Quílez (2012), this reform will reduce coverage rate and benefit rate, since it modifies the calculation of the regulatory base, shifting the computation period from fifteen to twenty-five years, and the coefficient of years of contribution grows more linearly after 15 years of contributions (Devesa et al., 2011). In addition, according to De la Fuente and Domenech (2011) and Devesa *et al*. (2012a), gaps in the base calculation (temporary punctual lack of contribution during working life), as well as new penalties for early retirement and bonuses for delaying retirement age are distancing the new system from achieving contributory equity. In matters of equity, Devesa and Domínguez (2013) claim the necessity to propose redesigning the coverage to guarantee that the system provides economic benefits that are appropriate for the need of pensioners, which will undoubtedly be greater as their age increases.

On the other hand, a sustainability factor has been introduced to adjust the amount of the initial pension according to the evolution of life expectancy. The existing studies are not conclusive, about its possible effectiveness, since some studies estimate a saving of 33% in 2050 on the expected expenditure in the absence of reform (De la Fuente & Domenech, 2011), while other authors such as Conde-Ruiz and González (2012, 2013) estimate a saving of 43%. On the other hand, Devesa et al. (2012b) suggest that, after incorporating coefficients of life expectancy, the estimated saving for 2050 would be 1.6% of the GDP. Other members of the scientific community do not believe that it is necessary to apply the factor (Serrano, Bravo & García, 2004), and there are even those, such as Zubiri (2012), who propose eliminating the sustainability factor and replacing it with a tax called solidarity contribution.

THE REFORM OF THE PUBLIC PENSION SYSTEM IN SPAIN

The latest pension reform in Spain is aimed at solving the existing problems of the system, which became more obvious during the economic crisis and made more evident the limited sustainability of the system in an immediate future (De la Fuente & Domenech, 2011).

This reform has been carried out in two stages. First, in 2011, Law 27/2011 on updating and modernizing the social security system intended to promote and ensure the sustainability of the system, introducing various modifications that affected the main parameters for calculating pensions. Among the measures adopted in 2011 that affect non-contributory pensions, that is to say, benefits that do not depend on the contributory effort made, we can highlight limiting the amount of the non-contributory pension supplement, so that it does not exceed the non-contributory pension; partially modifying the legal treatment of disability; extending the coverage for work accidents or illness, and including benefits for childcare (Devesa *et al*., 2011).

The measures that include parametric changes and affect the contributory part are delaying legal retirement age from 65 to 67 years; increasing the regulatory base of the last fifteen years of contribution; extending the premium for delayed retirement between 2% and 4%, according to the years of contribution; establishing two types of early retirement and regulating partial retirement (Domenech, 2011).

Additionally, it proposed the introduction of a sustainability mechanism: the intergenerational equity factor (IEF), but its development and formalization was not carried out until the second stage of the reform in 2013, proposed in Law 23/2013 and finally registered and regulated by Royal Legislative Decree 8/2015, which develops and extends the proposed sustainability measures by implementing

SF instead of IEF, aiming to adjust pension benefits according to demographic evolution. The first year of the application of SF will be 2019 and will be reviewed every five years.

The SF seeks to guarantee, for present and future generations, the receipt of adequate and sufficient pensions, by protecting against the risk associated with an increased longevity and adjusting intergenerational equity in retirement pensions. Specifically, it adjusts the initial pension so that the total amount received by a pensioner throughout his life, who enters the pension system within a certain number of years and who will foreseeably have a longer life expectancy, will be equivalent to the amount received by those who retire at an earlier moment. To this effect, estimated life expectancy is taken into account in both moments.

Therefore, SF is additional to the already existing parameters to calculate retirement pensions and helps to obtain an average pension amount compatible with the total expenditure level destined to these pensions, as well as to maintain the financial equilibrium of the system in the medium and long run.

Devesa and Domínguez (2013) point out that the inclusion of the factor in the 2013 reform achieves the improvement of intergenerational equity, since it includes in the system a correction for the amount of the first pension and the dynamic trend of increased life expectancy. This is an important point, given that several previous studies highlighted the lack of equity in the system (Monasterio, Sánchez & Blanco, 1996, Bandrés & Cuenca, 1998, Jimeno & Licandro, 1999, Jimeno, 2003, Sánchez & Sánchez, 2007).

The other mechanism introduced by Law 23/2013 and regulated by Royal Legislative Decree 8/2015 is the revaluation index; the purpose of this index is to ensure budget balance, so that the revaluation of pensions is no longer linked to the evolution of prices, but rather is adjusted according to how the expenses and income of the system change over time. The aim of the pension revaluation index is the financial sustainability of the pension system, guaranteeing, in addition, the sufficiency of these benefits.

In this paper, the object of study is the sustainability factor and its previous proposal (the intergenerational equity factor), analyzing, as indicated, the future repercussion of SF, as well as the impact that IEF and SF would have had if their application had been implemented earlier.

