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Should pensions be redistributive? The impact of Spanish reforms on the system's sustainability and adequacy

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Should pensions be redistributive? The impact of Spanish reforms on the system's sustainability and adequacy

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Abstract

Concerns about the consequences of demographic ageing on the sustainability of the pension system has led to the adoption of reforms reducing pension expenditure. However, the impact of these reforms on pension adequacy is now coming under increasing scrutiny. Taking recent Spanish reforms as an example, this paper analyses the extent to which fostering pension sustainability threatens pension adequacy, with a particular focus on inter- and intra-generational equity. Using an extension of the DyPeS microsimulation model, results show that the introduction of mechanisms linking retirement pensions to the evolution of the social security budget balance has strong and negative effects on adequacy and on income redistribution. Unexpected effects of the Bismarckian reforms on income redistribution are also observed. The outcomes reported for the Spanish pension system highlight the need to reconsider the convenience of using the pension system as an income redistribution device.

Keywords: pensions' adequacy, microsimulation, pension system reforms, Spain,

JEL Classification: H53, H55, H68.

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Introduction

The sustainability of welfare state programs, and specifically that of public pension systems, has been a matter of constant concern in recent decades. The marked ageing process that Europe is beginning to experience threatens a welfare system organized mainly on a pay-as-you-go basis, where the increasing ratio between the working-age (typically ages 16-64) and the economic dependent populations (ages 0-15 and 65+) is proving to be critical.

This marked ageing process has been exacerbated by the deep economic crisis that began in 2008 and which has left governments between a rock and a hard place. Public deficits started to rise dramatically and Social Security systems in a number of countries, including Spain, entered the red much sooner than predicted by demographic projections. In this context, many countries have introduced reforms to their pension systems in an attempt at controlling expenditure. One of the most noteworthy measures, in this regard, has been the adoption of mechanisms linking retirement pensions to the evolution of the social security budget balance, thus making explicit the dependence of the latter on demographic and economic factors.

However, changes to pension systems cannot be solely evaluated in terms of sustainability. They also need to be assessed in terms of adequacy, i.e., the extent to which they guarantee a minimum level of income for the elderly. By 'adequate', the World Bank understands that "all people regardless of their level or form of economic activity" have access to benefits "that are sufficient to prevent old-age poverty on a country-specific absolute level in addition to providing a reliable means to smooth lifetime consumption" (Holzmann and Hinz, 2005). As such, an 'adequate' system seeks to improve the position of the worst off, being compatible with any distribution of income between groups and, particularly, with any level of income inequality. Other distribution measures have also been considered by international organizations and the academic literature for the measurement of adequacy. These include various measures of the relative position of the elderly with respect to other groups as well as indicators of income inequality within the elderly.

The Ageing Report of the Economic Policy Committee (European Commission, 2015) argues that pension systems, and in particular public pension schemes, have continued to ensure that most old people in the majority of EU countries are protected against the risk of poverty and deprivation and can enjoy living standards in line with the rest of the population. In general, the elderly (aged 65+) are not at any greater risk of poverty than other age groups. Indeed, in most countries, the elderly seem to have been better protected against the social impact of the recession and the public finance crisis than have other age groups. The relative income position of the old has generally improved in recent years. The relative median income ratio – median income of people aged 65+ as a share of people aged 0-64 – increased between 2005 and 2013 in 20 out of 28 Member States, with an increase of more than 15 percentage points in Luxembourg, Portugal, Cyprus, Ireland, Spain and Greece. Overall, it is clear that the incomes of older people have been relatively well protected during the crisis (Holzmann and Hinz, 2005). In this respect, when measuring the relative position of the older population (by median income ratios, for example), Spain is one of the best situated, with ratios close to 100% in 2013 (Pension Adequacy Report of the EC, 2015). Nevertheless, Spain has been hit particularly hard by the crisis, and many pensioner households may also suffer a deterioration of their financial situation as a result of sharing their resources with the younger generations in the family.

The definition of ‘adequacy’ and its measurement are themselves an unresolved issue in the literature. Several papers and reports discuss existing indicators and propose new ones (Borella and Fornero, 2009; Pension Adequacy Report of the EC, 2015; Chybalski, 2012). Brady (2010) develops a replacement rate that accounts for savings, taxes, and owner-occupied housing. Binswanger and Schunk (2012) address adequacy with a randomized survey design, individually tailored to each respondent’s financial situation, and conducted in both the U.S. and the Netherlands. They find that the majority of individuals aim to achieve a spending profile in which retirement spending exceeds 80% of working life spending. The minimum desired replacement rates range between 95% for the lowest income quintile and 45% for the highest. For the Netherlands, these rates fall between 75 and 60%.

Several other studies seek to measure pension adequacy in a specific country. Knoef et al. (2016) measure the pension adequacy of the Dutch system, taking into account the total resources that people really accumulate. Using a large administrative data set, Chia and Tsui (2003) assess the adequacy of Singapore's publicly managed central provident fund system and find that it is inadequate to meet the future consumption needs of the female elderly. Others take a comparative perspective. For example, Holzmann (2013) reviews key recent and ongoing changes that are triggering reforms, outlines the main reform trends across pension pillars over the last two decades, and presents key policy areas on which the pension reform community needs to focus to make a difference.

As for methodology, microsimulation techniques have been introduced to complement more macro-oriented simulation models of pension systems, especially as regards attempts to simultaneously address sustainability and adequacy concerns. Microsimulation models can be used to draw a finer-grained picture of the evolution of old-age poverty in the future. Indeed, their use in policy evaluation and, particularly, in pension reforms has become fairly widespread (see, e.g., Borella and Coda Moscarola, 2010; van Sonsbeek, 2010; Buddelmeyer et al., 2006; Stensnes and Stolen, 2007). This is mainly thanks to the availability of an increasing number and quality of databases and computing tools. In the specific context in which we are working, these simulation tools need to be able to provide both a macro and a micro perspective: the former being essential for undertaking a consistent analysis of the sustainability of pensions or any other welfare state transfer; the latter being critical for a consideration of the adequacy of the benefit or of income redistribution, in general.

This paper analyses the impact on the sustainability and adequacy of the Spanish pensions system of the implementation of the sustainability factors (2013 reform), with a particular focus on inter- and intra-generational equity issues. The redistributive impact of measures introduced earlier in 2011 is also assessed.[1] We implement the specific sustainability factors introduced in Spain in the DyPeS microsimulation model, a dynamic, time-based, behavioural model, employing administrative data referring to Spain's Social Security. In conjunction with the sustainability factors, we also implement three groups of adequacy indicators in seeking to respond to three main questions: a) Are pensions sufficient to prevent old-age poverty? b) Are they equitable within the same generation? c) Are they equitable between generations?

The rest of the paper is organized as follows. Section 2 briefly describes the retirement pension system in Spain and summarizes the main reforms introduced in the decades preceding the introduction of the sustainability factors in 2013. Section 3 describes the microsimulation model used in the analysis, together with the data and the hypotheses adopted. Section 4 presents our results regarding the impact of the 2013 reform, in terms of both sustainability and adequacy, and relates them to the impact on pension adequacy of the 2011 reform. Finally, Section 5 presents our main conclusions.

[1] See Patxot et al. (2015) for an analysis of the impact of the 2011 reform on sustainability.

Institutional Framework: The Spanish contributory pension system

The Spanish contributory pension system, managed by the Social Security, is the most important program of social protection in Spain, in terms of both the size of the population protected and the share of expenditure. In 2014, the Social Security dedicated 10.5% of GDP to contributory pensions. The contributory pension system is organized on a pay-as-you-go basis under a defined benefit scheme. Pensioners and workers are classified into different regimes (i.e., the General Regime and five Special Regimes) covering retirement, permanent disability and survivor pensions. The retirement pension is by far the most important program: in December 2014, it accounted for almost 60% of total contributory pensions, representing 65% of total Social Security expenditure (corresponding to 7.4% of GDP).

The present system was introduced in 1967 when the General Social Security Law was enacted. Since then, many partial reforms have been introduced, impacting different aspects of the system. The contributory (or Bismarckian) nature of the retirement pension system relies basically on the fact that the initial pension benefit is dependent, to some degree, on the worker's past contributions, although the worker must have completed a minimum period of contributions. Specifically, the initial pension (IP) is determined by applying the percentage [p(n)] (which depends on the contribution period) to the regulatory base [RB] (defined as the average contribution base over the last few years). Moreover, various correction coefficients (c) may also apply in certain circumstances (such as delayed or early retirement):

$$IP=RB*p(n)*(1-c) \qquad [1]$$

The Bismarckian nature of these parameters has been increased as a result of various reforms, although a fully contributory system has yet to be achieved. Additionally, retirement pensions (and also contributions) are subject to lower and upper limits in pursuit of equity, which also mitigate their contributory nature.

Without seeking to be exhaustive, we present a chronological summary of the main reforms made to the retirement pension system. The first major reform of the Social Security was introduced in 1985, whereby the minimum period of contributions for receiving a pension was increased from 10 to 15 years, and the period for calculating the RB was also increased from 2 to 8 years. Both measures sought to reduce expenditure by limiting access and by reducing benefits through the application of a less recent regulatory base. Moreover, an explicit actualization mechanism (annual) for existing pensions was introduced, taking into account the predicted rate of inflation for the next year.

In 1995, all political parties signed the Toledo Pact, following the setting up of a special Parliamentary commission whose remit was to analyse the pension system and make recommendations about possible reforms. The Pact recommended the need to reinforce the contributory nature of the system, separate the financing of the non-contributory pensions from that of the Social Security, promote delayed (voluntary) retirement, guarantee the purchasing power of pensions over time and create a reserve fund with eventual surpluses to be used in the future. Some of these recommendations were implemented in the 1997 reform. In order to strengthen its contributory nature, the components of the formula for calculating the IP – both the years considered when calculating the RB and the percentage to be applied according to the number of years of contribution – were again modified.[2] The improvement in its contributory nature, however, was modest. The 1997 Reform also introduced (albeit in a somewhat vague

[2] Years for computing the RB increased from 8 to 15 and the percentage was modified as follows: the first 15 years of contribution gave the right to 50% (60% before the reform) of the RB as initial pension benefit. Each additional year up to 25 increased the pension by 3 percentage points, and each additional year between 26 and 35 increased the pension by 2 percentage points (prior to the reform, each additional year between 16-35 increased the pension by 2 percentage points).

fashion) the creation of a Social Security reserve fund with eventual surpluses, and the possibility of measures to promote delayed retirement. In 2002, a new Law enacted more specific measures to encourage delayed retirement and to discourage partial retirement.

