# Should the pension system be redistributive? The sustainability and adequacy effects of the 2013 reform in Spain

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**Abstract**

The concern about the consequences of the demographic aging causes a growing need for policy evaluation (both *ex ante* and *ex post*) of reform measures in pension policy. The main benchmark used to assess pension reforms continues to be the cut in pensions expenditure needed to meet sustainability requirements. Nevertheless, the impact of such reforms on pension adequacy is increasingly under discussion. This paper analyses the impact of the 2013 reform of the Spanish pension system in terms of adequacy, with a particular focus on inter and intra-generational equity issues. To that purpose, we incorporate the sustainability factor into the dynamic microsimulation model DyPes and compare several indicators of adequacy resulting from different scenarios. The 2013 reform, and particularly the introduction a mechanism to link retirement pensions to the evolution of the social security budget balance, has strong and negative effects for the adequacy of the system. We also find ambiguous effects of the pension cuts in income redistribution that recommend caution when using the pensions system as an income redistribution device.

**JEL Classification: H53, H55, H68.**

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**Acknowledgements**

This research received institutional support from the Spanish Science and Technology System (Project Nos. ECO2012-37572 and ECO2012-35054), the Catalan Government Science Network (Project Nos. SGR2009-600 and SGR2009-359 and from XREPP – Xarxa de Referència en Economia e Polítiques Públiques). Authors would like to acknowledge Martin Spielauer collaboration on the model code revision.

## 1. Introduction

The sustainability of welfare state programs, and specifically the public pensions system, has been a matter of constant concern during the last decades. The strong ageing process that Europe is starting to experience threats a welfare system organized mainly in pay-as-you-go basis, where an increasing ratio between working age (typically ages 16-64) and economic dependent population (ages 0-15 and 65 and more) turns out to be key.

In addition to the strong ageing process, the deep economic crisis started in 2008 has put the governments between the rock and a hard place. Public deficits started to grow dramatically and the Social Security systems in some countries, as Spain, started to be in red much earlier than predicted. In this context, many countries have adopted reforms of their pension systems in order to try to control the expenditure. One of the most remarkable measures has been introducing some kind of mechanism to link retirement pensions to the evolution of the social security budget balance, hence making explicit its dependence on demographic and economic factors.

The recent changes in pensions' systems claim for focusing not only on sustainability but also on adequacy. The adequacy objective is related to guaranty a minimum level of income of older people. By "adequate" the World Bank intends 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). Therefore, the `adequacy´ definition, in principle, focuses on improving the position of the worst situated, being compatible with any distribution of income between groups, and particularly, it is compatible with any level of income inequality. Other distribution measures are also considered when measuring adequacy by academic circles or international organizations: several indicators of the relative position of the older population with respect to other groups and also indicators of income inequality within the elderly.

The Ageing Report of the Economic Policy Committee (European Commission, 2015) puts forward 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, older people (aged 65+) are not more at risk of poverty than other age groups. Indeed, in most countries older people seem so far to have been better protected

against the social impact of the recession and public finance crisis than other age groups. The relative income position of old people has generally improved in recent years. The relative median income ratio increased between 2005 and 2013 in 20 out of 28 Member States, with an increase by 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 older population (by median income ratios, for example), Spain is one of the best situated, with ratios close to 100% in 2013 (Adequacy report of the EC, 2015). Nevertheless, Spain have 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, which is something difficult to measure.

The definition of adequacy and its measurement are themselves an issue in the literature. Several papers and reports propose indicators and discus the existing ones (Borella and Fornero, 2009; Adequacy report 2015 of the European Commission; Chybalski, 2012). Brady (2010) develops a replacement rate that accounts for savings, taxes, and owner-occupied housing. Binswanger and Schunk (2012) address adequacy measurement with a randomized survey design, individually tailored to each respondent's financial situation, and conducted both in the U.S. and The Netherlands. They find that adequate levels of retirement spending exceed 80% of working life spending for a majority of respondents.

Several other papers and reports are aimed to measure adequacy for concrete countries. Knoef, et al (2016) analyses whether the Dutch pension adequacy is still high when we take into account the resources that people really accumulate, using a large administrative data set Chia and Tsui (2003) assess the adequacy of the Singapore's publicly managed central provident fund (CPF) 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 recent and ongoing key changes that are triggering reform, outlines the main reform trends across pension pillars over the last two decades; and presents key policy areas on which the pension reform community will need to focus to make a difference..

With respect to the methods microsimulation techniques appear as a complement to a more macro oriented simulation models of the pension system, especially in what refers to the possibility to approach sustainability and adequacy issues at the same time. They can be used to draw a more fine-grained picture of the evolution, in particular, of old-age poverty

in the future. The use of microsimulation models in policy evaluation and, particularly, in pension reforms is becoming more 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 amount and quality of databases and computing tools. In the context we are dealing with, these simulation tools need to have both a macro and a micro perspective. The former is essential if one aims at analysing in a consistent way the sustainability of pensions or any other welfare state transfer. The latter is crucial when considering the adequacy of the benefit level in respect to income redistribution.

This paper analyses the impact of implementing the sustainability factors in the Spanish pensions system (the 2013 reform), both on sustainability and adequacy, , with a particular focus on inter and intra-generational equity issues. We implement the specific sustainability factors into the microsimulation model DyPes (Patxot et al, 2015). The DyPes model is a dynamic, time-based, behavioral microsimulation model, based on administrative data of the Spanish Social Security. We also implement three groups of adequacy indicators to respond to three major 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 is dedicated to briefly describe the retirement pensions system in Spain, as well as to summarize the main reforms along the last decades until the introduction of a sustainability factors in 2013. Section 3 describes the microsimulation model used for the analysis, together with the data and the different hypothesis adopted. Section 4 presents the results we obtain about the impact of the 2013 reform in terms of both sustainability and adequacy. Finally, Section 5 summarizes the main conclusions.

## 2. 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 attending both to the population protected and to the share of expenditure. In 2014 Social Security spent 10.5% of GDP in 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 survival pensions. The retirement pension is undoubtedly the most important program. In December 2014, retirement pensions were almost 60% of total contributory pensions,

which represented a 65% of the total Social Security expenditure (corresponding to 7.4% of GDP).