METHODOLOGY

Based on the fundamental objective of analyzing how the application of the sustainability factor will influence future pensions starting in 2019, this study seeks to demonstrate that after the application of the sustainability factor in the Spanish pension system, from 2019 to 2051, the amount of pensions will be adjusted to demographic changes, trying to reduce imbalances and problems that arose in recent years. Likewise, it analyzes what would have been the effect of applying IEF on the initial pension, proposed in the 2011 reform but never approved.

Additionally, the study examines whether the IEF and SF values experiment variations if their calculation uses life expectancy at 67 years (legal retirement age after 2027) or at 65 years (legal retirement age until 2027 and allowed retirement age as of 2027 for those who have 38.5 years of contributions). Finally, it investigates what would have been the impact of an earlier application of these factors since the beginning of the 1990s (specifically 1991, given that it was the moment when these mechanisms began to be implemented in other countries), until its implementation in the 2013 reform. In all these cases, the analysis assumes both annual reviews and revaluations made every five years for the corresponding correction factor.

Ultimately, the empirical analyses carried out in the present study seek to verify, first, whether the application of the intergenerational equity factor or the sustainability factor would have represented a positive and reasonable adjustment of the initial pension according to the demographic evolution since 1991, so the average pension would not have reached such high levels as at the present. Second, they aim to verify how effective IEF would have been and to compare it with the results that the application of SF will report in the next thirty years (from 2019 to 2051).

The formula proposed to calculate IEF was based on comparing the life expectancy of those who had accessed the system at a certain age at an earlier date with the life expectancy of new pensioners who were retiring at the same age, but in a later moment. Therefore, it tried to protect the pension system from the greater longevity of future retirees. Specifically, the formula proposed to determine this factor was the following:

$$FEI_{j,t+s=}\frac{e_{j,t}}{e_{j,t+s}} \quad [1]$$

Where:

$e_{j,t}$ is the life expectancy of an individual of *j* years of age, in the reference year *t*.

$e_{j,t+s}$ is the life expectancy of an individual of *j* years of age, in the year *t* + *s* (year in which the factor is calculated).

IEF was intended to modify the calculation of the initial pension and it moderated it in proportion to any increase in the life expectancy of the retired person with respect to a life expectancy taken as reference. Its aim was that, at any time, two people who retired at the same age and had accumulated the same regulatory base were treated by the system in the same way.

With the reform of Law 23/2013, the sustainability mechanism that finally got implemented is SF. However, it was the Royal Legislative Decree 8/2015 of October 30 that approved the revised text of the General Law of Social Security, where this factor was regulated; more specifically, Article 211 included the calculation of this factor, as shown below:

$$FS_t = FS_{t-1} * e_{67}^{*} \quad [2]$$

Where:

FS_t is the sustainability factor in *t*.

$FS_{2018} = 1$.

t is the year of application of the factor, which will take values from 2019 onwards.

e_{67}^{*} is calculated every five years and represents the interannual variation in a five-year period of life expectancy at 67 years, obtained according to the mortality tables of the retired population of the social security system.

As indicated in Article 211 of Royal Legislative Decree 8/2015, the calculation formula of e_{67}^{*} changes every five years and is used for the next five-year period. For the calculation of the sustainability factor in the period 2019 to 2023, including both life expectancy numbers, e_{67}^{*} will take the value:

$$\left[\frac{e_{67}^{2012}}{e_{67}^{2017}}\right]^{\frac{1}{5}} \quad [3]$$

Where:

e_{67}^{2012} is life expectancy at 67 in 2012.

e_{67}^{2017} is life expectancy at 67 in 2017.

For the calculation of the sustainability factor in the period 2024-2028, including both life expectancy numbers, e_{67}^{*} will take the value:

$$\left[\frac{e_{67}^{2017}}{e_{67}^{2022}}\right]^{\frac{1}{5}} \quad [4]$$

Where:

e_{67}^{2017} is life expectancy at 67 in 2017.

e_{67}^{2022} is life expectancy at 67 in 2022.

And so on and so forth. The aforementioned Article 211 also specifies that for the application of the sustainability factor the first four decimal points should be used.

EMPIRICAL ANALYSIS

Database

Statistics, as well as reports, bulletins and projections prepared by the National Institute of Statistics (INE, for its acronym in Spanish) have been used as the main source of information for this work. The values of life expectancy at 65 years in Spain from 1991 to 2014 and projections of life expectancy at 65 years from 2015 to 2051, as well as data referring to life expectancy at 67 years from 1991 to 2051 have been obtained from the INE mortality tables.

Figure 1 shows the evolution of life expectancy at 65 and 67 years in Spain, from 1991 to 2013. Figure 2 presents the predictions of life expectancy at 65 and 67 years from 2014 to 2051.

Figure 1 shows that life expectancy has been steadily and continuously increasing from 1991 to 2013, being more pronounced in the case of 65 years. This trend shows the progressive ageing of the Spanish population over the last twenty-five years and the consequent increase of tax burden on public pension expenditure. This trend seems to continue in the future, as shown by INE estimates up to 2051 (Figure 2), although the difference between life expectancy at 65 and 67 years seems to disappear, with the possibility that life expectancy at 67 years old may be higher than the expectancy at 65 in 2051.