In 2007, changes were once again made in retirement pensions. The conditions for accessing partial retirement were further tightened, while the premium coefficient (c) applied to delayed retirement was increased. The next major Social Security reform in Spain was implemented by means of Law 27/2011. In the middle of a deep economic crisis, the government decided to implement far-reaching reforms in order to reduce expenditure and avoid short-term financial deficits caused by the dramatic fall in contributions. Among the measures introduced, mention should be made of the extension of the ordinary retirement age from 65 to 67 (although it remained at 65 for individuals with long working careers). In order to strengthen the contributory nature, both components of the formula for calculating the initial pension were again modified – the period of past contributions considered in obtaining the RB was increased from 15 to 25 years, while the percentage to apply to the RB was also modified for individuals with more than 15 years of contribution (being extended from 35 to 37 years and being made more proportional). The possibility of early retirement was also modified by introducing two paths of access (voluntary and involuntary) for those with long contribution histories. A lengthy period of transition (2013-2027) was established before all these measures were fully adopted.

Finally, the 2011 reform announced the introduction of a "sustainability factor" in the pension system by 2027 to take into account the increase in life expectancy, albeit couched in very vague terms and without specifying the exact formula. Two years later, and following the publication of a report entrusted to an Expert Committee created for that exact purpose, Law 23/2013 described how that "sustainability factor" was to work. Specifically, it comprised two distinct elements, known as the "pension revaluation index" (that is an annual pension update index, henceforth *UI*) and the "sustainability factor" (*SF*). The *UI* replaced the consumer price index as the reference for updating benefits each year. As such, it affects all pensions in the system (not only new entries). The UI is calculated each year (t+1) using the following formula:

$$UI_{t+1} = \bar{g}_{I,t+1} - \bar{g}_{p,t+1} - \bar{g}_{s,t+1} + \alpha \left[\frac{I^*_{t+1} - G^*_{t+1}}{G^*_{t+1}}\right] \quad [2]$$

where $\bar{g}$ is a moving arithmetic average, estimated for eleven years (the corresponding year, five periods before and five periods later), of the variation rate in Social Security revenues (sub-index *I*), the Social Security expenditure in contributory pensions (sub-index *p*) and the substitution effect (sub-index *s*);[3] I and G represent the moving geometric average of annual Social Security revenues and expenditures, respectively, estimated also for eleven years; finally, α is a parameter taking a value between 0.25 and 0.33, and revised every five years. In this way, the *UI* seeks to take into account Social Security (im)balances (both in past and future predictions) when obtaining the pension benefits. However, it is worth noting that there are legally established minimum (0.25%) and maximum values (consumer price index plus 0.5%) for the *UI*, independently of the value obtained using the formula. In fact, *UI* was first adopted in updating pensions in 2014, and since then the lower limit (0.25) has been applied.

The sustainability factor (SF) only affects new pensioners joining the system in 2019 onwards (the date established for its launch). From that date, new pensions are to be calculated by correcting (downwards) the result of the standard formula (Eq. 1) by the predicted increase in life expectancy at the age of 67, as follows:

[3] The s*ubstitution effect* refers to the increase in the average pension system due to the difference in the benefits of new entries (new retirees with higher pensions) and system withdrawals (typically old people with lower pensions). In this way, after 35 years of contributions, individuals reached 100% of the RB, as they had before, but with a different distribution in favour of longer (as opposed to shorter) working careers.

$$SF_t = SF_{t-1} \cdot e^*_{67} \quad [3]$$

where t is the first year in which the SF is applied (for 2018, the value of SF will be 1), and e^*_{67} is the growth rate in life expectancy at age 67 over the previous five years. The parameter e^*_{67} will be estimated every five years.

Several countries have similarly used life expectancy as a reference point for introducing a sustainability factor in their pension systems. However, the majority have automatically linked increases in life expectancy to pensionable ages (Italy, Greece, Denmark and Netherlands) and/or the number of contribution years (France and Italy). Spain is one of the few countries (together with Portugal and Finland) to link benefit levels to life expectancy. Some institutions, including the European Commission, have pointed out that the first option is the best way to incentivize people to work longer and, hence, to neutralize the costs of structural longevity growth. In contrast, linking benefit levels to life expectancy is seen as "far less transparent", with the implication that it "can pose a threat to adequacy over time as people fail to react to financial incentives to delay pension take-up" (Pension Adequacy Report of the EC, 2015). To the extent that the DyPeS model is a behavioural model that allows individuals to react to changes in pension system incentives, we should be able to test this, as well as other effects, of the 2013 reform.

The model

This section describes the microsimulation model, DyPeS. It was developed to analyse the Spanish contributory pension system and has been used in previous studies to measure the impact of the 2011 reform of the Spanish pension system (Patxot et al., 2015) and the corresponding behavioural reaction. Subsection 3.1 briefly outlines the model's structure and the way in which the retirement decision is modelled. Subsection 3.2 details the data employed, while Subsection 3.3 is devoted to explaining the way in which wages and retirement decisions are modelled.

Model structure.

DyPeS is a dynamic micro-based model – meaning that it simulates micro units over time. It was developed using ModGen, a generic dynamic microsimulation programming language designed and maintained by Statistics Canada and widely used in social science dynamic microsimulation.[4] This programming language allows the building of two parallel versions of the model: the time-based and the case-based versions. The former simulates successive cross-sections while the latter simulates each case from birth to death before the simulation of the next case begins. In this paper, the time-based version is used, due to the nature of the problem we seek to analyse. As we need information on Social Security budgets to calculate the sustainability factor, successive periods (years) need to be simulated in order to obtain this information. For the same reason, the model is open, in the sense that new agents are introduced, apart from those in the initial sample; and population-based, as opposed to cohort-based, as all the population – contemporaneous workers and pensioners – needs to be simulated every year.

DyPeS runs the simulation with a starting population subsample drawn from the Continuous Sample of Working Careers (*Muestra Continua de Vidas Labourales* or MCVL in its Spanish abbreviation). The next section explains this database in more detail. It is programmed in continuous time, though some of the events happen only once a year. With

[4] ModGen supports the creation, maintenance and documentation of most dynamic microsimulation model types, including both continuous and discrete time, case and time-based models as well as interacting and non-interacting populations. It is freely available at the Statistics Canada website.

respect to previous versions of the model (Fernández-Diaz et al., 2013; Patxot et al., 2015), here one of the main improvements introduced is the calculation and projection of the sustainability factors enacted by the 2013 reform. The implementation of the sustainability factor shown in Equation [3] is quite straightforward, but this is not the case of the pension revaluation index. As indicated by Equation [2], this index and the projection of Social Security budgets have to be simultaneously determined, causing obvious problems of recursivity. These problems are solved in DyPeS by running the simulation following an iteration process. As we see below, the non-limited values of the index obtained from DyPeS for the first two years of application (-1.9% both years) are similar to those obtained by the Ministry and AIREF (AIREF, 2015; Roch et al., 2015) (-1.28% in 2015 and between -0.69 and -3.28% for 2016, depending on the scenario). The model also projects that the pension revaluation index will be stuck in the lower band during the following decades. This is due mainly to the negative impact of the 2008 economic crisis on the Social Security budget, but also to the expected negative demographic impact (baby-boomers starting to retire in 2020).

The DyPeS model introduces behaviour into the retirement decision, meaning that it accounts for behavioural reactions to financial incentives when individuals opt for retirement. This enables us to disentangle the effects of the reform that are related to the individuals' reactions to changes in the regulations (see O'Donoghue, 2001 for a definition of behavioural vs. statistical simulation). The retirement module determines whether an eligible individual actually retires according to a retirement model.[5] The data used to estimate the parameters governing the retirement decision consist of a monthly panel data set covering the period 2005-2010 (from the MCVL). It includes all individuals eligible for retirement during this period, excluding those who retired due to collective agreements or who were forced to do so by

[5] The model parameters are estimated using Stata 11 and are introduced in DyPeS programming or directly in the input tables created for that purpose.

regulation (unemployed reaching the minimum retirement age). Covariates of the model include personal characteristics and financial incentives (Ref paper behaviour). The model is estimated using a piecewise constant exponential function approach in which the hazard is assumed to be constant within pre-specified survival time intervals, but the constants may differ for different intervals. Those older than 58 compute their retirement hazards monthly and the covariates that determine the retirement decision are also updated monthly.

Microsimulation models that include behaviour in the retirement decision are scarce and heterogeneous in their modelling approach. Such models are preferably endowed with simple - non-behavioural - rules for retirement, assuming, for example, that individuals retire as soon as they become eligible (Borella and Coda Moscarola, 2010) or aligning the transitions to observed patterns (Dekkers et al., 2009; Richiardi and Leombruni, 2006). However, by integrating econometric analysis with lifecycle theory, the literature on retirement behaviour can account for the role played by the financial incentives embedded in the pension rule. For example, Stock and Wise (1990) and Coile and Gruber (2001) for the United States; Baker et al. (2003) for Canada; Blundell et al. (2002) for the United Kingdom; and García-Pérez et al., (2013) and Vegas et al. (2013) for Spain, all find that individuals' retirement choices respond to some extent to the financial incentives of the pension system.

To date, there have been a few attempts to introduce behavioural reactions to pension rules into microsimulation models. Van Sonsbeek (2010) models the retirement decision by adopting the option value approach first suggested by Stock and Wise (1990). The author combines individual data on wages, state pension and private pension entitlements with individually varied option value parameters (time preference, leisure preference and risk aversion). Bianchi et al. (2003) also employ an individual reaction function, based on the Stock and Wise option value model, in which the worker calculates the expected value of the utility of retiring today and in the future, using available information. Borella and Coda Moscarola

(2010) specifically compare the results of a behavioural model with a scenario without behaviour in which people retire as soon as possible. The retirement decision is modelled estimating a probit model and the main money's worth measures used in these estimates are the present value of pension benefits (PVB) and the peak value (PV), defined as the maximum forecasted accrual at each age.[6]

All other events are modelled using information from the official statistics (demographics) or using the transition rates obtained from the MCVL. The following are the main events experienced by agents: they, first, experience birth and, second, entry in the labour market, then labour market transitions from employment to unemployment occur until the agents decide to retire and eventually die.

Wages and labour market transitions are conditioned by level of education, which is assigned as follows. For future contributors, the final education level attained determines how they enter the labour market (contribution group, entry age and wage), as shown below. Initial wages (for those working or contributing in 2007) take the value observed in the fiscal module of the MCVL in 2007. In case this value is missing, the contribution basis is used. This information is then used to impute future entry wages, while the error term observed in each cell is used to ensure the variability of the initial wage. Changes in the level of qualification and unemployment events are also derived from the transitions observed in the data set. Wages grow according to an econometric model – a version of the traditional Mincer model – estimated outside the microsimulation model by the authors (see section 3.3. for a detailed explanation of the wage growth mechanism).

Once agents reach the eligible age for retirement (fixed from 59 to 75), they start computing their expected pensions in each of the available pathways depending on their labour market status and, eventually, retire according to the survival times estimated by our retirement

[6] See Patxot et al. (2015) for a more detailed discussion of behavioural models.

model. In order to capture the impact of labour market conditions on the probability of retirement, potential pensions are weighted by the probability of being unemployed in future years. A model of unemployment probabilities for people older than 58 is estimated outside the microsimulation model. We explain this probability using variables found mainly in the literature, seeking to capture differences in personal characteristics, productivity and contextual factors: sex, age, migrant status, educational level, contribution group, experience and unemployment rate.