The present system started in 1967 when the General Social Security Law entered into force. From then until now, many partial reforms have taken place affecting different aspects. Hereafter, we focus on the description of the retirement pension system, which is the object of our analysis. The contributory retirement pension is an economic benefit for an indefinite duration, aimed to cover the loss of income suffered for an individual when he finishes his working career. Its contributory (or *Bismarkian*) nature relays basically on the initial pension benefit depends to some extent on the past contributions of the worker, though a minimum period of contributions is required. Specifically, the initial pension (IP) is determined by applying the percentage [p(n)] (which depends on the contribution period) to the regulating base [RB] (defined as the average contribution base in the last years). Moreover, some correction coefficients (c) can also apply in certain circumstances (as delayed or advanced retirement):

$$IP=RB*p(n)*(1-c) \quad (1)$$

The parameters behind this rule have been changed through different reforms which will be explained below. It is worth noting that, although those reforms have been in the direction of reinforce contributiveness, this is not yet fully achieved. Additionally, retirement pensions (and also contributions) are subject to lower and upper limits pursuing equity which also mitigate contributiveness.

Without being exhaustive, we present a brief summary (in chronological order) of the most remarkable reforms of the retirement pension system implemented since the beginning of the system in 1967. The first important reform of the Social Security was enacted in the Law 26/1985 of Urgent Measures for Rationalization of the Social Security's Structure and Protective Function. This law was the result of the increasing concern about the financial sustainability of the system. After almost 15 years from the modern system's birth, pension expenditure started to rise sharply, motivated in part because of the increase in the contribution bases used to calculate the entry pension (the last two years immediately previous to retirement). The main modifications introduced were three. First, the minimum period of contributions to get a pension increased from 10 to 15 years. Second, the period to calculate the RB was also risen from 2 to 8 years. Both measures were clearly aimed to reduce expenditure by limiting the access and reducing benefits. Third, in order to keep the

purchasing power of old pensioners an explicit actualization mechanism (annual) for existing pensions was introduced, taking into account the predicted inflation for the next year. It is worth mentioning that this first reform was very controversial and was the trigger of the first general strike of the Spanish young democracy.

In 1995, all political parties approved the Toledo Agreement, a special commission into the Parliament exclusively aimed to analyze the pension system and to make recommendations about possible reforms. The first document produced by the Toledo Agreement, ratified by the Parliament in April 1995 contained 13 recommendations. Among them, it is worth mentioning the need to reinforce the contributiveness of the system, to separate the financing of the non-contributive pensions from Social Security, to promote delayed (voluntary) retirement, to guarantee the purchasing power of the pensions along time and to create a reserve fund with eventual surpluses to be used in the future.

Law 24/1997 of Consolidation and Rationalization of Social Security System implemented some of the Toledo Agreement recommendations. In order to reinforce contributiveness, the components of formula to calculate the initial pension were modified. On the one hand, the period to calculate the regulating base was increased from the last 8 years previous to retirement, to the last 15 years. Also, the percentage to apply to the regulating base according to the contributed years [p(n)] was changed..[1] This way, with 35 years of contribution, individuals reached 100% of the regulating base, exactly the same as before, but with a different distribution in favor of longest working careers with respect to the shorter ones. The improving of contributiveness with these measures was modest, however. Law 24/1997 established also, with a stable formula, the mandatory updating of all pensions every year according to the evolution of the consumer price index evolution, and the obligation to compensate for eventual deviations. Finally, it introduced (although in a vague way) the creation of a reserve fund of Social Security with eventual surpluses, and the possibility of measures to promote delayed retirement. In 2002, the Law 35/2002 of Measures to Establish a Gradual and Flexible Retirement system deepened in some specific measures to encourage delayed retirement and to discourage partial retirement.



[1] In the following way: first 15 years of contribution give right to 50% (60% before that reform) of the RB as initial pension benefit. Each additional year until 25 increased the pension in 3 percentage points, and each additional year between 26 and 35 gave 2 percentage points more (previous to reform, each additional year between 16-35 generated 2 percentage points more).

Law 40/2007 introduced some new changes in retirement pensions. On the one hand, it tightened again the conditions to access partial retirement, while it improved the premium coefficient (c) to delayed retirement. The next big reform of the Social Security in Spain took place with the Law of Updating, Adequacy and Modernization of the Social Security System (Law 27 /2011). In the middle of a strong economic crisis, the government decided to implement a deep reform in order to reduce expenditure and to try to avoid financing deficits caused in the short term by the dramatic fall of contributions. Among the measures introduced by Law 27/2011 it is worth mention the delay of the ordinary retirement age from 65 to 67 (although it remains being 65 for those individuals with very long labor careers). Also, in order to reinforce contributiveness, both components of the formula to obtain the initial pension were modified again. The period of past contributions considered in obtaining the Regulating Base (RB) was increased from 15 to 25 years. Regarding the percentage to apply to RB to determine the initial pension [p(n], it has been also modified for those individuals with more than 15 years of contribution. On the one hand it becomes more proportional –as depends on months instead of total years of contribution– and on the other hand, the period to get the maximum pension (100% of RB) increases from 35 to 37 years of contributions. The possibility of early retirement was also modified by introducing two ways to access (voluntary or involuntary) for long contribution careers. As the changes were significant, a transitory period (2013-2027) was established in order to fully apply all the described measures.

Finally but not least, the same Law 27/2011, announced a "sustainability factor" in the pension system by 2027 to take into account the increase of the life expectancy, although in a very vague way and without specifying the exact formula of such element. Two years later, and after the report entrusted to a Commission of Experts created to that purpose, the Law 23/2013 specified exactly how that "sustainability factor" would work. In particular, the "sustainability factor" mentioned in Law 27/2011 was divided into two different elements, named "annual update index" (*UI*) and "sustainability factor" (*SF*), respectively. First, the *UI* replaces the consumer price index as the reference to update the amount of benefits each year. This means that it affects all the pensions in the system (not only the new entries). It must be calculated each year (t+1) using the following formula:

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

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 of the Social Security revenues (sub-index *I*), the Social Security expenditure in contributory pensions (sub-index *p*) and the substitution effect (sub-index *s*);[2] I and G represent the moving geometric average of the 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, revised every five years. This way, the *UI* aims to take into account the Social Security (im)balances (both in the past and the future predictions) in updating the pension benefits. However, it is worth noting that there are legally established minimum (0.25%) and maximum values (consumption price index plus 0.5%) for the *UI*, independently of the formula result. In fact, *UI* started to be applied to update the pensions for 2014 and so far the lower limit (0.25) has been applied.