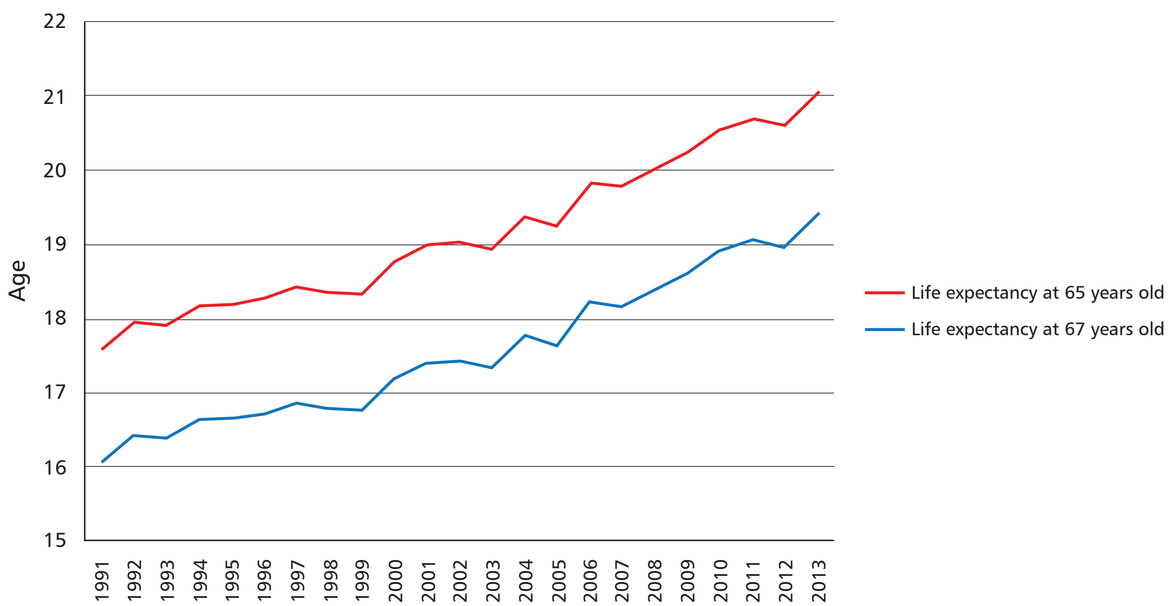
Empirical results

First, a simulation is performed on what would have been the impact of implementing IEF (proposed in the 2011 reform) and SF (approved in the 2013) in 1991. Additionally, the simulation uses for the calculation of these factors life expectancy at both 65 years and 67 years (legal retirement age in Spain starting in 2027).

It should be noted that for the calculation of IEF and SF, the latest available INE projections (INE, 2012) have been used; given that these are

Figure 1.

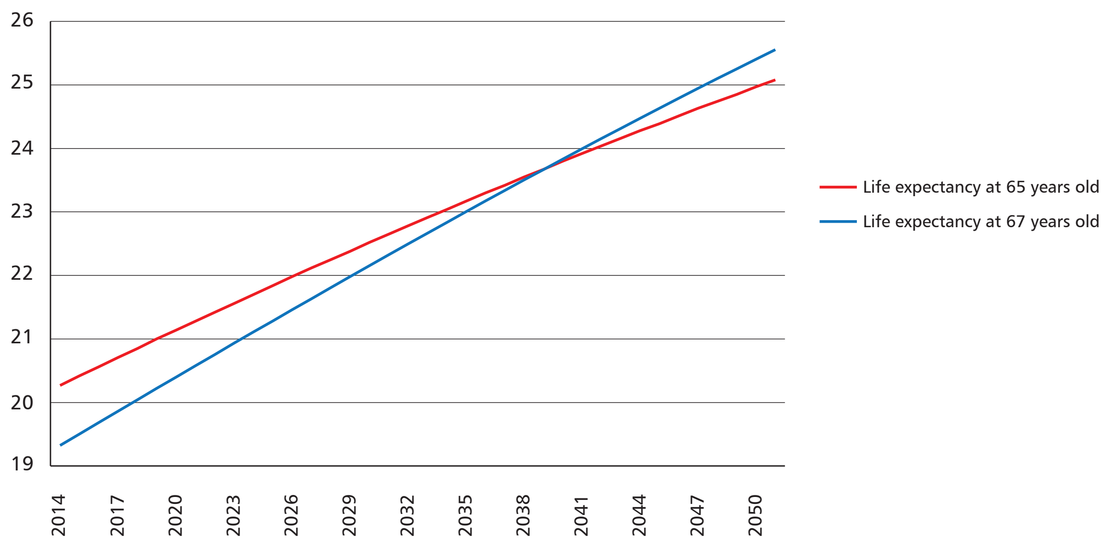
Evolution of life expectancy at 65 and 67 years in Spain, 1991-2013



Source: Authors' elaboration based on INE information (2012).

Figure 2.

Projections of the evolution of life expectancy at 65 and 67 years in Spain, 2014-2051



Source: Authors' elaboration based on INE information (2012).

periodically updated, therefore at the time of its entry into force, SF should be calculated with the latest available estimates. Consequently, the results may vary slightly with respect to the estimates obtained in this work.