Finally, agents die according to exogenous age and gender-specific mortality rates evolving in line with those used in the standard population projections. The projection routine of the model starts in 2008. Hence, for events occurring before – affecting agents alive in 2007, the observed data are taken from the data set.

Data employed.

DyPeS starts from a subsample of individuals registered with the Social Security in 2007 extracted for the 2007 wave of the MCVL. The year 2007 is chosen as the base year and the reference point for most data. In this way, the data employed for transitions are not distorted by the effects of the crisis. The MCVL extracts 4% of the population registered with the Social Security at that point in time. Then, all past information about their working careers and contributions is added. This information is reliable from 1980 onwards for their working conditions and from 1990 onwards with regard to their pensions. The sample includes both pensioners and contributors born between 1907 and 1991. Hence, in order to project future expenditure and revenue, new entries in the labour market from 2008 onwards and new births after 1991 need to be added to the model. To add the new-borns, we compare the number of people in the 2007 population and in the 2007 MCVL wave and take into account official population projections (Spanish National Institute of Statistics, INE).

The data employed to simulate each of the events are described below. The first step is to assign a level of education, but while the MCVL contains information about individuals' education, this variable is collected from a different data set that is not updated very frequently. As a result, the level of education is frequently missing or underestimated. For individuals registered in the MCVL, we retain the value as reported and correct it upwards in cases where there is an inconsistency between the value of education and the contribution group.[7] For "future" individuals, born from 1991 onwards, the final education level is assigned randomly so as to reproduce the educational distribution reported for the Spanish population by MEC (2010)[8]. According to this publication, the level of education has risen substantially.

In a second step, once the main characteristics of the individuals are assigned and they reach the age of 16, they are exposed to the probability of entering the labour market by age, gender, education and initial qualification level. This probability is obtained from the observation of the entry path of the last cohort, which has completed its incorporation into the labour market – those aged 36-40 in 2007.

In a third step, once individuals enter the labour market, they are exposed to labour market transitions. The hazards observed are extracted from the MCVL 2007. Specifically, transitions between qualification levels within employment and transitions between employment and unemployment are obtained by age and gender and qualification level when necessary. To this effect, the 13 contribution groups in the general regime of the Spanish Social Security are grouped in five subgroups – that is, those subject to the same contribution limits (thresholds). As the transition hazards among the different qualification levels are quite stable during the observed period (2002-2007), the value of the last transition observed before the

[7] This can only be done for the first contribution group (University level).
[8] See: https://www.educacion.gob.es/educabase/menu.do?type=pcaxis&path=/Formacionyml/EPA2015/NivFor&file=pcaxis&l=s0

economic crisis (2006 to 2007) is taken, and it is held constant for the future.[9] The following sections describe in detail how wage growth and retirement transitions are estimated based on several waves of the MCVL.

Modelling wages and retirement decisions.

The DyPeS model enables us to project the effects of the labour market on the pension system, because productivity growth at the macro level is linked to individual wage growth and, hence, to the point of retirement and entry pensions level. It achieves this through two principal mechanisms: the wage growth model and the retirement decision model. Wages grow according to a model based on the traditional Mincer equation:

For period *t*

$$w_{it} = \overline{w}_t \left(\frac{\beta_0}{\overline{w}_t} + \frac{\beta_1}{\overline{w}_t} w_{i,t-1}, \frac{\alpha}{\overline{w}_t} X_{it} \right) \qquad [4]$$

where w_{it} is the yearly wage of individual i, $\overline{w}_t$ is the average wage of the economy and β_0, β_1 and α are the parameters of interest that we wish to estimate. The set of explanatory variables, X_i includes, apart from the previous wage, personal characteristics – age, age squared and migrant status; productivity indicators – education, qualification group and experience; business cycle indicators – unemployment rate; and cohort effects that are supposed, for the sake of simplicity, to be linear.

Thus we obtain:

[9] In line with Patxot et al. (2015), the crisis is simulated by increasing the unemployment hazard and reducing the reemployment hazard using observed trends.

$$\beta_0^* = \frac{\beta_0}{\overline{w_t}}, \beta_1^* = \frac{\beta_1}{\overline{w_t}}, \alpha^* = \frac{\alpha}{\overline{w_t}} \qquad [5]$$

for the projected periods ($t+1$ and the following periods):

$$w_{it+1} = \overline{w}_{t+1}\left(\beta_0^* + \beta_1^* w_{i,t}, \alpha^* X_{it+1}\right) \qquad [6]$$

To estimate the model, we use a panel data set covering the period 1997-2010, which has been drawn up using information from the MCVL and information from the macroeconomic indicators provided by the Spanish National Institute of Statistics (INE).

During the simulation, earnings (and contribution bases) are updated on a continuous basis. To do so, both a current value and an accumulated value are maintained and updated in the following cases. First, earnings are updated at the beginning of the year, in accordance with Equations 4 and 5. At the same time, contribution bases are also updated. Second, whenever a labour status transition occurs – both among contribution groups within employment status, and between unemployment and employment statuses, a change in wages is applied depending on gender and the original and final states. For this purpose, the average change in wage observed is used. Finally, every time one of the aforementioned changes occurs, total earnings (and contribution bases) functions are updated. This also happens at the end of the year, so that the annual flow of earnings and contribution bases can be recovered and stored.

As explanatory variables, the retirement model includes the individual replacement rate and the maximum expected pension. These two variables are clearly related to an individual's wage trajectory and, also, to the average productivity of the economy, in line with the model presented above. These mechanisms cause productivity growth to have an impact on both the level and adequacy of pensions and, hence, on the average retirement age. On the one hand, more optimistic productivity growth scenarios would lead to higher individual growth rates and, consequently, worsen the relative position of the elderly with respect to the working population (decreasing median income ratios, for example). On the other hand, higher wages mean higher future entry pensions, given that the formula calculating initial pensions links them directly to the contributions made over the preceding 20 years. Finally, higher wages would lead to a decrease in replacement rates, making it more attractive for workers to remain in the labour market. This, in turn, would also have a positive impact on initial pensions. Increases in entry pension levels, obviously, mean increasing median income ratios and, hence, an improvement in the relative position of older generations. Consequently, projecting different productivity growth rate scenarios can provide interesting information for policy evaluation as regards the impact of changes in the retirement age and their interaction with labour market performance. Note that the results in this respect are not easily predictable without a complete model that links, to some extent, the micro and macro levels (see Appendix 1 for detailed results in relation to this question).

Results: The effects of the 2013 reform on pension sustainability and adequacy

This section presents and discusses the results of the 2013 reform captured via the extension of the DyPeS microsimulation model. We focus primarily on the impact of the reform on the sustainability of the pension system (subsection 4.1) and on the adequacy of the resulting retirement pensions (subsection 4.2). Subsection 4.3 undertakes an in-depth analysis of inequality.

Different scenarios are defined. First, the baseline is the pre-reform scenario, taking into account the leading measures introduced in the past, including the 2011 reform. Second, the reform scenario considers the legal configuration of the sustainability factors introduced in the 2013 reform, including the limiting values of the *UI*. Finally, an alternative scenario is defined where the *UI* is not limited at all, in order to cope with the effects of the demographic pressure that threatens the pension system. The following subsections show, first, the evolution of the sustainability indicators, compared to those reported in the EC's Ageing Report (Ageing Report of the EC, 2015) and, second, the evolution of the adequacy measures in different scenarios.

The goal of sustainability

Before examining the impact of the 2013 reform on the pension system's sustainability – the main objective of the reform, we first analyse the overall performance of the model in demographic and macroeconomic terms. The benchmarks for comparison are, on the one hand, the values obtained from official data for the period 2008-2015[10] (the model starts its projections in 2008) and the last wave of the AWG projections (2015) for future years. Table 1 presents the projections of four demographic and macroeconomic indicators that have a critical impact on the sustainability of the system (but which do not vary greatly between scenarios, with the exception of the benefit ratio). Using this information, we are able to calculate a decomposition of the ratio of pensions to the total wage bill, following the same logic as that of the decomposition of the pension expenditure to GDP ratio calculated in the 2015 Ageing Report (Ageing Report of the EC, 2015). This decomposition expresses the proportion of pensions in relation to the wage bill as the product of four factors: Old dependency ratio (which quantifies the impact of demography); the number of retirement pensioners in relation to the population over the age of 65 (the coverage ratio, only considering retirement pensions); the benefit ratio; and labour market performance (in our case, measured by the inverse of the ratio of contributors to the population aged 16-64).

[10] Demographic data and pension information obtained from the National Institute of Statistics (INE) and the Spanish Social Security, respectively.

To the extent that our model explicitly models labour market income and its effect on the initial retirement pension at the micro level, it is a useful instrument for relating labour market performance to the ageing process, allowing for a specific intergenerational distribution interpretation. This analysis is of particular interest because the UI formula introduced by the 2013 reform relates retirement benefits to the social security balance, which implicitly means linking pension levels to wage growth, the main source of social security revenues (a more detailed analysis of the impact of labour productivity on pension sustainability and adequacy is provided in the Appendix).

Table 1. Demographic and macroeconomic indicators. Projections obtained from simulation

Year	(1) Old dependency ratio (%)	(2) Coverage ratio (%)	(3) Benefit ratio (%)	(3') Benefit ratio 2013 Reform (%)	(4) Labour market factor (Population 16-64 to contributors)	(5) Retirement pensions / wage bill Base (%)	(5') Retirement pensions / wage bill. 2013 Reform (%)
2013	23.5	63.6	47.5	47.5	1.38	9.80	9.80
2020	21.3	67.8	62.3	55.4	1.29	11.62	10.32
2030	26.3	69.2	74.1	57.9	1.24	16.76	13.10
2040	44.7	64.5	76.0	58.4	1.16	25.51	19.59
2050	66.5	67.4	81.5	61.5	1.09	39.99	30.16
2060	61.5	70.2	87.3	62.0	1.13	42.69	30.32

Note: As explained in the text 5=1+2+3+4 (or 5' using 3')

The first panel shows the evolution of the old dependency ratio, which describes a similar but more pronounced increase to that outlined in the 2015 Ageing Report of the EC (which projects values of 53% for 2060). The evolution of this ratio is coherent with the demographic projections, i.e., with the first wave of baby boomers reaching the age of 65 in 2022. The coverage ratio (for public retirement pensions only) increases in the first years of the projection, provided baby boomer females enter retirement with greater pension entitlements than those of the preceding cohorts, due to their higher participation rates. The initial value for 2013 (around 65%) is coherent with that obtained from merging data on population and pensions from official sources.[11] In this case, the initial values are not readily compared with those reported in the Ageing Report, because it assumes a coverage ratio of public retirement pensions of 88.4% in 2013.[12] More significantly, the evolution of this ratio differs considerably between the two projections: showing a sizable increase in our projections (from 63.7 to 70.2% in 2060) but only a very moderate increase in those of the 2015 Ageing Report (from 84.4 to 86.6%). As it is based on micro data, our model probably reflects better the increase in female participation and the resulting increase in their pension entitlements.