Second, the sustainability (*SF*) factor will affect only the new pensioners accessing to the system from 2019 (the new date established for its launch). From then onwards, new pensions will be calculated correcting the result of the standard formula (Eq. 1) by the predicted increase of the life expectancy at age 67, in the following way:

$$FS_t = FS_{t-1} \cdot e^*_{67} \qquad [3]$$

Being *t* the initial year of *FS* application established in 2019 (for 2018, the value of *FS* will be 1), and $e^*_{67}$ the growth rate of the life expectancy at age 67 in the previous five years. The parameter $e^*_{67}$ will be estimated every five-years.

Several countries have used life expectancy as a reference point to update pensions. But the majority of them have linked pensionable ages (as legislated by Denmark in 2006) and/or the number of contribution (as the 2003 French reform) years to developments in life expectancy. Spain is one of the few countries that links benefit levels to life expectancy. Institutions like the European Commission have pointed out that the first option is more the preferable way to allow pension system to neutralise the costs of structural longevity growth and incentivize to work longer. By contrast linking benefit levels to life expectancy is seen as "far less transparent", implying that it "can pose a threat to adequacy over time as people fail to react to financial incentives to delay pension take-up." (Adequacy report of de

[2] The s*ubstitution effect* refers to the increase of the average pension system due to difference in the benefits of new entries (new retirees with higher pensions) and system's withdrawals (typically old people with lower pensions amounts).

EC, 2015). As far as the DyPes model is a behavioural model that allows individuals to react to changes in pensions system incentives, we will be able to test this assessment, among other effects of the 2013 reform.

## 3. The model

This section is devoted to the description of the microsimulation model DyPeS. It was developed to analyse the Spanish contributory pension system and have 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 a) briefly outlines the model structure and the way in which retirement decision is modelled, Subsection b) is devoted to explaining the way in which different career scenarios are modelled while Subsection c) details the data employed

### 3.1 Model structure

DyPeS is a dynamic micro-based model – meaning that it simulates the micro units over time. The programing language (Modgen) allows for creating two parallel versions of the model: the time-based version and the case-based version. The first one simulates successive cross-sections while the second simulates each case from birth to death before the simulation of the next case begins. In this paper we use the time-based version, due to the nature of the problem we want to analyse. As far as we need information on social security budgets to calculate the sustainability factor, successive periods (years) need to be simulated to obtain such information. (RECURSIVE AQUI??). For the same reason the model is opened, in the sense that new agents are introduced, apart from those in the initial sample; and population-based, instead of cohort-based.

Dypes starts running the simulation with a starting population subsample that comes from the Continuous Sample of Working careers (Muestra Continua de Vidas Laborales, MCVL in Spanish). The next section is devoted to explain in more detail this data. It is programmed in continuous time, though some of the events happen only once a year. DyPeS has been developed using ModGen, a generic dynamic microsimulation programming language

developed and maintained by Statistics Canada and widely used in social science dynamic microsimulation.[3]

With respect to previous versions of the model (Patxot et al, 2015), one of the main improvements is the calculation and projection of the sustainability factor enacted by the 2103 reform up to 2060. As the formula is expressed (see sectio2 2), this implies that its introduction into the model as a mechanism to update individual pensions, and the projection of Social Security budgets have to be simultaneous determined, which causes obvious recursivity problems. These problems are solved in DyPes by running the simulation in two steps. The resulting sustainability factor values for recent years are close to those obtained by the Ministry and AIREF (AIREF, 2015; Roch et al, 2015): 0.2. The model also project that sustainability factor will be fixed in the lower band during the following decades. This is mainly caused by the expected negative impact of demography (baby-boomers starting to retire in 2020) and the negative impact of the economic crisis started in 2008 in the Social Security budget.

The DyPes model introduces behaviour into the retirement decision, meaning that it accounts for behavioural reactions to financial incentives when deciding to retire. This allows to disentangle which part of the reform's effects is related to individuals' reaction to changes in regulations (see O'Donoghue, 2001 for a definition of behavioural models versus statistical simulation). The retirement module determines whether an eligible individual actually retires according to a retirement model. [4] Data employed to estimate the parameters governing the retirement decision consists in 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 forced by regulation (unemployed that reach the minimum retirement age). Covariates of the model include personal characteristics and financial incentives (there is also a non-behavioural version of the model that excludes these incentives). The model is estimated using a piece-wise constant exponential function approach in which the hazard is assumed constant within pre-specified survival time intervals but the constants may differ for different intervals. People older than 58 compute their retirement hazards monthly, and covariates



[3] 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 web site.

[4] The model parameters are estimated using stata 11 and introduced in DyPes programing or directly in the input tables created to that purpose

that determine retirement decision are also monthly updated (see Patxot et al, 2015 for a detailed explanation of the retirement module).

The microsimulation models that introduce behaviour into the retirement decision are scarce and heterogeneous in the modelling approach. Microsimulation models are preferably endowed with very simple - non-behavioural - rules for retirement, for example assuming that individuals retire as soon as eligible (Borella and Coda Moscarola, 2010) or aligning the transitions to the observed patterns (Dekkers et al., 2009; Richiardi and Leombruni, 2006). On the other hand, the literature on retirement behaviour accounts for the role played by financial incentives embedded in the pension rule by integrating the empirical evidence with lifecycle theory. For example, Stock and Wise (1990), Coile and Gruber (2001) for the United States, Baker et al. (2003) for Canada, Blundell et al. (2002) for the United Kingdom. For Spain, García-Pérez, Jiménez-Martín & Sánchez-Martín (2013) and Vegas et al. (2013) all find that individuals' retirement choices do respond to financial incentives of the pension system to some extent.