Table 1 shows the simulation of the application of IEF starting in 1991 for life expectancy at 65 and 67 years (Panels A and B, respectively). The second column of Panels A an d B in Table 1 show the estimated value of IEF from 1991 to 2013, considering a fixed base in 1991 and annual revisions.

The results of Panel A show how the factor gradually corrects downward the initial pension (factor is less than one) due to increased life expectancy at 65 years. If this factor had been applied since 1991, it would have meant a progressive pension reduction in the system with respect to those of 1991 (column 3); in particular, the initial pension of those who retired in 1992 would be 0.2% lower than the initial pension of the previous generation, while the initial pension of those who retired in 2013 would have been corrected downward by up to 16.5%, compared to 1991.

This last value shows how, in the long term, new retirees entering the system are affected in a remarkable way; given this, it would be more reasonable to adjust gradually the base of the factor, so that it evolves according to demography. To analyze how a change in the factor would affect the evolution of the population, this factor has been calculated annually with a five-year change in the base in columns four and five.

Columns four and five of Panel A in Table 1 show how the initial pension of retirees entering the system would also decrease, but less sharply than in the previous case. Pension reduction would be around 0.2-0.3% on average, being more affected during 2009 and 2010 due to a greater increase in life expectancy in those years, becoming more than 20 years starting in 2008. Table 1 presents the simulation of the impact of IEF on pensions considering 1991 as the base year and with five-year changes in the base (highlighted in bold) for life expectancy at 65 years (Panel A) and at 67 years (Panel B)), from 1991 to 2013.

Table 1.

Simulation of the impact of IEF on pensions (1991-2013)

Year	IEF (e_{65}) 1991 as base year	Change in pension	IEF (e_{65}) five-year changes in base	Change in pension
Panel A: IEF obtained with life expectancy at 65 years				
1991	1,0000	0,0000	1,0000	0,0000
1992	0,9804	–0,0196	0,9804	–0,0196
1993	0,9818	–0,0182	0,9818	–0,0182
1994	0,9681	–0,0319	0,9681	–0,0319
1995	0,9664	–0,0336	0,9664	–0,0336
1996	0,9628	–0,0372	0,9963	–0,0037
1997	0,9548	–0,0452	0,9881	–0,0119
1998	0,9587	–0,0413	0,9920	–0,0080
1999	0,9599	–0,0401	0,9933	–0,0067
2000	0,9374	–0,0626	0,9700	–0,0300
2001	0,9260	–0,0740	0,9878	–0,0122
2002	0,9250	–0,0750	0,9868	–0,0132
2003	0,9291	–0,0709	0,9911	–0,0089
2004	0,9081	–0,0919	0,9687	–0,0313
2005	0,9136	–0,0864	0,9746	–0,0254
2006	0,8870	–0,1130	0,9709	–0,0291
2007	0,8888	–0,1112	0,9728	–0,0272
2008	0,8783	–0,1217	0,9614	–0,0386
2009	0,8688	–0,1312	0,9510	–0,0490
2010	0,8555	–0,1445	0,9364	–0,0636
2011	0,8499	–0,1501	0,9935	–0,0065
2012	0,8533	–0,1467	0,9974	–0,0026
2013	0,8354	–0,1646	0,9765	–0,0235
Year	IEF (e_{67}) 1991 as base year	Change in pension	IEF (e_{67}) five-year changes in base	Change in pension
Panel B: IEF obtained with life expectancy at 67 years				
1991	1,0000	0,0000	1,0000	0,0000
1992	0,9793	–0,0207	0,9793	–0,0207
1993	0,9805	–0,0195	0,9805	–0,0195
1994	0,9661	–0,0339	0,9661	–0,0339
1995	0,9643	–0,0357	0,9643	–0,0357
1996	0,9613	–0,0387	0,9969	–0,0031
1997	0,9528	–0,0472	0,9881	–0,0119
1998	0,9574	–0,0426	0,9929	–0,0071
1999	0,9585	–0,0415	0,9940	–0,0060
2000	0,9348	–0,0652	0,9694	–0,0306
2001	0,9227	–0,0773	0,9871	–0,0129
2002	0,9222	–0,0778	0,9866	–0,0134
2003	0,9268	–0,073	0,9915	–0,0085
2004	0,9040	–0,0960	0,9671	–0,0329
2005	0,9104	–0,0896	0,9740	–0,0260
2006	0,8821	–0,1179	0,9688	–0,0312
2007	0,8850	–0,1150	0,9721	–0,0279
2008	0,8738	–0,1262	0,9597	–0,0403
2009	0,8628	–0,1372	0,9476	–0,0524
2010	0,8492	–0,1508	0,9327	–0,0673
Year	IEF (e_{67}) 1991 as base year	Change in pension	IEF (e_{67}) five-year changes in base	Change in pension
2011	0,8433	–0,1567	0,9930	–0,0070
2012	0,8473	–0,1527	0,9977	–0,0023
2013	0,8276	–0,1724	0,9746	–0,0254

Source: Authors' elaboration based on INE information.