The initial value of the labour market factor is very similar to the value predicted by the aforementioned report, which assumes participation rates close to 78%. The evolution of this factor is also very similar, reaching values of 85% (2015 Ageing Report) and 88% (in our projections). Overall, the model is able to replicate long-run trends in terms of demographic and labour market conditions.

The factor that differs most markedly from the 2015 Ageing Report projections is the benefit ratio. Our starting value for 2013 is coherent with official sources[13] (0.52), if we consider that our model excludes civil servants in state-level administration (with their own specific pension system), who earn higher wages. The 2015 Ageing Report projects a decrease in the benefit ratio of around 20 percentage points, while in our projections it increases. Insofar as our microsimulation model projects future pensions in relation to the past evolution of wages, it should capture better all the factors that might affect the future evolution of the benefit ratio.

[11] For example, in 2013, the population older than 64 stood at 8.34 million (National Institute of Statistics, INE), and the number of pensioners at 5.52 million (Spanish Social Security), giving a coverage ratio of 66% (INE).

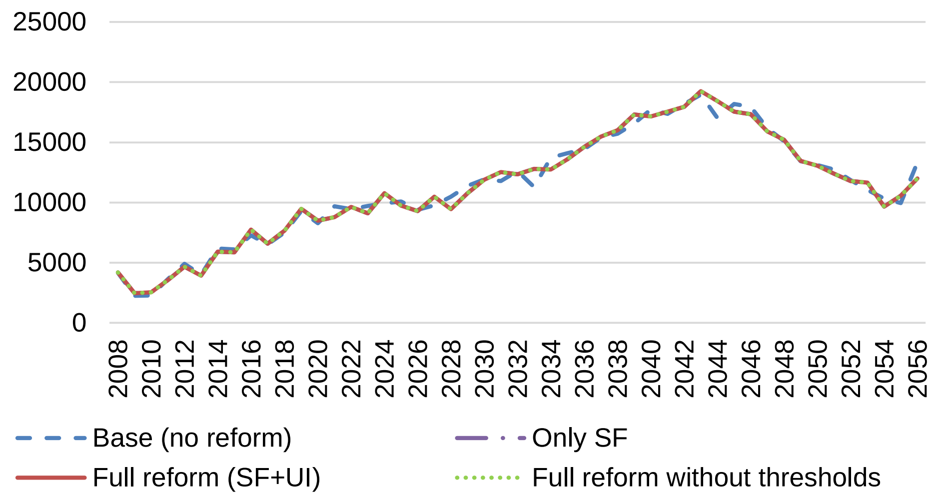
[12] This ratio is not provided directly in the tables of the 2015 Ageing Report, but can be derived from other data contained in tables reporting the number of public pensions and the proportion of pensions for those aged over 65.

[13] The Spanish National Institute of Statistics (INE) reports a yearly average wage of 22,698 euros, and the Social Security reports an average pension of 11,861 euros.

As we see at the end of this section, the interplay between the past evolution of wages and pensions in Spain has non-trivial implications for sustainability.

Figure 1 shows the changes in the number of entry pensions associated with the 2013 reform. These changes are related entirely to changes in the level of entry pensions, due to the introduction of the sustainability factor (SF) described in Equation [3] – note that the *UI* (Equation [2]) does not affect entry pensions. The introduction of the SF leads workers to retire earlier to avoid further cuts in pensions due to their increased life expectancy, although some might seek to extend their labour participation in order to obtain pension improvements from the application of the Bismarckian pension formula. Clearly, more marked changes in the number of entry pensions are derived from the 2011 reform, given that delaying retirement was one of its main goals. It should be mentioned at this point that the 2013 reform did not seek to delay retirement, mainly because a reform with this specific objective was promulgated two years earlier in 2011. Despite not being among the specific objectives of the reform, it is interesting to note the very limited and erratic impact of the reform in terms of entry pensions.

Figure 1. Number of entry pensions



These results seem to confirm the findings of the 2015 Adequacy Report: namely, that people fail to react to financial incentives to delay pension take-up in line with developments in life expectancy. And this is not (solely) because an individual's behaviour is not fully rational when choosing to retire. The behavioural model embedded in DyPeS supposes that individuals do behave rationally. But, in a future context in which pensions are set to grow at a permanently low rate (the expectation is that the *UI* will be fixed in the lower band), the mechanism for updating pensions remains neutral to the decision of when to retire.

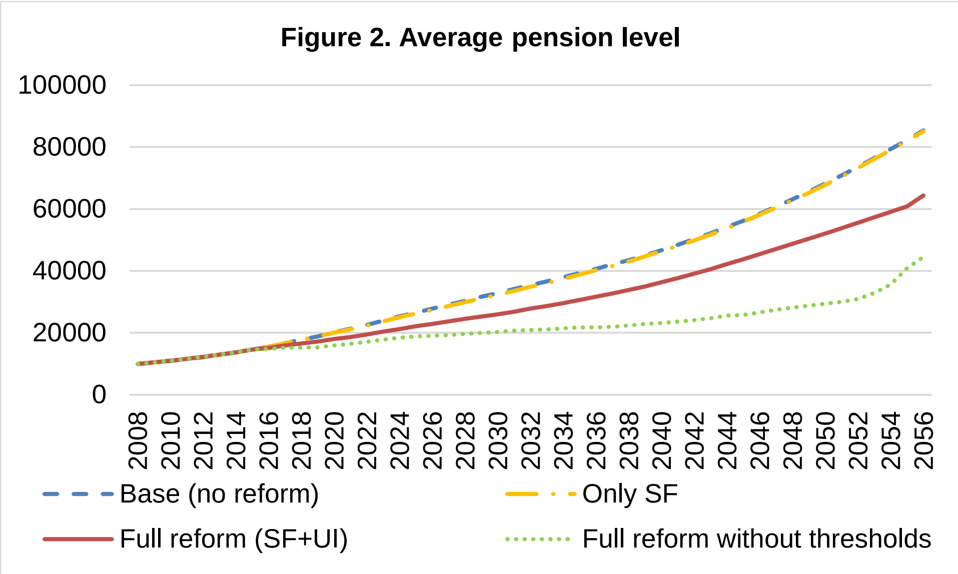
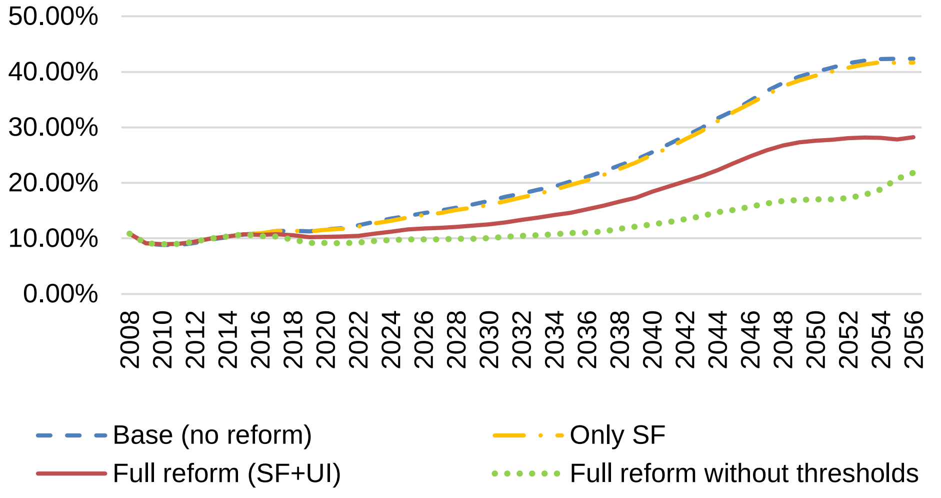


Figure 2 shows the evolution of the pension level. The cut in pensions introduced by the 2013 reform (mostly due to the *UI* index) is quite substantial, but much less than the cut that would have resulted from a scenario with no limits. As explained above, Law 23/2013 of 23 December regulating the sustainability factors of Social Security pensions established that, from 2015, pensions are to be updated annually in accordance with the so-called Pensions Revaluation Index (or the update index). The rule states, however, that regardless of the result of applying the formula, the revaluation of Social Security contributory pensions should not be less than a minimum annual percentage (0.25%) nor exceed a maximum rate (evolution of the Consumer Price Index in the previous year + 0.50%). Notoriously, the results of our simulation for the scenario in which the 2013 reform is fully implemented with thresholds indicate that the *UI* will be fixed in the lower band of 0.25% during the whole period of analysis (2015-2055).

The scenario that considers the implementation of the *UI* without thresholds, produces *UI* values close to 2% for 2015 and 2016, which is coherent with other estimations (AIREF, 2015)

Figure 3. Pensions expenditure to wage bill ratio



Finally, Figure 3 summarizes the overall effect of the reform by showing the evolution of the ratio between pension expenditure and the wage bill. The model predicts a decrease of more than 10 percentage points of this ratio following the introduction of the 2013 reform. And this decrease is magnified once again by the scenario with no limits. This ratio is not fully comparable to the ratio of pension expenditure to GDP presented in the Ageing Report (2012) but it is sufficiently informative of the extent of the effects.

In short, it can be concluded that the main objective of the reform – a reduction in future public expenditure on pensions – is achieved to a considerable extent, if not fully. The next section analyses whether the adequacy effects of the reform allow for an equally positive interpretation.

The goal of adequacy

There is no broad consensus in the academic literature and among policymaking circles as to what constitutes the best measure of pension adequacy. Moreover, a review of recent reports (Adequacy Report of the EC, 2015) suggests that the concept of adequacy is in fact a compilation of various objectives: that is, not only securing a minimum standard of living for the elderly (the “strict” definition of “adequacy”), but also achieving distributional and equity objectives (in both inter- and intra-generational terms). It should be stressed, however, that protecting the elderly from the risk of poverty and depravation is compatible with an income distribution that improves the position of those that are worst off. Consequently, no single measure appears to offer a clear indication of the extent to which the reforms impact on the achievement of these pension system goals.

In keeping with this situation, we treat the different objectives associated with the more general adequacy goal separately, providing in each case the most suitable indicators. Above all, we seek to be consistent with institutional reports that measure adequacy (primarily with the 2015 Adequacy Report of the EC) by adopting indicators of intergenerational equity, and implementing them as an output in our simulation model. We also add further indicators of intergenerational equity that may improve the analysis (including the Gini index – see point b below). As discussed in the previous section, the effects of introducing only the SF measure, which relates pension benefits to life expectancy, has a negligible effect on pension levels. Therefore, in this section, only three scenarios are compared: the baseline (without the 2013 reform), the fully implemented 2013 reform, and the 2013 reform without thresholds.