So far, there have been some attempts to introduce behavioral reaction to pension rules into microsimulation models. Van Sonsbeek (2010), models the retirement decision by the option value approach first suggested by Stock and Wise (1990), combining the individual data on wages, state pension entitlements and private pension entitlements with individually varied option value parameters (time preference, leisure preference and risk aversion). Bianchi, Romanelli and Vagliasindi (2003) also use an individual reaction function based on the Stock and Wise option value (OV) model in which the worker calculates the expected value of the utility of retiring today and in the future, using the 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. 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 (see Patxot et al, 2015 for a more detailed discussion on behavioural models.)

The rest of events are modelled using information from official statistics (for demographics) or transition rates that come from the MCVL. The following are the main events experienced by agents. They experience, first, 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.

The labour market transitions and wages are conditioned by the education level, which is assigned as follows. For future contributors, the final education level attained determines the way they enter the labour market (contribution group, entry age and wage), as shown bellow. Initial wages (for those working or contributing in 2007) take the value present in the fiscal module of the MCVL in 2007. In case this value is missing, the contribution basis is taken. This information is used to impute future entry wages, while the error term observed in each cell is used to ensure variability of initial wage. Changes in the qualification level and unemployment events are also derived based on 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 attain the eligible retirement age (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 model. In order to capture the impact of labour market conditions on retirement probability, 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 mainly variables found in the literature, trying to capture differences in personal characteristics, productivity and contextual factors: sex, age, migrant status, educational level, contribution group, experience and unemployment rate (see Patxot et al 2015 for more details).

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.

### 3.2 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 who have some relation with Social Security administration at that moment. Then, all past information on their working careers and contributions is added. The information is reliable from 1980 for

working conditions and from 1990 regarding pensions. The sample includes both pensioners and contributors born from 1907 to 1991. Hence, in order to project future expenditure and revenue, new entries in the labour market from 2008 on and new births from 1991 need to be added to the model. In order to add 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.

The data employed to simulate each of the events are described below. The first step is to assign an education level. The MCVL contains information about the education level of the individuals. Nevertheless, this variable is collected from a different data set that is not updated very frequently. As a result, the education level is frequently missing or underestimated. For individuals registered in the MCVL, we keep the value reported and correct it upwards in case there is an inconsistency between the value of education and the contribution group.[5] For "future" individuals, born from 1991 on, the final education level is assigned randomly so as to reproduce the educational distribution observed for the Spanish population by MEC (2010). According to this publication, the education level has grown 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 the labour market transitions. The hazards observed are extracted from the MCVL 2007. In particular, transitions between qualification levels within employment and transitions between employment and unemployment are obtained by age and gender and qualification level when necessary. To that effect, the 13 contribution groups in the general regime of the Spanish Social Security are grouped in five subgroups – those subject to the same contribution limits (thresholds). As the transition hazards among the different qualification levels are quite stable during the period observed (2002-2007), the value of the last transition observed before the economic crisis (2006 to 2007) is taken, and is held constant

[5] This can only be done for the first contribution group (University level).

for the future. The next sections describe in detail the way wage growth and retirement transitions are estimated based on several waves of the MCVL.

### 3.3. Modelling wage growth

As mentioned in the introduction, the DyPes model allows for projecting the effects of labour market on the pension system. That is because productivity growth at macro level is linked to individual wage growths and, hence, to retirement time and entry pensions level. It is achieved through two main mechanisms: the wage growth model and the retirement decision model. Wages grow according to a model based on the traditional Mincer equation:

for the period $t$

$$w_{it} = \overline{w}_t\left(\frac{\beta_0}{\overline{w}_t} + \frac{\beta_1}{\overline{w}_t} w_{i,t-1}, \frac{\alpha}{\overline{w}_t} X_{it}\right) \quad (2)$$

then we obtain:

$$\beta_0^* = \frac{\beta_0}{w_t} \;\; and \;\; \beta_1^* = \frac{\beta_1}{w_t} w_{i,t-1} \quad (3)$$

For $t+1$ and the following periods:

$$w_{it+1} = \overline{w}_{t+1}\left(\beta_0^* + \beta_1^* w_{i,t}, \alpha^* X_{it+1}\right) \quad (4)$$

where $w_{it}$ is the yearly wage of the individual i, $\overline{w}_t$ is the average wage of the economy and $\beta_0$ , $\beta_1$ and $\alpha$ are the parameters of interest that we wish to estimate. The set of explanatory variables, $X_i$ includes, apart from 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 simplicity, to be linear. To estimate the model we use a panel data set covering the period 1997-2010, which has been elaborated using information from the MCVL and information on macroeconomic indicators provided by the Spanish National Institute of Statistics (INE).

During the simulation, earnings (and contribution bases) are updated on a continuous time basis. For this purpose, 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,

according to equations 2 and 4. At the same moment, contribution bases are also updated. Second, whenever a labour status transition occurs – both among contribution groups within employment status, and between unemployment and employment status –, a change in wage is applied depending on gender and the original and final states. For that purpose, the average change in wage observed is used. Finally, each time one of the abovementioned 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.

The retirement model includes as explanatory variables the individual replacement rate and the maximum expected pension. These two variables are clearly related to individual's wage trajectory and, also, to the average productivity of the economy, thanks to the model showed above. (See Patxot et al, 2015, for a detailed description of the retirement model).

The above described mechanisms cause productivity growth to have an impact on pensions' level and adequacy and hence on the average retirement age. On the one hand, more optimistic scenarios regarding productivity growth would cause higher individual growth rates and, consequently, worsen the relative position of the elderly with respect to working population (decreasing median income ratios, for example). On the other hand, higher wages imply higher entry pensions, because the formula for calculating initial pensions directly links them to the contributions of the last 20 years. Finally, higher wages would produce a decrease in replacement rates, making remaining in the labour market more attractive. This, in turns, would have also a positive impact on initial pensions. Increases in entry pensions levels, obviously, mean increasing median income ratios and improve the relative position of the older generations. In consequence, projecting different scenarios of productivity growth rates can provide interesting indications for policy evaluation, in what refers to the impact of changes in retirement age and its interaction with labour market performance. Note that the results in this respect are not simply predictable without a complete model that links to some extent the micro and the macro level.