Panel B shows the same analysis as Panel A, but considering life expectancy at 67 years. Comparing these results with the ones presented in Panel A, it can be observed that pension reduction would have been greater in both cases, that is, when 1991 is taken as base year as well as when calculations are made on a five-year basis, since the increase in life expectancy is proportionally superior. However, we observe again that pensions would have been reduced to 17.2% if we considered 1991 as the base year, and the reduction would stabilize around 0.02%-0.03% in the case of five-year changes, being more pronounced from 2008 to 2010.

Table 2 shows the simulation of SF values for life expectancy at 65 years (Panel A) and at 67 years (Panel B). The first results are shown for 1998, since the value of e^{*}_{65} would be obtained using life expectancies from 1991 and 1996 in order to apply SF for the period 1998-2002, while SF for the year 1997 takes a unitary value. Table 2 presents the impact of the application of SF on pensions from 1998 to 2013, taking into account reviews of the factor every five years (highlighted in bold), starting in 1991, for life expectancy at 65 (Panel A) and 67 years (Panel B).

Table 2.

Impact of the application of SF on pensions from 1998 to 2013

Year	e^*_{65}	SF	Change in pension
Panel A: Impact of SF considering life expectancy at 65 years			
1998	0,9925	0,9925	–0,0075
1999	0,9925	0,9850	–0,0150
2000	0,9925	0,9775	–0,0225
2001	0,9925	0,9702	–0,0298
2002	0,9925	0,9628	–0,0372
2003	0,9922	0,9554	–0,0446
2004	0,9922	0,9479	–0,0521
2005	0,9922	0,9406	–0,0594
2006	0,9922	0,9333	–0,0667
2007	0,9922	0,9260	–0,0740
2008	0,9914	0,9181	–0,0819
2009	0,9914	0,9102	–0,0898
2010	0,9914	0,9024	–0,0976
2011	0,9914	0,8947	–0,1053
2012	0,9914	0,8870	–0,1130
2013	0,9915	0,8795	–0,1205

Year	e^*_{67}	SF	Change in pension
Panel B: Impact of SF considering life expectancy at 67 years			
1998	0,9921	0,9921	–0,0079
1999	0,9921	0,9843	–0,0157
2000	0,9921	0,9766	–0,0234
2001	0,9921	0,9689	–0,0311
2002	0,9921	0,9613	–0,0387
2003	0,9918	0,9534	–0,0466
2004	0,9918	0,9456	–0,0544
2005	0,9918	0,9379	–0,0621
2006	0,9918	0,9303	–0,0697
2007	0,9918	0,9227	–0,0773
2008	0,9910	0,9144	–0,0856
2009	0,9910	0,9062	–0,0938
2010	0,9910	0,8981	–0,1019
2011	0,9910	0,8900	–0,1100
2012	0,9910	0,8821	–0,1179
2013	0,9911	0,8742	–0,1258

Source: Authors' elaboration based on INE information

Both Panel A and Panel B show very similar values of e^*_{65} and e^*_{67}, which means that SF is being progressively reduced while life expectancy is increasing. The application of this factor shows that pensions go from a reduction of 0.08% in 1998 to reaching a reduction of 12% fifteen years later, in 2013. Second, we calculated the future impact that the implementation of IEF would have had from 2014 to 2051 (Table 3), as well as the future impact of the application of FS (Table 4).

The evolution of IEF, calculated for life expectancy both at 65 years (Table 3, Panel A) and at 67 years (Table 3, Panel B), shows a progressive reduction of pensions as life expectancy is expected to continue to increase until 2051. Nevertheless, as shown in Table 1, the impact of IEF is noticeably reduced when the base is reviewed every five years, instead of maintaining a fixed base year. Table 3 shows the simulation of the impact of IEF on pensions, considering 2014 as the base year and changes every five years (highlighted in bold) for life expectancy at 65 years (Panel A) and at 67 years (Panel B) from 2014 to 2051.

Table 3.

Impact of IEF on pensions (2014-2051)

Year	IEF (e_{65}) 2014 as base year	Change in pension	IEF (e_{65}) five-year change in base	Change in pension
Panel A: IEF obtained with life expectancy at 65 years				
2014	1,0000	0,0000	1,0000	0,0000
2015	0,9927	–0,0073	0,9927	–0,0073
2016	0,9859	–0,0141	0,9859	–0,0141
2017	0,9788	–0,0212	0,9788	–0,0212