Intergenerational equity

In order to determine the intergenerational equity effects of the reform, we focus primarily on the relative distribution between workers and pensioners, paying specific attention to two dimensions of analysis. First, we investigate the relative position of the elderly with respect to the working-age population (simultaneous comparison of two cohorts). Second, the projection model allows us to monitor the future evolution of their relative positions, providing a complementary picture of intergenerational equity insofar as it reflects the position of future generations at the time of retirement (comparison of two cohorts at different times).

Specifically, we compute two indicators of intergenerational equity: the benefits ratio and the relative median income ratio. The former can be computed in aggregate accounting models based on representative age cohorts, while the latter – and more detailed measures of income redistribution – can only be obtained in the framework of microsimulation.

The "benefit ratio" can be defined as the average pension benefit relative to the economy-wide average wage. The ratio between these two indicators provides an estimate of the overall generosity of pension systems, measuring, at the same time, the relative position of workers and pensioners. Hence, it also measures the income replacement capacity of the system. In this sense, the benefit ratio represents the broadest of measures as it compares all (public) pension payments with economy-wide incomes, whereas other indicators are narrower in their approach. The Aggregate Replacement Ratio, for example, only compares the pension income of those aged 65-74 with the earnings situation of people aged 50-59 (Adequacy Report of the EC, 2015).

Figure 4. Benefit ratio of public pensions

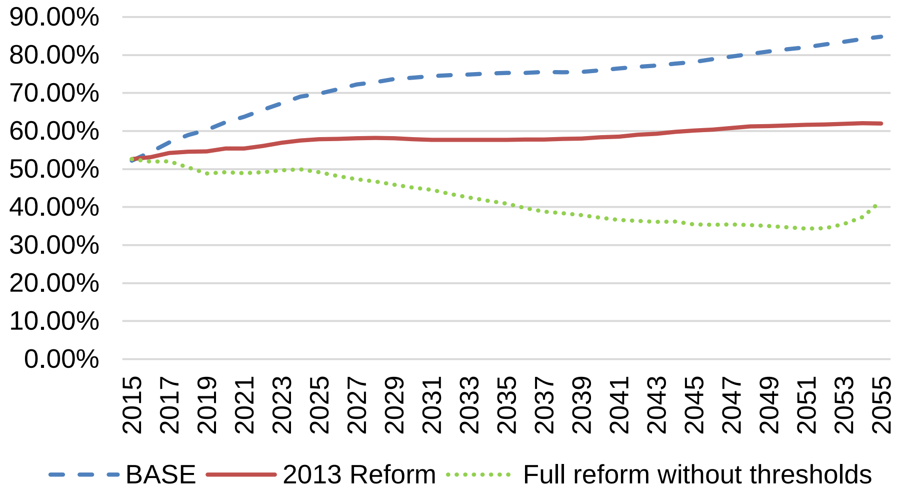


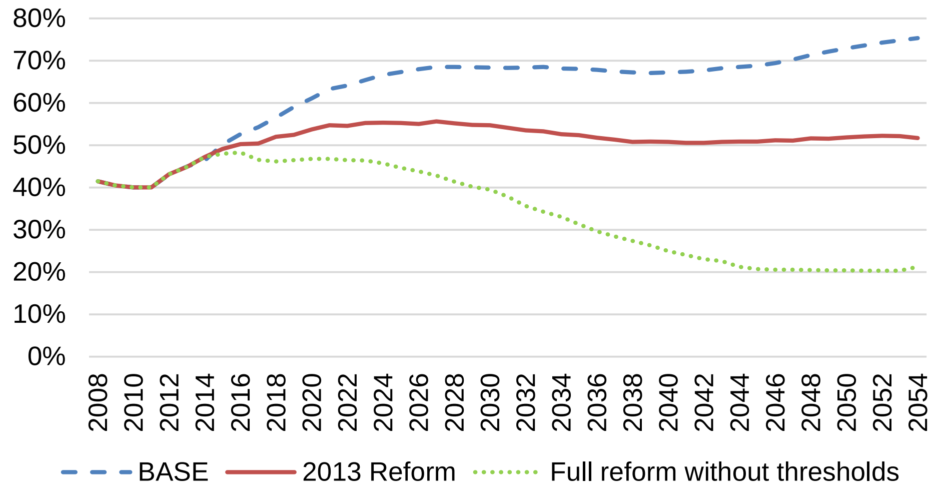
Figure 4 presents the results of running three different scenarios: the baseline without the reform, the fully implemented reform and the 2013 reform excluding the thresholds that the

Law imposes on the UI. Insofar as these thresholds can be considered somewhat “ad hoc”, subject to modification without far-reaching changes in the Law, it is interesting to predict a hypothetical scenario without them. In this respect, the evolution of the benefit ratio that results from this scenario highlights the huge potential impact of the reform in terms of adequacy. The application of the formula as currently promulgated by the law also shows sizable effects of the reform in terms of the benefit ratio.

Interestingly, the application of the 2013 reform causes the benefit ratio to stay constant over the projection period, while the baseline scenario produces an almost monotonic increase in the ratio. As we discuss below, this highlights a paradox within the Spanish pension system.

The relative median income ratio is calculated as the median income of people aged 65 as a share of the median income of people aged 0-64. While the Adequacy Report constructs this ratio by comparing the median equivalised disposable income of these two groups and includes all sources of income, our model only includes pensions and labour income.

Figure 5. Median income ratio (Pensions to labour income)



The evolution of this indicator is quite similar to the one described above, but a number of differences remain. The steeper increase at the outset might reflect the fact that workers are subject to labour market instability (due to the economic crisis), while pensioners are no longer subject to these effects. This situation is best captured by the median income ratio, which has greater explanatory power in the case of inequality. The changes between scenarios are also similar, but again some differences are observed: the impact of the 2013 reform is slightly smaller and, hence, the effect of the scenario with no limits is higher.

Overall, both indicators present the same general pattern. While the effects of a hypothetical formula for updating pensions without thresholds are devastating, the effects of introducing the reform as it currently stands are far from negligible. Interestingly, in both cases, the baseline scenario shows a continuous increase in the relative position of pensioners with respect to that of workers. Besides the legal features of the pension system, this trend is clearly attributable to the assumptions made with respect to the evolution of wages. Examining the past evolution of pensions and wages hints at a paradoxical feature traditionally characterizing the Spanish pension system and one that has important effects on our simulation results.

Figure 6. Growth in Wages and Pensions. 1995-2055*

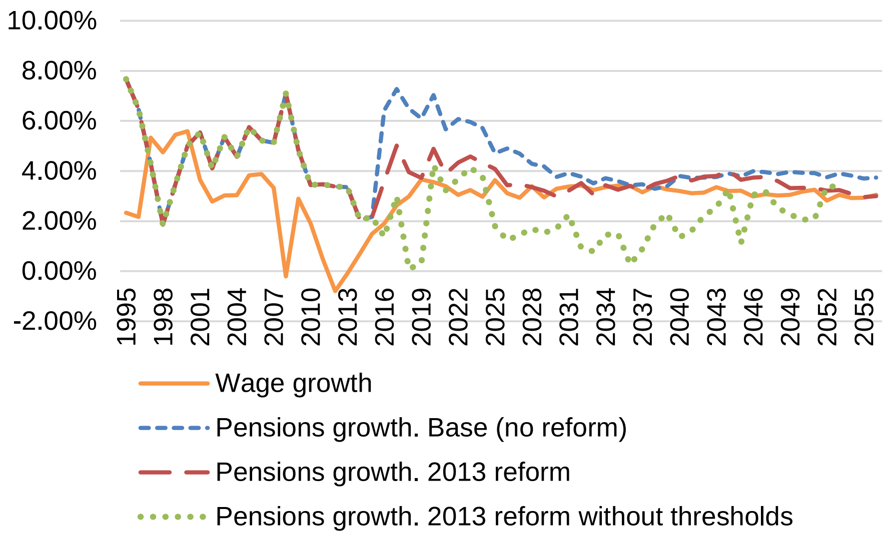


Figure 6 shows the past evolution of the growth in wages and pensions up to 2015, continuing with the projected values under different scenarios. It is notable that, on average, pensions have grown faster than wages in Spain for more than a decade. Interestingly, by conditioning retirement benefits to the social security balance, the introduction of the *UI* in the 2013 reform positively links pension levels to wage growth (that is, to the main source of social security revenues). Thus, the relationship between pensions and wage growth is implicitly "sustainable" (a sustainable benefits ratio): increasing gains in retirement benefits due to higher wages are only maintained when the growth in pensions does not compromise the social security budget.[14]

The economic crisis resulted in notable cuts both in pension and wage growth rates. From 2012 onwards, an increase in wage growth rates occurred due to the relative recovery from the crisis (note 2012 was the worst year in terms of unemployment rates and other macro indicators). From 2015 onwards, for the baseline scenario (in the absence of the 2013 reform), the model projects an increase in the pension growth rates, to the extent that they recover their pre-crisis levels. Clearly, in practice this increase is moderated by the application of the 2013 reform, so that pensions and wages follow quite similar trends during the projection. Finally, the *UI* without any limits follows the expected path. It undergoes a sharp decline during the crisis, before recovering, only to fall again for a prolonged period as the baby boomers start to retire. The rate increases at the end of the projection period, but the calculations in the last five years of the projection period are no longer reliable (and no future data are available to compute it).

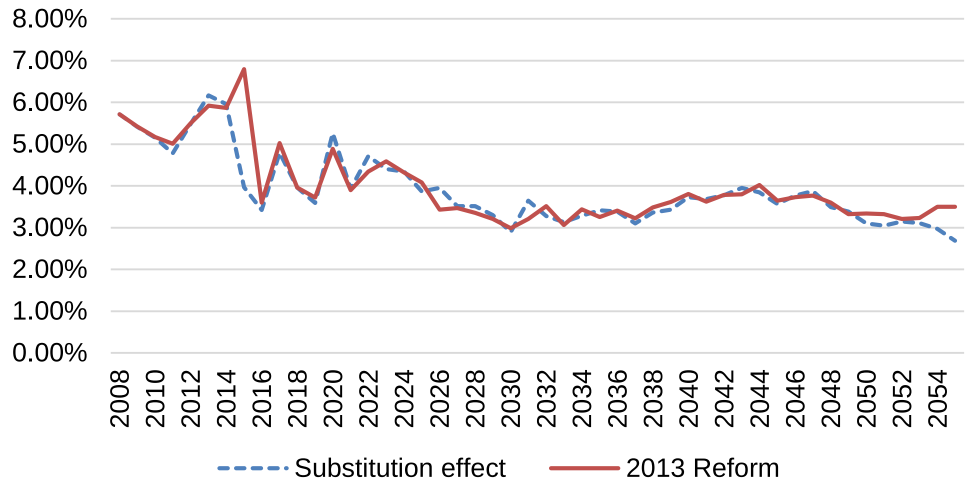
At this point, it is worth decomposing the factors responsible for the growth in pensions, focusing above all on the impact of new pensions (the substitution effect). Figure 7 represents the evolution of pension growth discussed above (Figure 6) across the projection period (baseline, *UI* in the 2013 reform and *UI* with no limits) together with the evolution of the so-called substitution effect. This is one of the factors defining the *UI* and it basically captures the

[14] To investigate this relationship further, simulations of different wage growth scenarios and their consequences for sustainability and adequacy are included in the Appendix.

growth in pensions due to the fact that new pensions are, on average higher than the old ones. Interestingly, as expected when obtaining the *UI* value (fixed in the lower band across the whole period), most of the projected growth in pensions is caused by the substitution effect.