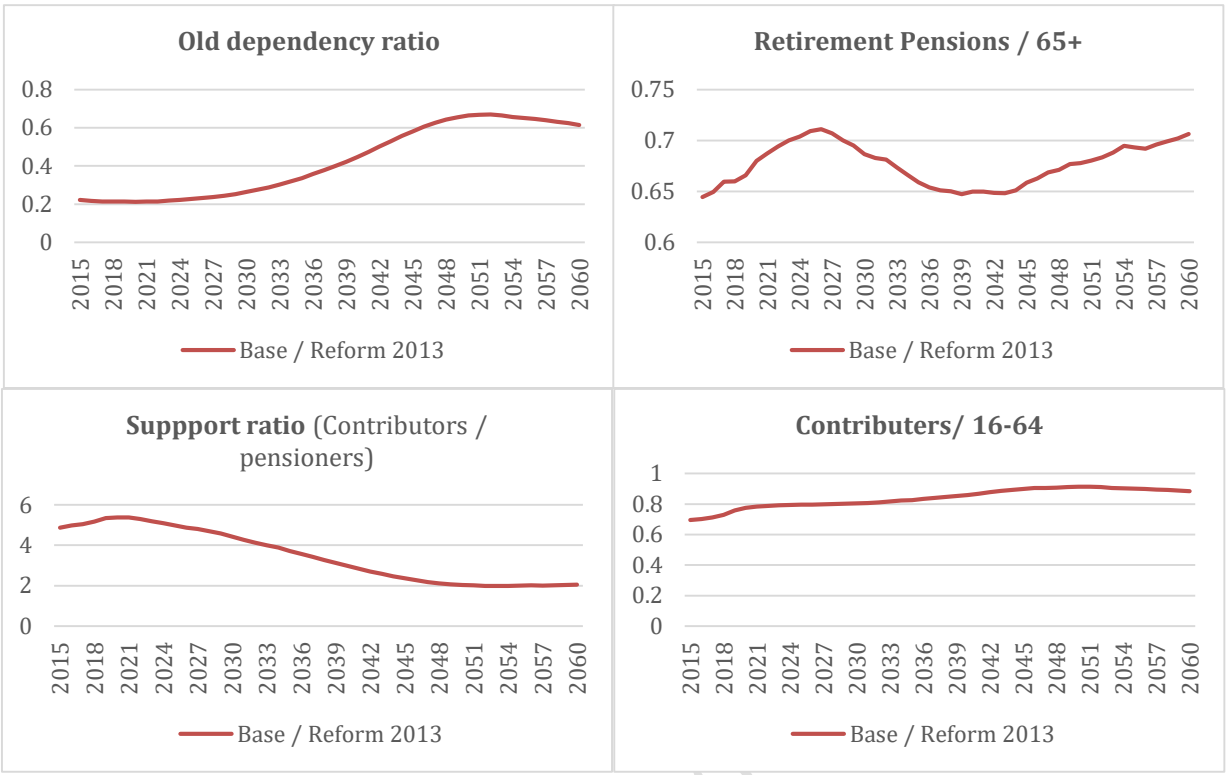
## 4. Results The effects of the 2013 Reform on sustainability and adequacy

This section is devoted to show and comment the results of the 2013 reform captured by the extension of the DyPes microsimulation model. We will mainly focus on the impact of the reform on both the sustainability of the pensions system (subsection 4.1) and the

adequacy of the level of the resulting retirement pensions (subsection 4.2). To that end, we will define different scenarios. First, the baseline is the pre-reform scenario which already includes the main measures introduced in the 2011 reform. Second, the reform scenario includes the legal configuration of the sustainability factors introduced by 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 the extent of the demographic challenge pressure on the pension system. The following subsections will show, first, the evolution of the sustainability indicators, compared to those obtained in the Ageing report (Ageing Report of the EC, 2015) and continue looking at the evolution of the adequacy measures together with and then focus in the main macroeconomic aggregates and the main adequacy indicators resulting from projecting two different scenarios: one without reform (the baseline) and the other that introduces the 2013 reform.

### 4.1. The sustainability goal

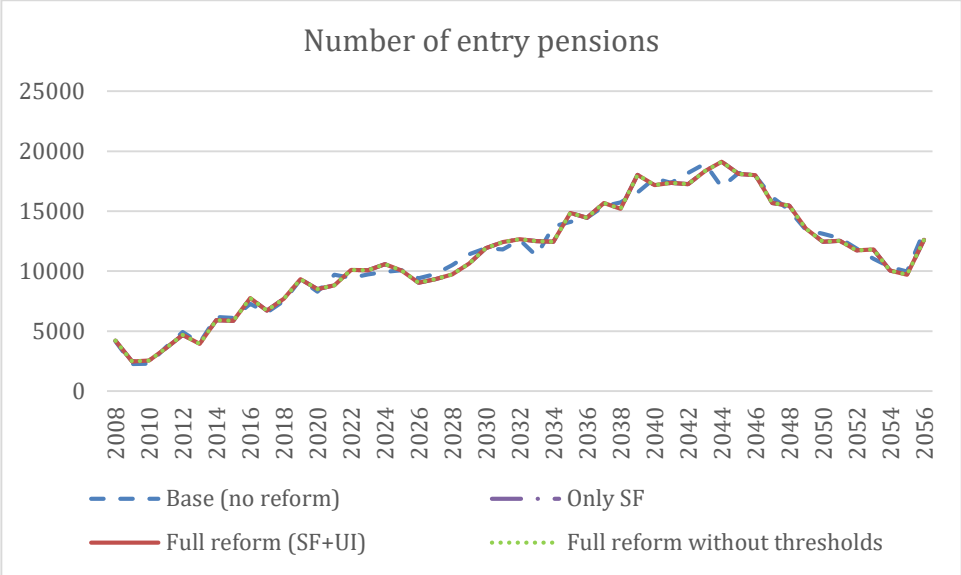
Before approaching the impact of the 2013 reform on the sustainability of the pension system - the main objective of the Reform- we start this section by analyzing the overall performance of the model in macroeconomic terms. The benchmark for comparison will be the last wave of the AWG projections (2015). Figure 1 presents the projections of four demographic and macroeconomic indicators which crucially affect the sustainability of the system (which not vary between scenarios). The first panel shows the evolution of the old dependency ratio, which is similar to that assumed by the Ageing Report of the EC in 2012, reaching values close to 60% in 2060. The evolution of this ratio is coherent with the demographic projections, with the first wave of baby boomers reaching the age of 65 in 2022. The same can be said with respect to the pension's support ratio (contributors/pensioners), which evolution shows a pronounced decrease from 2020. The same evolution is projected by the Ageing report, although the initial values are higher in our projections. Participation rates are also a bit higher than those predicted by the above mentioned report, which assumes participation rates close to 77%. Those differences are minor, are mainly due to the characteristics of the MCVL. Recall this sample only contains people in relation with social security, excluding non-participants and hence it is not possible to reproduce accurately the labor market transitions of this kind.