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Year	IEF (e_{65}) 2014 as base year	Change in pension	IEF (e_{65}) five-year change in base	Change in pension
2018	0,9722	–0,0278	0,9722	–0,0278
2019	0,9652	–0,0348	0,9929	–0,0071
2020	0,9588	–0,0412	0,9863	–0,0137
2021	0,9525	–0,0475	0,9798	–0,0202
2022	0,9463	–0,0537	0,9734	–0,0266
2023	0,9402	–0,0598	0,9671	–0,0329
2024	0,9341	–0,0659	0,9935	–0,0065
2025	0,9281	–0,0719	0,9872	–0,0128
2026	0,9222	–0,0778	0,9809	–0,0191
2027	0,9164	–0,0836	0,9747	–0,0253
2028	0,9110	–0,0890	0,9690	–0,0310
2029	0,9057	–0,0943	0,9942	–0,0058
2030	0,9001	–0,0999	0,9880	–0,0120
2031	0,8949	–0,1051	0,9823	–0,0177
2032	0,8898	–0,1102	0,9767	–0,0233
2033	0,8848	–0,1152	0,9712	–0,0288
2034	0,8798	–0,1202	0,9944	–0,0056
2035	0,8748	–0,1252	0,9888	–0,0112
2036	0,8700	–0,1300	0,9833	–0,0167
2037	0,8655	–0,1345	0,9782	–0,0218
2038	0,8607	–0,1393	0,9728	–0,0272
2039	0,8564	–0,1436	0,9949	–0,0051
2040	0,8517	–0,1483	0,9895	–0,0105
2041	0,8474	–0,1526	0,9845	–0,0155
2042	0,8432	–0,1568	0,9796	–0,0204
2043	0,8390	–0,1610	0,9748	–0,0252
2044	0,8348	–0,1652	0,9951	–0,0049
2045	0,8311	–0,1689	0,9906	–0,0094
2046	0,8270	–0,1730	0,9857	–0,0143
2047	0,8230	–0,1770	0,9809	–0,0191
2048	0,8193	–0,1807	0,9766	–0,0234
2049	0,8157	–0,1843	0,9956	–0,0044
2050	0,8118	–0,1882	0,9908	–0,0092
2051	0,8082	–0,1918	0,9864	–0,0136

Year	IEF (e_{67}) 1991 as base year	Change in pension	IEF (e_{75}) five-year change in base	Change in pension
Panel B: IEF obtained with life expectancy at 67 years				
2014	1,0000	0,0000	1,0000	0,0000
2015	0,9908	–0,0092	0,9908	–0,0092
2016	0,9817	–0,0183	0,9817	–0,0183
2017	0,9729	–0,0271	0,9729	–0,0271
Year	IEF (e_{67}) 1991 as base year	Change in pension	IEF (e_{75}) five-year change in base	Change in pension
2018	0,9642	–0,0358	0,9642	–0,0358
2019	0,9556	–0,0444	0,9911	–0,0089
2020	0,9473	–0,0527	0,9825	–0,0175
2021	0,9391	–0,0609	0,9740	–0,0260
2022	0,9311	–0,0689	0,9656	–0,0344
2023	0,9232	–0,0768	0,9575	–0,0425
2024	0,9155	–0,0845	0,9917	–0,0083
2025	0,9079	–0,0921	0,9835	–0,0165
2026	0,9005	–0,0995	0,9754	–0,0246
2027	0,8933	–0,1067	0,9676	–0,0324
2028	0,8861	–0,1139	0,9599	–0,0401
2029	0,8792	–0,1208	0,9921	–0,0079
2030	0,8723	–0,1277	0,9844	–0,0156
2031	0,8656	–0,1344	0,9768	–0,0232
2032	0,8590	–0,1410	0,9694	–0,0306
2033	0,8526	–0,1474	0,9621	–0,0379
2034	0,8463	–0,1537	0,9926	–0,0074
2035	0,8401	–0,1599	0,9853	–0,0147
2036	0,8340	–0,1660	0,9782	–0,0218
Year	IEF (e_{67}) 1991 as base year	Change in pension	IEF (e_{67}) five-year change in base	Change in pension
Panel B: IEF obtained with life expectancy at 67 years				
2037	0,8280	–0,1720	0,9712	–0,0288
2038	0,8222	–0,1778	0,9644	–0,0356
2039	0,8165	–0,1835	0,9931	–0,0069
2040	0,8109	–0,1891	0,9862	–0,0138
2041	0,8054	–0,1946	0,9796	–0,0204
2042	0,8000	–0,2000	0,9730	–0,0270
2043	0,7948	–0,2052	0,9666	–0,0334
2044	0,7896	–0,2104	0,9935	–0,0065
2045	0,7845	–0,2155	0,9871	–0,0129
2046	0,7796	–0,2204	0,9809	–0,0191
2047	0,7747	–0,2253	0,9748	–0,0252
2048	0,7700	–0,2300	0,9688	–0,0312
2049	0,7653	–0,2347	0,9939	–0,0061
2050	0,7607	–0,2393	0,9880	–0,0120
2051	0,7562	–0,2438	0,9822	–0,0178

Source: Authors' elaboration based on INE information.

These results show that IEF could present certain deficiencies, given that if the base had been maintained constant, the factor to be applied to new generations would have been conditioned by past demographic trends, which would not have captured correctly the evolution of the population. The analysis also includes a five-year review of IEF, since the regulation of SF takes this into account. In this case, it can be observed that, when demographic evolution is included, the factor corrects this effect, but it does it in a very light way, so the system could continue to suffer future deficits. In light of this situation, the SF proposal is believed to correct this effect since, as observed in Table 2 and shown in Table 4, it incorporates demographic evolution to a greater extent, which reduces pensions even more.