Overall, Figures 6 and 7 explain the sharp fall in the benefit ratio and in the median income ratio when the *UI* is not limited. In a way, they show what would happen if the past (paradoxically) positive differential between pension growth and wage growth were to be reversed in the future.

Figure 7. Average pensions'growth and substitution effect

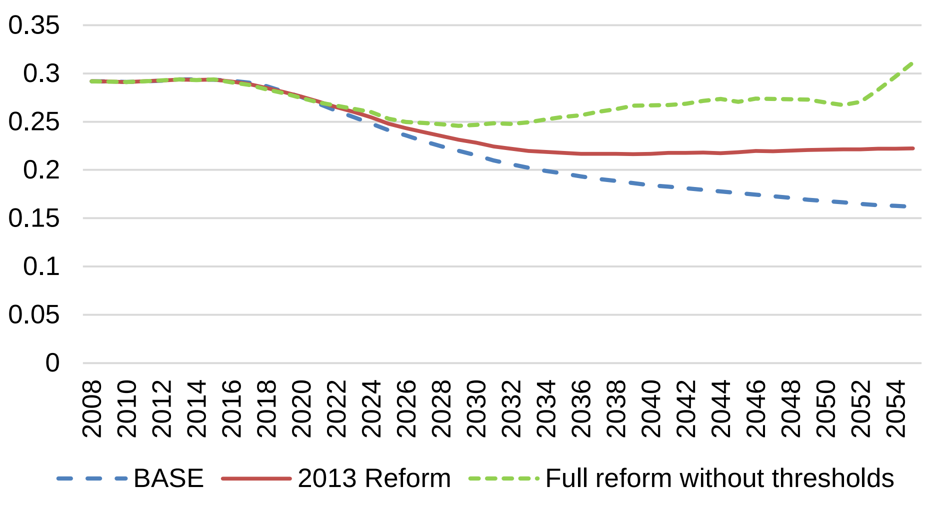


Intragenerational equity

As stressed earlier, the microsimulation model developed here allows us to implement indicators of both inter- and intra-generational income redistribution. Below, we show the evolution of two indicators of intragenerational redistribution: the Gini index and the income quintile ratio for pensioners. This enables us to examine more closely the effects on income redistribution of the cuts in pensions introduced to foster sustainability.

The evolution of the Gini coefficient for pensions is shown in Figure 8. In the baseline scenario, this indicator is decreasing over the projection period, albeit with a slight increase between 2010 and 2013. This sustained decrease is in line with the decrease observed in wages in Figure 9. This figure compares the Gini index for labour income and pensions in the case of the baseline scenario. After an initial increase due to the economic crisis, the Gini index for wages decreases. The reason for this fall is not clear, but there is likely to be a limit to the possibility of replicating observed inequality via microsimulation, even when wages include a random term, as is the case in DyPeS. The meaningful results of our projections are those obtained when we compare scenarios (i.e., the scenarios with and without reform). In this sense, Figure 8 shows that the introduction of the two sustainability factors (*UI* and SF) unambiguously increases inequality, at least according to the Gini index. The effect is notoriously higher when the UI is not limited and, hence, the cut in pensions is greater. This is the expected result if we consider that the UI affects all pensions proportionally, irrespective of their level, hence producing a regressive impact.

Figure 8. Gini index: Pensions



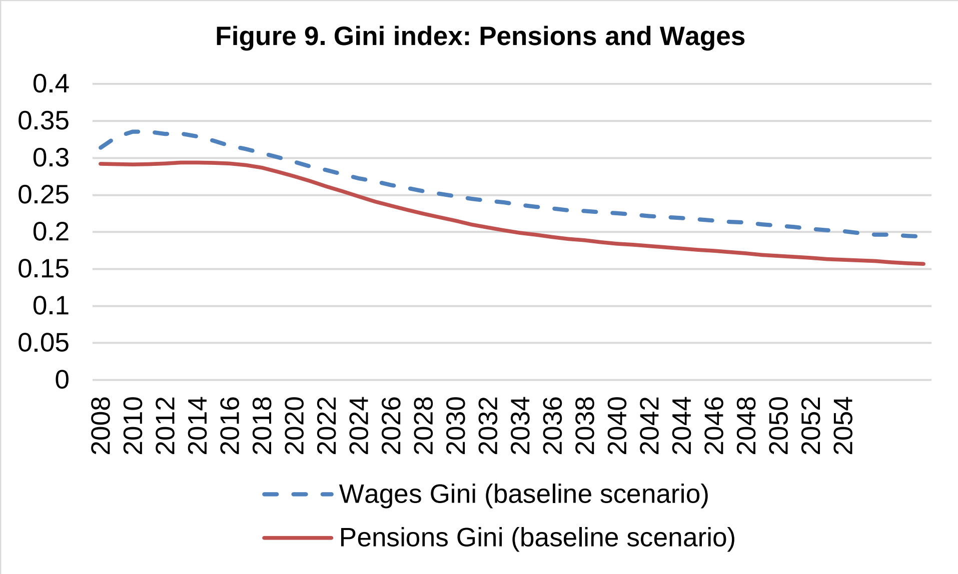
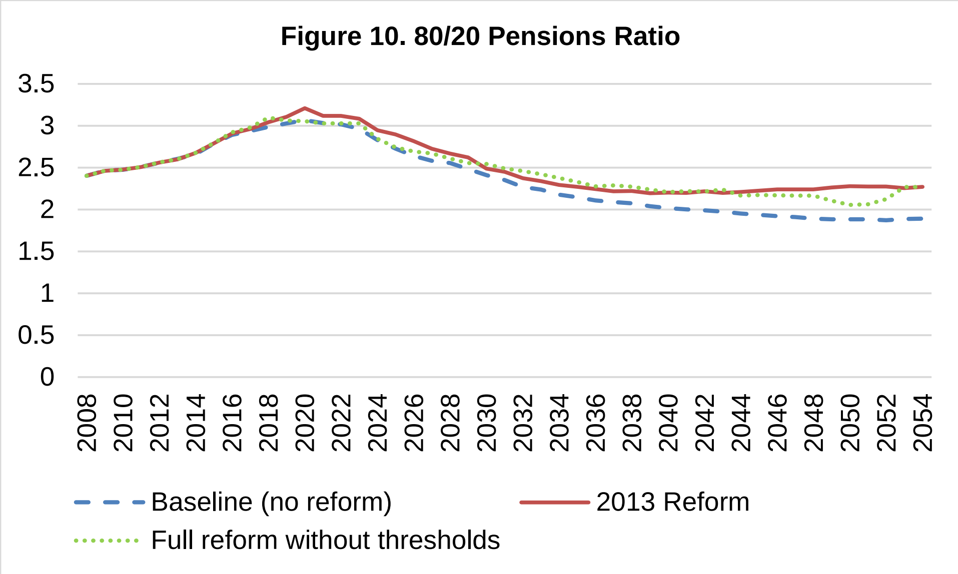
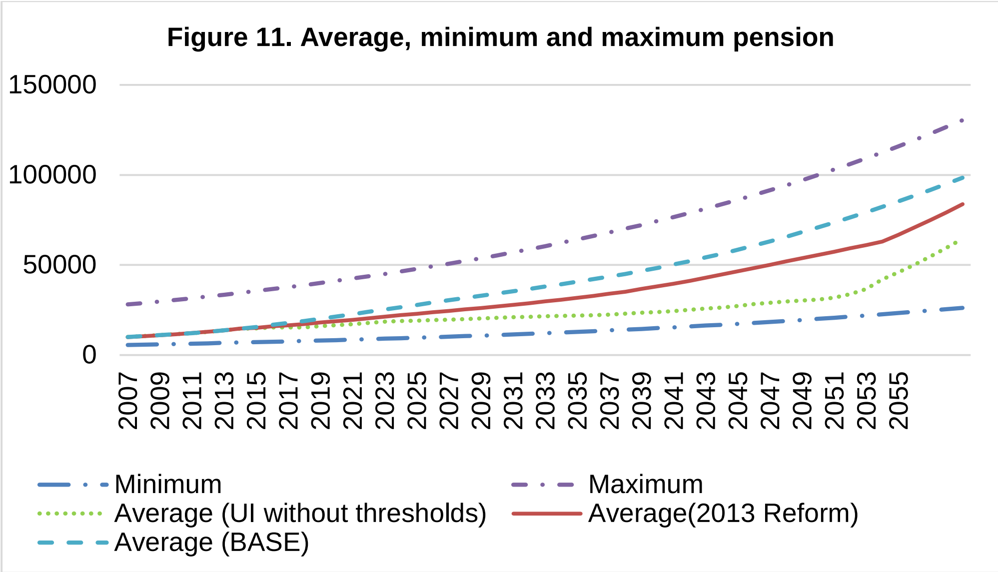


Figure 10 shows the changes in the 80/20 pensions ratio. Unlike the Gini index, the income quintile ratio (S80/S20) is closely affected by the introduction of the *UI* in the 2013 reform, the link being mediated by the existence of lower and upper thresholds. The application of the *UI* has a marked effect on the numbers of people receiving maximum and minimum pensions (as explained in detail below) and, consequently, it has a significant impact on the extremes of the distribution. The 80/20 pensions ratio compares the total income received by the 20 percent of pensioners with the highest income (the top quintile) with the total income received by the 20 percent of the pensioners with the lowest income (the lowest quintile). If the S80/S20 ratio is, for example, four, then the income of the richest 20 percent of the elderly is four times higher than the income of the poorest 20 percent. The S80/S20 indicator is a widely used indicator for measuring inequality. It is included in the Joint Assessment Framework (JAF), as well as in the Social EMU scoreboard on key social and employment indicators. In the baseline scenario, this ratio rises from 2.5 to 3 until 2022 – when baby boomers start retiring – and then in the long run it falls to a ratio of 2. In line with the Gini index, the introduction of the 2013 reform (in both cases, with and without thresholds) increases pension inequality.