The coverage ratio increases in the first years of the projection as long as baby boom females enter into retirement with more pension entitlements that the preceding cohorts, due to their higher participation rates. Hence, the model is able to replicate the long run trends in terms of demographic and labor market conditions

Figure 2 shows the changes in number of entry pensions associated to the 2013 reform. These changes are fully associated to changes in level of entry pensions, due to the introduction of the so called "intergenerational equity factor", SF, -note that the UI does not affect the entry pensions[i]. The introduction of the SF pushes people to retire earlier to avoid further cuts in pensions due to life expectancy, though people might try to extend labor participation in order to obtain pension improvements coming from the bismakian pension formula. Clearly, the main changes in the number of entry pensions come from the 2011 reform as long as delaying retirement was one of its main goals. It worth mentioning at this point that the 2013 reform was not aimed to delay retirement, mainly because a reform with this specific objective was promulgated two years before, in 2011. Despite not being among the specifics objectives of the reform, it is interesting to notice the very limited and erratic impact of the reform in terms of entry pensions. Graph 3 shows that the impact of the overall pension reforms (2011 and 2013) on participation rates would be close to 2 percentage points in 2060, which very close to the estimations found in the 2012 Ageing Report.

**Figure 2. Number of entry pensions (with respect to the baseline)**

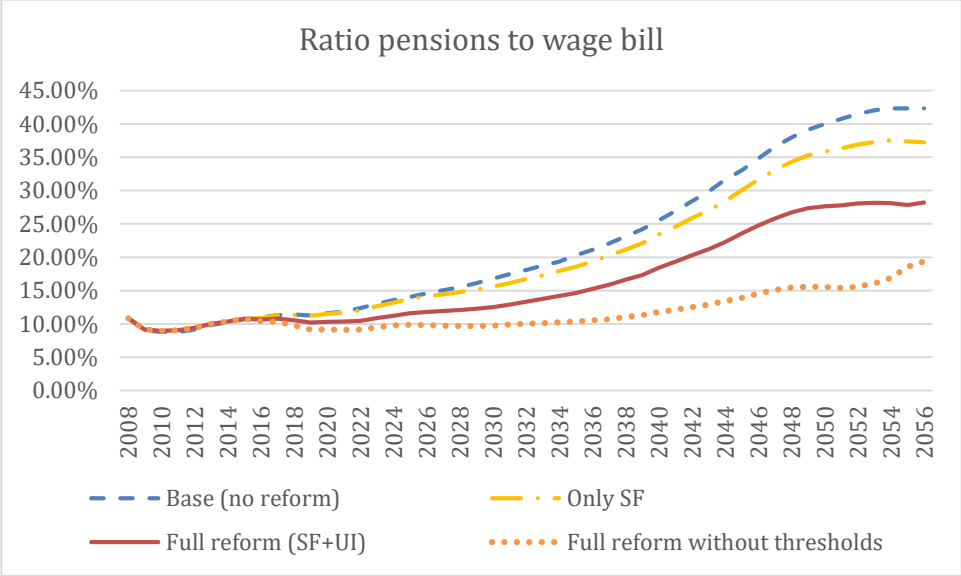



These results seems to confirm what previous studies already pointed out: that people fail to react to financial incentives to delay pension take-up in line with developments in life expectancy. And this in not (only) because individuals behavior is not fully rational when retiring. The behavioural model embedded in DyPes suppose that individuals do behave rationally. But, in a context of pensions growing at a permanent low rate (the sustainability factor expected to be fixed in the lower band) in the future years, the mechanism of updating pensions remains neutral to the decision of when to retire.

**Figure 3. Average pension level**

Figure 3 shows the evolution of the pension level. The cut in pension introduced by the 2013 reform is quite substantial, but far from the cut that would result from the scenario with no limit. As explained before, Law 23/2013 of 23 December regulating the sustainability factors of Social Security pensions established that, from 2015, pensions will be updated annually according to the so called Pensions Revaluation Index (UI). The rule states, however, that regardless of the result of applying the formula, the updating for Social Security contributory pensions should not be less than a minimum annual percentage rate (0.25%) nor exceed a maximum rate (evolution of 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 IRP 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 values of the UI close to 2% for 2015 and 2016, which is coherent with other estimations (AIREF, 2015)

**Figure 4. Ratio pensions to wage bill**




Finally, Figure 4 summarizes the overall effect of the reform by showing the evolution of the ratio pension's expenditure to wage bill. The model predicts a decrease of more than 10 percentage points of this ratio as a result of the introduction of the 2013 reform. And this decrease is again magnified by the non-limit scenario. This ratio is not fully comparable to the ratio of pension expenditure to GDP shown in the Ageing Report (2012) but it is sufficiently informative of the extent of the effects.

In summary, it can be said to conclude this section that the main objective of the reform – the decrease in future government spending in pensions- is achieved if not fully, to a considerable extent. Next section will analyze if adequacy effects of the reform allow for a so positive interpretation.