The results are presented in Table 4, Panel A (with life expectancy at 65 years) and Panel B (using life expectancy at 67 years). The values shown in Panel B correspond to the calculations of the final SF that will be applied, as regulated in Royal Legislative Decree 8/2015, starting in 2019. The numbers highlighted in bold correspond to the moment in time when the base is changed. Table 4 shows the impact of the application of SF on pensions from 2019 to 2051 for life expectancy at 65 years (Panel A) and at 67 years (Panel B).

Table 4.

Impact of the application of SF on pensions from 2019-2051

Year	e^*_{65}	SF	Change in pension
Panel A: Impact of SF considering life expectancy at 65 years			
2019	0,9991	0,9991	–0,0009
2020	0,9991	0,9982	–0,0018
2021	0,9991	0,9972	–0,0028
2022	0,9991	0,9963	–0,0037
2023	0,9991	0,9954	–0,0046
2024	0,9933	0,9887	–0,0113
2025	0,9933	0,9821	–0,0179
2026	0,9933	0,9755	–0,0245
2027	0,9933	0,9689	–0,0311
2028	0,9933	0,9624	–0,0376
2029	0,9936	0,9562	–0,0438
2030	0,9936	0,9501	–0,0499
2031	0,9936	0,9440	–0,0560
2032	0,9936	0,9380	–0,0620
2033	0,9936	0,9319	–0,0681
2034	0,9941	0,9265	–0,0735
2035	0,9941	0,9210	–0,0790
2036	0,9941	0,9156	–0,0844
2037	0,9941	0,9103	–0,0897
2038	0,9941	0,9049	–0,0951
2039	0,9945	0,8999	–0,1001
2040	0,9945	0,8950	–0,1050
2041	0,9945	0,8900	–0,1100
2042	0,9945	0,8851	–0,1149
2043	0,9945	0,8802	–0,1198
2044	0,9948	0,8756	–0,1244
2045	0,9948	0,8711	–0,1289
2046	0,9948	0,8665	–0,1335
2047	0,9948	0,8620	–0,1380
2048	0,9948	0,8575	–0,1425
2049	0,9952	0,8534	–0,1466
2050	0,9952	0,8492	–0,1508
2051	0,9952	0,8451	–0,1549

Year	e^*_{67}	SF	Change in pension
Panel B: Impact of SF considering life expectancy at 67 years			
2019	0,9908	0,9908	–0,0092
2020	0,9908	0,9817	–0,0183
2021	0,9908	0,9727	–0,0273
2022	0,9908	0,9638	–0,0362
2023	0,9908	0,9550	–0,0450
2024	0,9913	0,9466	–0,0534
2025	0,9913	0,9383	–0,0617
2026	0,9913	0,9301	–0,0699
2027	0,9913	0,9220	–0,0780
2028	0,9913	0,9139	–0,0861
2029	0,9917	0,9064	–0,0936
2030	0,9917	0,8989	–0,1011
2031	0,9917	0,8915	–0,1085
2032	0,9917	0,8841	–0,1159
2033	0,9917	0,8768	–0,1232
2034	0,9922	0,8700	–0,1300
2035	0,9922	0,8632	–0,1368
2036	0,9922	0,8565	–0,1435
2037	0,9922	0,8499	–0,1501
2038	0,9922	0,8432	–0,1568
2039	0,9927	0,8371	–0,1629
2040	0,9927	0,8309	–0,1691

Year	e^{*}_{67}	SF	Change in pension
2041	0,9927	0,8249	–0,1751
2042	0,9927	0,8188	–0,1812
2043	0,9927	0,8128	–0,1872
2044	0,9931	0,8072	–0,1928
2045	0,9931	0,8017	–0,1983
2046	0,9931	0,7962	–0,2038
2047	0,9931	0,7907	–0,2093
2048	0,9931	0,7853	–0,2147
2049	0,9936	0,7803	–0,2197
2050	0,9936	0,7753	–0,2247
2051	0,9936	0,7703	–0,2297

Source: Authors' elaboration based on INE information.

Table 4 shows the progressive reduction of the initial pension of retirees entering the system annually, being this more pronounced when considering life expectancy at 67 years (Panel B). This reduction is especially noticeable after 2030, since it foresees a real reduction of pensions by up to 10% (Panel B). This demonstrates that although SF is an instrument that seeks to promote equity in pensions for generations entering the system, future pensions can be significantly reduced if the demographic trend does not change in Spain; although the application of SF seeks to help balance the system, it seems that pensioners will receive a public pension for more years.

Devesa and Domínguez (2013) reach these same conclusions and indicate that the sustainability factor improves intergenerational equity compared to the initial proposal, since it includes the dynamic trend of increasing life expectancy in the calculation of the first pension. Likewise, Devesa *et al*. (2016) point out that the objective of the sustainability factor in Spain is to compensate increased life expectancy with a small amount of the initial pension, in line with the sustainability factors developed in Finland and Portugal.

Comparing the results of Table 4, Panel B, with previous studies, it can be observed that this measure will present sharper pension cuts in Spain than in other European countries, given the country's specific problems. Specifically, Devesa et al. (2012c) demonstrate that the sustainability coefficients on the initial pension in Portugal and Finland (taking 67 years as the base age and 2012 as the base year) will reach 0.837 and 0.861 in 2047, respectively. The present results, considering life expectancy at 67 years (Panel B, Table 4), show a lower estimate of SF: 0.7907 for the same year.