In order to understand the changes in these inequality indicators, we need to consider the evolution of the average pension in conjunction with the maximum and minimum thresholds (Figure 11) as well as the number of pensioners affected by these pension thresholds (Figure 12). Note that in the absence of a clear legal reference, we update the pension thresholds with inflation, while pensions grow in line with the past evolution of wages and the legal features of the pension formula. Although initially pensions grow at a relatively fast rate, Figure 11 shows that, for the baseline, the average pension is close to that of the maximum pension and, as a result, more pensioners are affected by the maximum threshold (Figure 12).[15] Correspondingly, the share of pensioners receiving the maximum pension rises and the share of pensioners receiving the minimum fall.

[15] Note that the mere evolution of the pension thresholds with inflation has no trivial redistributive effects of a different sign.



This situation changes when the reform scenarios (both with limits and no limits) are considered.[16] In the case of the 2013 reform, the pension cut implies that there is an initial decrease in the share of people reaching the maximum pension and slightly more people receiving the minimum. This latter effect is magnified when the *UI* is applied with no limits, so that the share of people affected by minimum pensions reaches 50%. This trend explains the ambiguous effects in redistribution. The Gini index still shows a clear deterioration in inequality, being much more marked as pensions suffer greater cuts (no limit vs. limited SF scenario). The 80/20 pensions ratio – focused on extreme groups – indicates similar but more ambiguous effects on inequality: the 2013 reform results in greater inequality, while the non-limit UI scenario is similar in impact to the scenario in which the *UI* is applied with thresholds.

[16] Note that the reform does not affect the maximum and minimum pensions.

Figure 12.a Percentage of pensioners with minimum pensions

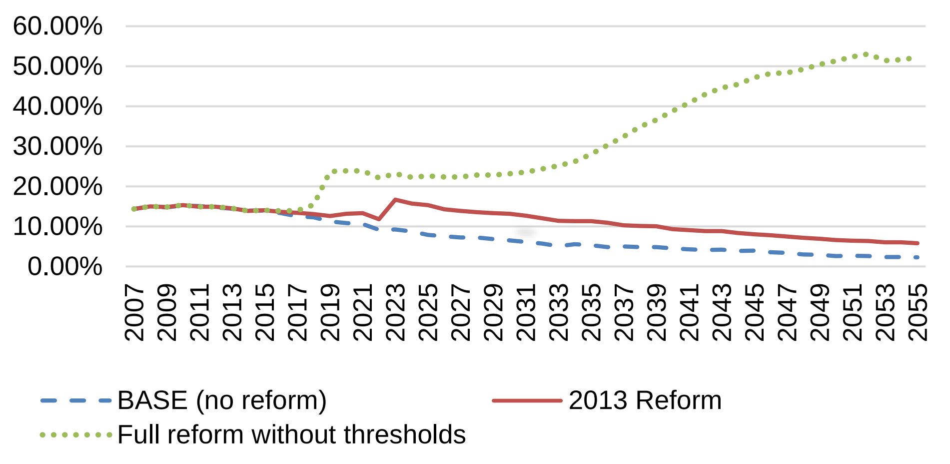
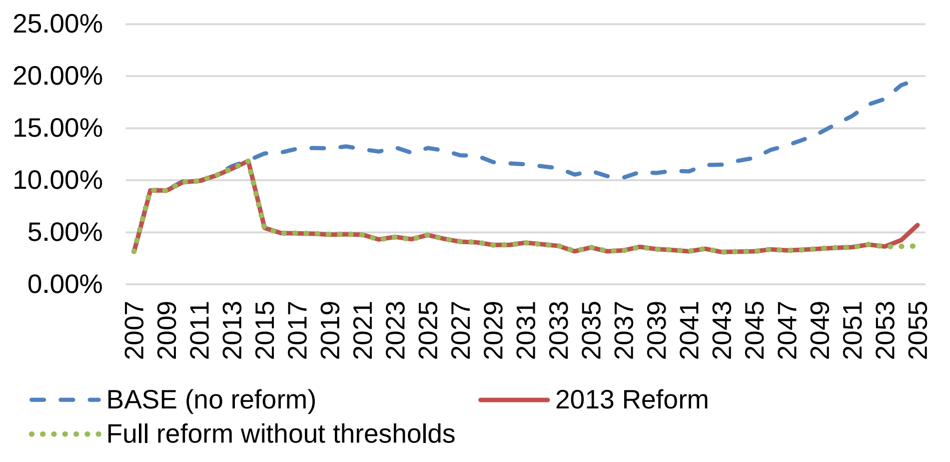


Figure 12.b Percentage of pensioners with maximum pensions

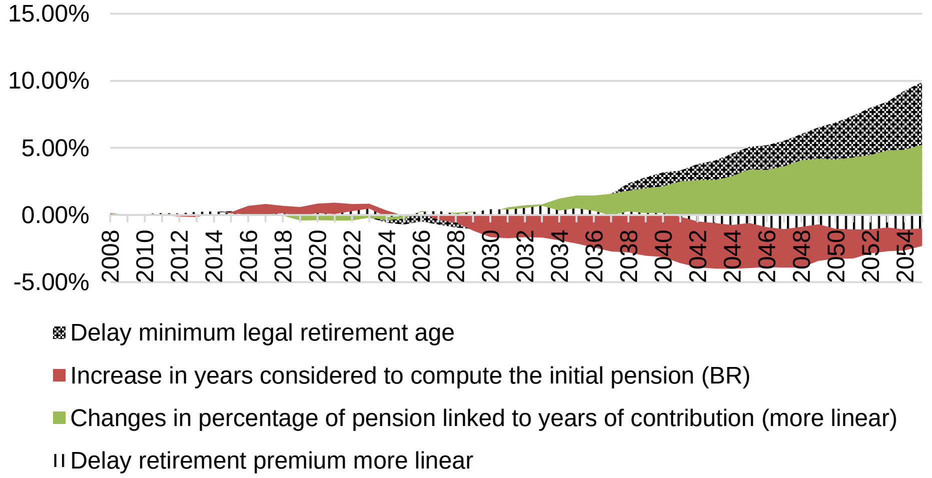


<u>Should we really redistribute income with pensions?</u>

The results indicate that the 2013 reform has notable redistribution effects and, in this regard, it is worth considering the extent to which the pension system should be used as a redistribution mechanism. As in many other countries, the pension system in Spain was designed along the lines of the Bismarckian (contributory) system, although some form of income redistribution was introduced from the beginning, both in the form of nonlinearities with the Bismarckian parameters, and with the addition of contribution and pension thresholds. In the wake of the Toledo Pact, one of the main guidelines of the reform was the strengthening of the Bismarckian nature of the system. This was supposed to be aimed at fostering sustainability, while in a pay-as-you-go system there is no clear link between these two goals. Yet, clearly, measures of this kind should – a priori – be producing less redistribution. However, it transpires that Bismarckian reforms of the pension system do not always result in less redistributive outcomes. Below, we analyse the redistributive effects of the measures introduced in the 2011 reform, which provided for the most substantial changes towards Bismarckianism. As Patxot et al. (2015) show the impact of these reforms on sustainability was somewhat limited.

Figure 13 shows the changes in the Gini index associated with the different components of the 2011 reform. The first reform measure – the one with the greatest impact on pension expenditure – was the delay in retirement age. This is not typically considered a Bismarckian reform, though it captures some of the essence of this system if attempts are made to extend the working life because of the increase in time spent as a pensioner (given the increase in life expectancy). Figure 13 shows that this measure increases inequality, reflecting, in all likelihood, the fact that older pensioners usually receive lower pensions.[17]

Figure 13. Changes in Gini index associated with different measures (2011 reform)



[17] Note that we avoid considering inequality from a lifetime perspective, an approach that lies beyond the scope of this paper.

The other three measures sought to strengthen the link between contributions and pension benefits directly. Nevertheless, the only one to have the expected effect on income redistribution is the change in the share of the regulatory base (RB) received as a pension, which was made more proportional. The increase in the delayed retirement premium to make it more linear has small, but erratic, effects. The improvement in redistribution probably reflects the fact that workers with precarious working careers are able to improve their pensions. Interestingly, the increase in the number of years of past contributions considered to compute the RB initially has a small negative effect, and later a positive impact, on income redistribution. Indeed, the impact of this measure on both sustainability and inequality deserves closer attention. First, as long as the earnings profile is increasing across the working career, this measure would lead to a cut in pensions. Second, if the earnings profile grows faster for high-income earners, this measure would reduce their pension entitlements by a larger amount, hence reducing inequality. The results in Figure 13 corroborate this reduction in inequality, but not for the first years of the projection. The opposite effect recorded before 2025 probably reflects the effect of the crisis that negatively impacts the working careers of many workers, especially those with precarious career paths. These erratic effects would appear to point to the need to use the whole working career to compute the regulatory base so as to avoid arbitrary effects on inequality.

Overall, our results indicate that the impact of reforms aimed at fostering sustainability has quite arbitrary effects on inequality. This has an immediate interpretation for the case of Spain: it would have been better to complete the Bismarkian reform before introducing sustainability factors. Moreover, the outcomes also cast doubt on the appropriateness of using the pension system as an income redistribution mechanism in general.

Conculsion

Concerns about the consequences of demographic ageing on the sustainability of the pension system has led to the adoption of reforms reducing pension expenditure. However, the impact of these reforms on pension adequacy has frequently been overlooked. In this paper, we have used an extended version of the DyPeS microsimulation model to assess the trade-off between the goals of sustainability and adequacy in the case of the Spanish pension system. The model is designed so as to be able to analyse both goals at the same time and, hence, the impact of pension reform on both intra- and inter-generational income redistribution. The results show that the introduction of sustainability factors to achieve sustainability has had marked effects on pension adequacy, both at the inter- and intra-generational levels. First, in the case of intergenerational redistribution, it is interesting to note that in the baseline case the benefit ratio (average pension to average wage) increases in line with the trend observed in the past when pensions grew at a faster rate than wages. When the pension revaluation index regulated in 2013 is applied this trend is curbed – provided pensions are reduced, the benefit ratio remains almost constant. In contrast, in a hypothetical scenario where the *UI* is applied with no limits, the benefit ratio falls dramatically. Second, in the case of intragenerational redistribution, we observe that the Gini index for pensions experiences a sizable increase from 0.16 to 0.22 in the case of the 2013 reform (or up to 0.29 with no limits on the UI).