### 4.2. The adequacy goal

There is not a broad consensus in academic literature and policymaking circles on what constitutes the best measure of pension adequacy. Moreover, when reading recent reports (Adequacy Report of the EC, 2015), the idea of adequacy is used as a compilation of different objectives: securing a minimum standard of living for the od-age population (the "strict" definition of "adequacy"), but also associated to distributional and equity objectives (in both inter and intragenerational terms). It is important to mention that avoiding the older people the risk of poverty and depravation is compatible with any distribution of income that improves the position of the worth situated. In consequence, no single measure appears to offer a clear indication of the extent to which reforms will impact on the achievement of such pension system goals.

In coherence with that, we will treat separately the different objectives associated to the more general adequacy goal, providing in each case the most suitable indicators. We will try to be consistent with the institutional reports which are nowadays measuring adequacy (mainly with the 2015 Adequacy report of the EC) looking at indicators of intergenerational equity, and implementing them as an output into our simulation model. We will also add some other indicators based in intergenerational equity that may improve the analysis (as the Gini index in the point b). As seen in the previous section, the effects of introducing only the SF measure, that relates pension benefits to life expectancy, has negligible effects on pensions' level. So, in this section, only three scenarios will be compared: the baseline (without the 2013 reform), the 2013 reform fully implemented, and the 2013 without thresholds.

#### *Intergenerational equity*

In the following the intergenerational equity effects of the reform are approached. We mainly focus on the relative distribution between workers and pensioners, paying attention to two dimensions of analysis. On the one hand we investigate the relative position of older population with respect to working age population (comparison of two cohorts at the same time). On the other hand, the projection model allows us to follow the future evolution of

this relative position, providing a complementary picture of intergenerational equity as far as it reflects how future generations will be situated at the time of retirement (comparison of two cohorts in different times).

In particular we will compute two different 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.

***Benefits ratio as measure of income replacement capacity of the system (Average pension / average wage)***

The "Benefit Ratio" is defined as the average pension benefit relative to the economy-wide average wage. The ratio of these two indicators is intended to provide an estimate of the overall generosity of pension systems. The Benefit Ratio provides the widest measure by comparing all (public) pension payments with economy-wide incomes, whereas the Aggregate Replacement Ratio compares the pension income of people aged 65-74 to the earnings situation of people aged 50-59 (Adequacy report of the EC, 2015)

**Figure 5. Benefits ratio**

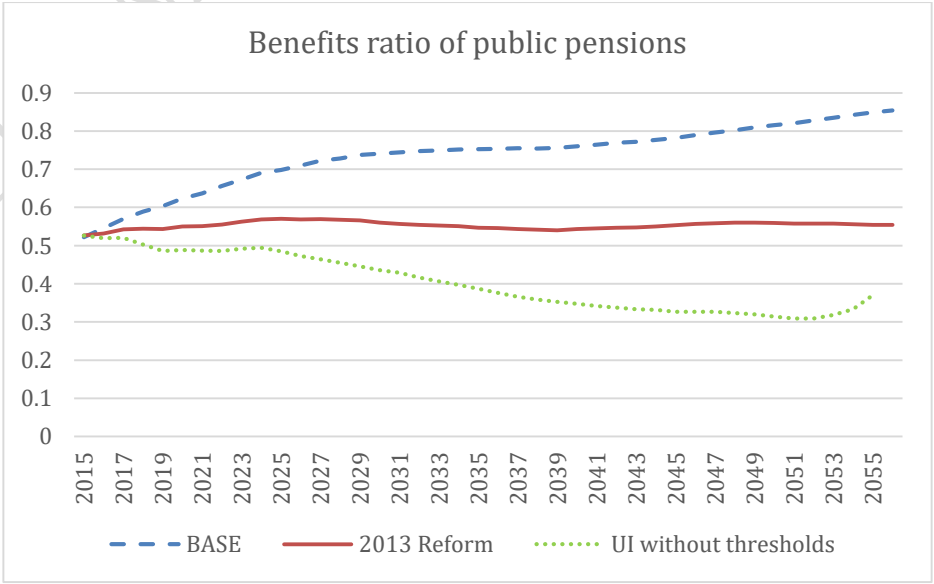


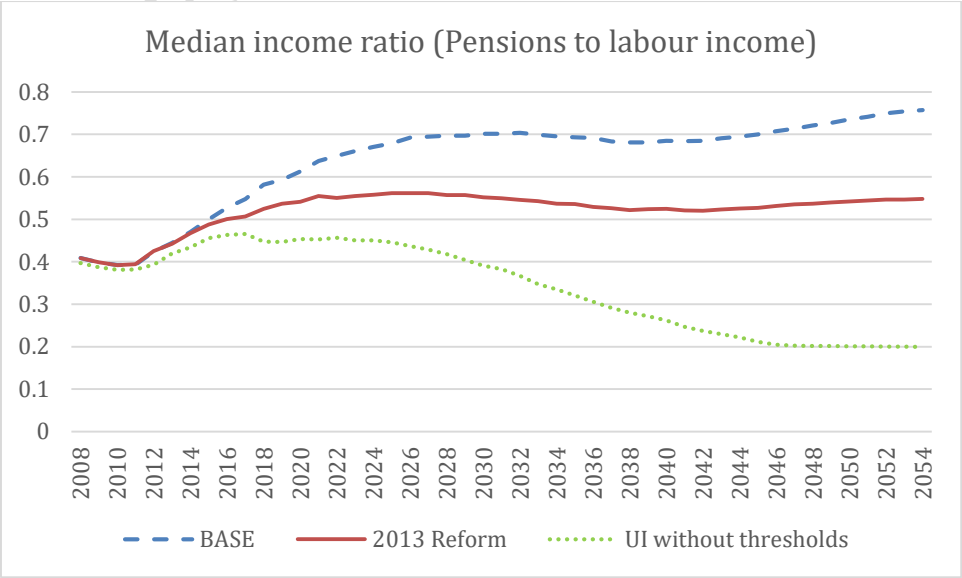
Figure 5 presents the results of running three different scenarios: the baseline without the reform, the one with the reform and a third one that excludes the thresholds that the Law imposes to the update the pension formula. As far as these thresholds are somehow "ad hoc", subject to be modified without profound changes in the Law, it is interesting to predict a hypothetic scenario without thresholds. In this respect, the evolution of the benefits ratio resulting from this scenario shows a huge potential impact of the reform in terms of adequacy. The application of the formula as it is nowadays promulgated by the law shows also sizable effects of the reform in terms of benefits ratio.