Overall, it is observed that life expectancy in Spain has been increasing progressively since 1991 to the present, which justifies the increase in pension expenditure; likewise, predictions indicate that life expectancy will continue to increase at least until 2051 and, consequently, pension spending will continue to increase too. This evolution justifies the reform that has been carried out in Spain, since it has been proven that SF will correct downward the initial pension if life expectancy continues to increase in the country.

In fact, if this reform had been applied earlier, pension expenditure would have been reduced, in both cases of applying IEF or SF, to the detriment of the purchasing power of pensioners. Specifically, assuming the application of IEF from 1991 to 2013, considering life expectancy at 67 years and annual reviews, the initial pension would have been reduced by 17.24% from 1991 to 2013. Similarly, when projecting the calculation of IEF to the time period between 2014 and 2051, considering life expectancy at 67 years, pension reduction would have reached 24.38%, assuming annual reviews. Had IEF changed the base every five years, results would change significantly, since the reduction would be much smaller, decreasing by 2.54% in the period 1991-2013 and by 1.78% in the period 2014-2015, considering life expectancy at 67 years.

On the other hand, comparing the results of five-year changes in the base for IEF and SF, it is observed that the sustainability factor can lead to a greater pension reduction. In addition, if life expectancy does not change, pension reductions may be higher than initially expected, since Devesa *et al*. (2016) claim an approximate annual fall of 0.5% of the initial pension. In contrast, the present results show that, applying SF, the initial pension would have been reduced by 12% from 1998 to 2013, and with respect to its future impact, from 2019 to 2051, the initial pension will be slowly reduced during the first years (0.9% in 2019), but it could reach a reduction of almost 23% in 2051. Therefore, as Devesa and Domínguez (2013) previously indicated, the objectives of sufficiency and equity are not guaranteed with the reforms of 2011 and 2013. Consequently, if the life expectancy of the Spanish population continues to increase, SF will correct the amount of pensions downward, allowing an adjustment for public pension spending at the expense of increasingly lower pensions for generations that will be retiring.

CONCLUSIONS

This work has analyzed the impact of one of the most novel measures of the latest reform of the public pension system in Spain (Royal Legislative Decree 8/2015): the sustainability factor, which will be applied for the first time in 2019. Additionally, this paper examined what would have been the impact of the intergenerational equity factor, which was proposed in 2011 but never applied. Finally, it studied how pensions would have evolved if this type of measures had been applied earlier.

The sustainability factor, which will be applied for the first time in 2019, seeks to anticipate and neutralize the imbalances of the pension system caused by demographic changes over time, such as population ageing. Its main objective is to adjust the value of the initial pension according to the evolution of the value of life expectancy.

The results obtained when estimating the intergenerational equity factor, proposed in 2011 but never applied, show that if this factor had been applied from 1991 to 2013, the initial pension, taking 1991 as the base year, would have been reduced by 16.5% in 2013. However, assuming five-year changes in the base, pension reduction corresponding to 2013 would have been 2.3% with respect to the pension corresponding to 1991. When life expectancy at 67 years is used to calculate IEF for the same time period, pension reductions corresponding to 2013, compared to that of 1991, would have been 17.2% and 2.5% for annual reviews and for five-year reviews of the base, respectively.

When projecting the calculation of IEF to the time period between 2014 and 2051, considering life expectancy at 65 years, it is concluded that the reduction of the initial pension (base year 2014) would be 19.2 % in 2051 with annual revisions, while it would only reach 1.4% if the base is recalculated every five years. The reduction of the initial pension corresponding to 2014, applying IEF with a life expectancy at 67 years, would be 24.4% and 1.8% for annual reviews and for five-year reviews, respectively.

The calculation of the estimates of the sustainability factor allows us to affirm that an early application of this factor, from 1998 to 2013, would have meant a reduction of the initial pension by 12%, which would have resulted in the detriment of the purchasing power of pensioners, but in savings in public pension expenditure. Regarding its future impact, from 2019 to 2051, the results show that the initial pension will be reduced slowly during the first years (0.9% in 2019), but it could reach a reduction of 23% in 2051 if the current demographic trend does not change.

Consequently, the present results show that the implementation of SF will result in a progressive pension reduction over the years if life expectancy continues to increase; that is to say, it seems that SF would fulfill the purpose of maintaining the sustainability of the pension system in the face of demographic changes associated with longevity, although new retirees entering the system would see their initial pension reduced.

Comparing IEF and SF, the effect of the sustainability factor is greater, with a more pronounced reduction of the initial pension. Although this might be detrimental for people who are at an age close to retirement and future pensioners, it will help balance the system. Consequently, if we want to maintain the sustainability of the public pension system in Spain, the application of the sustainability factor is necessary, since the imbalances between social security income and expenses are obvious; however, citizens should consider the possibility of supplementing public pensions with private savings instruments, such as private pension plans, which guarantee them a sufficient pension and allow them to maintain a standard of life similar to what they had before retirement.

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