Hence, while the 2013 reform implies a substantial cut in pensions, lifting the limits would lead to an even higher cut in the pension level and a considerable reduction in the relative position of pensioners with respect to workers and to an increase in inequality. This leads us to consider the impact of previous reform measures on redistribution (above all, the 2011 reform with its limited impact on sustainability). Interestingly, even though these reforms sought to foster the Bismarckian (or contributory) nature of the system, unexpected effects on redistribution were also observed. Specifically, the gradual increase in the number of years of past contributions considered when computing the regulatory base (RB) initially has a small negative effect, but later a positive impact, on income redistribution. On the one hand, as long as the earnings profile is increasing across the working career, this measure would lead to a cut in pensions. On the other hand, if the earnings profile grows faster for high income earners, this measure would reduce their pension entitlements further, hence reducing inequality. Our results corroborate this trend in inequality but not for the first years of the projection. The opposite effect found before 2025 probably reflects the effect of the crisis negatively impacting the working careers of many workers, especially those with precarious paths. These somewhat erratic effects would appear to point to the need to use the whole working career to compute the regulatory base so as to avoid arbitrary effects on inequality. Overall, the reforms introduced to date in Spain have altered the income redistribution impact of the pension system. On the one hand, initial efforts to foster its contributory nature and, hence, its sustainability have been unable to achieve this last goal because of the pay-as-you-go nature of the system. On the other hand, the most recent attempt to foster sustainability (the 2013 reform) has made some progress; yet, various problems remain. First, the thresholds applied to the *UI* limit the extent to which sustainability can be achieved. Second, marked effects on pension adequacy and income redistribution might affect different cohorts in an arbitrary fashion.

Overall, our results indicate that the impact of reforms aimed at fostering sustainability has quite arbitrary effects on inequality. This has an immediate interpretation for the case of Spain: it would have been better to complete the Bismarkian reform before introducing sustainability factors. Moreover, the outcomes also cast doubt on the appropriateness of using the pension system as an income redistribution mechanism in general. Further research is required in order to investigate the redistributive effects of pensions from a lifetime perspective and in relation to other social programs.

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Appendix 1. The labour market effects on sustainability and adequacy

The achievement of both sustainability and adequacy will depend on the labour market performance. But the labour market evolution, and particularly productivity growth, may also affect the income inequality and contribute to mitigate or magnify the effects of the reforms in terms of adequacy. In this respect, previous works have pointed out the necessity of realistic assumptions regarding labour market conditions (Grech, 2013).

The DyPes model allows for projecting the effects of different hypothesis about the labour market performance, particularly about labour market productivity growth. It is because the model links the wage growth at the micro level to the labour productivity of the economy (see section 3.3 for a detailed description). This way, different assumptions about labour market can be studied affecting pensions' adequacy and relative income position of the older population.

Figure A.1. Wage growth rates resulting from different scenarions (nominal terms)

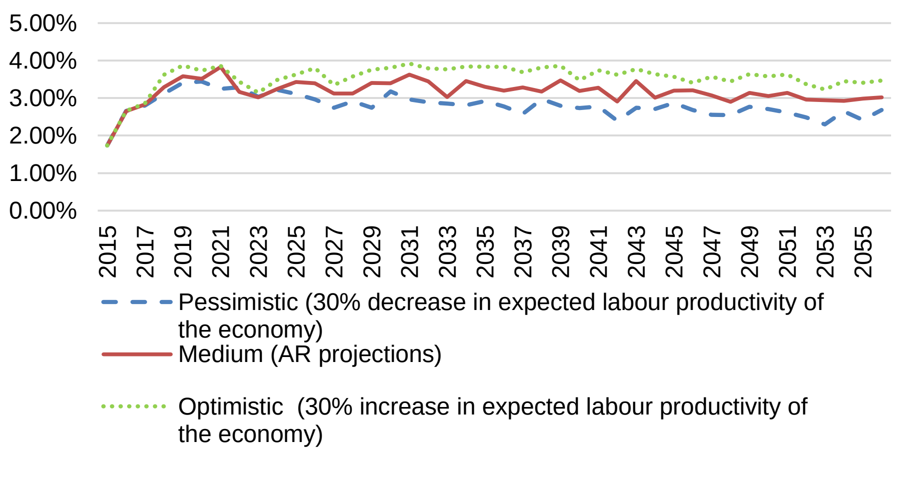


Figure A.1 shows the resulting wage growth rates of different scenarios. The baseline scenario uses the Ageing Report projections on productivity (Ageing Report of the EC, 2015), and the pessimistic (optimistic) scenario consider a 30% decrease (increase) in yearly wage growth rates with respect to the baseline. Figure A.2 present the effects of moving to a pessimistic (optimistic) scenario on pensions level. It is interesting to notice that changes in labour productivity have considerable effects on pensions' level, being these effects more pronounced in early years in the case of decreasing labour productivity. In the last years of the projections, the effects are quite symmetric: increases (decreases) of 30% of the labour productivity will lead to an increase in pensions' level of around 3.5%.

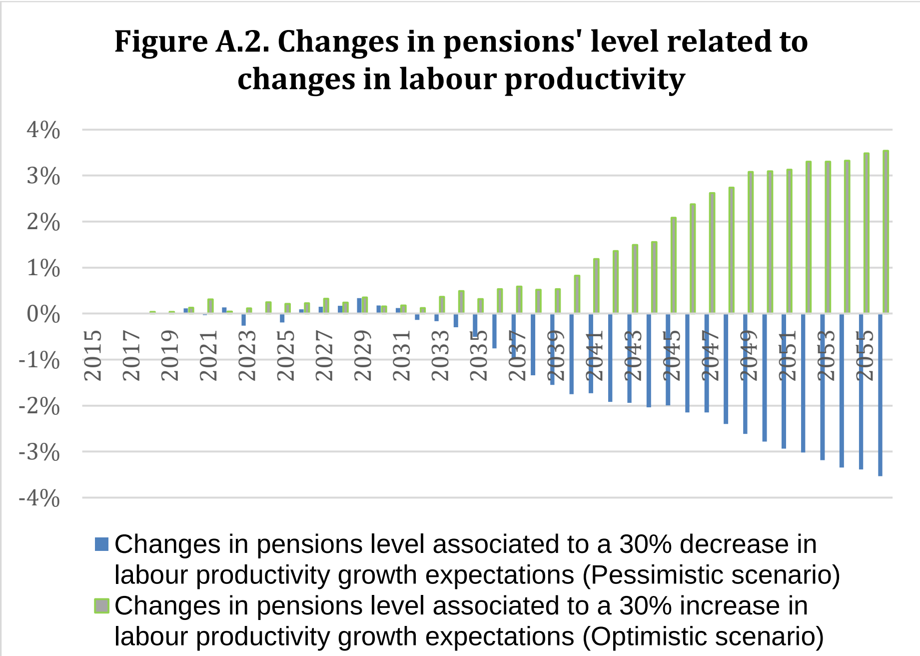
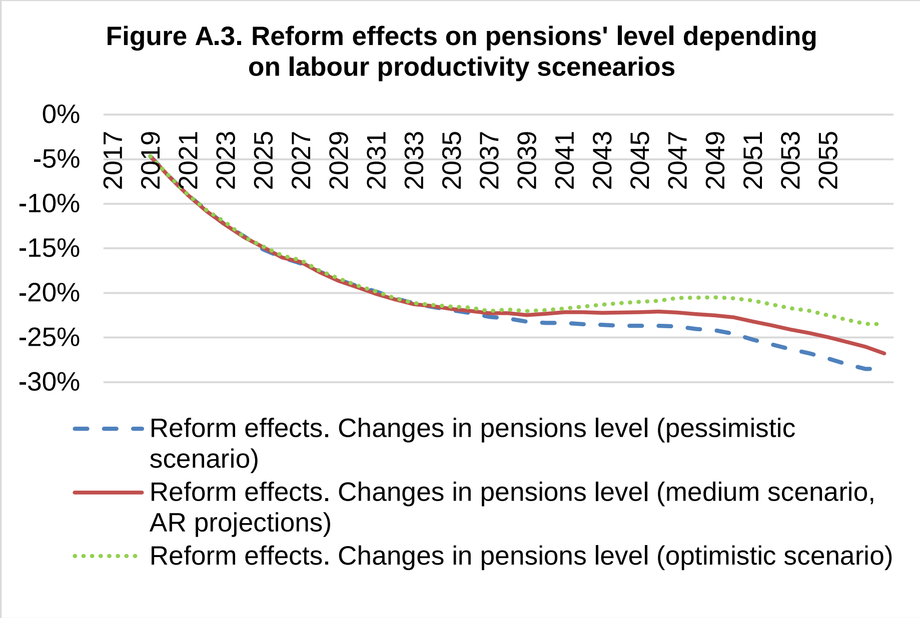


Figure A.3 presents the results of exploring if the performance of labour market would mitigate or magnify the effects of the reform. These effects exist, have the expected sign, but are not very strong, with differences between scenarios smaller than 3 percentage points.



By contrast, Figure A.4 and A.5 show that the effects of labour market productivity on adequacy are sizable. Figure A.4 shows the changes in the relative position of the older population associated to changes in labour productivity. In this case, the effects of improving productivity are quite symetric. Changes in pensions' level associated to a 30% decrease (increase) in labour productivity would increase (decrease) median income ratios in an increasing way, reaching values of 11% (approx.) in 2055.

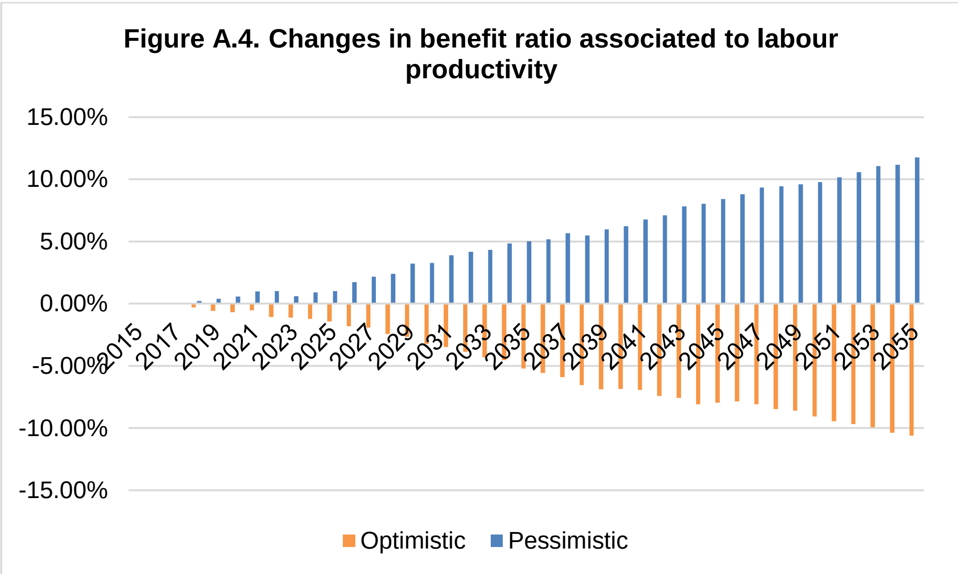


Figure A.4 illustrates that improvements in labour productivity would amplify the effects of the 2013 reform increasing intergenerational inequality. In summary, this appendix have illustrated what have been pointed out in the article: higher wages would have a positive impact on pensions level –mainly through the link between benefits and social security budget established by the 2013 reform- but implying higher intergenerational inequality.

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