Turning to the baseline scenario it is interesting to note that the application of the 2013 reform implies that the benefit ratio stays constant along the projection period, while the baseline scenario produces an almost monotonic increase in this ratio. As we will discuss later, this shows a paradoxical circumstance of the Spanish pension system.

***Relative median income ratio as a measure of the relative income position of the elderly (pensions relative to wages)***

The relative median income ratio is calculated as the median income of people aged 65 as share of the median income of people aged 0-64. While the Adequacy report construct this ratio comparing the median equivalised disposable income of these two groups and including all sources of income, our model only allows for including pensions and labour income.

**Figure 6. Median income ratio**

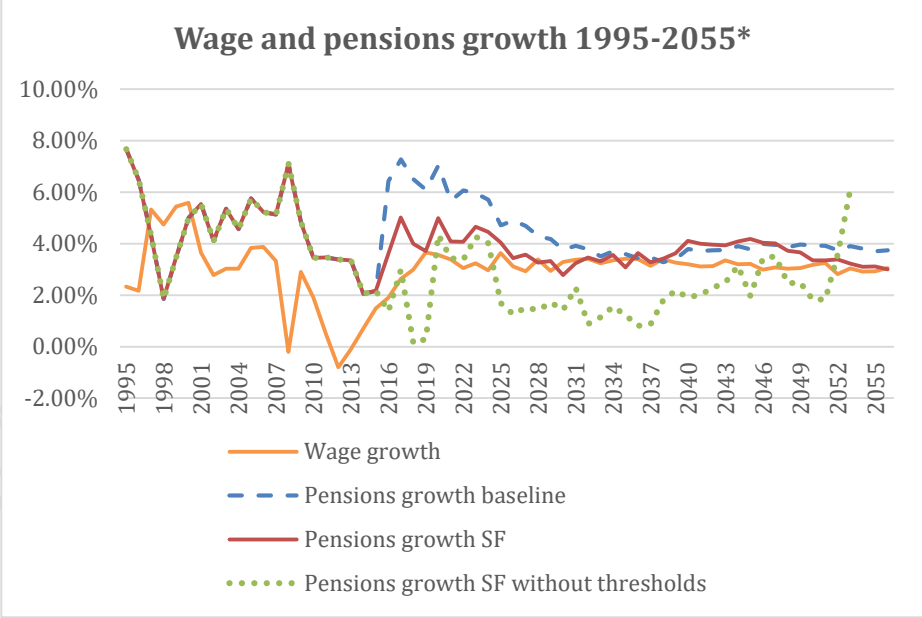


The evolution of this indicator is rather similar to the one shown before but some differences remain. The increase at the beginning might be due to the fact that workers are subject to labor market instability (due to the economic crisis), while pensioners are not still reproducing these effects. The differences between scenarios are also similar, but again there are some differences: The impact of the 2013 reform is slightly smaller and hence the effect of the non-limit scenario is higher.

Overall, both indicators show the same general pattern. While the effects of a hypothetic formula to update pensions without thresholds are devastating, the effects of introducing the reform as it is nowadays are not negligible at all. Quite interestingly in both cases, the baseline scenario shows a continuous increase of the relative position of pensioners with respect to workers. Besides the legal features of the pension system, this trend is clearly due to a great extent to the assumptions done with respect the evolution of wages. Looking at the past evolution of pensions and wage gives us a hint on a paradoxical feature of the Spanish pension system in the past which has important effects on our simulation results.



**Figure 7. Wages and pensions growth**

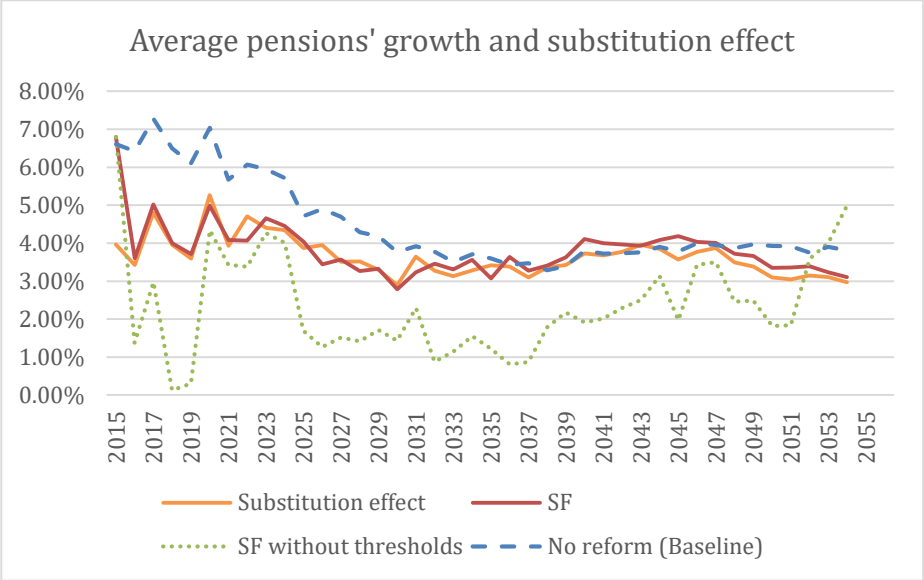



*Nominal growth rates. Observed data from 1995 to 2015 (Annual Economic Data Base of the European Commission and Spanish Social Security). Data from 2016 is projected.

Figure 7 shows the past evolution of wages and pensions growth rates up to 2015 continuing with the projected values under different scenarios. It is remarkable that, on average, pensions have been growing faster that wages in Spain during more than one decade. Then, the effects of the economic crisis are sizable both in pensions and wage growth rates. From 2012, an increase of wage growth rates can be observed, due to the relative recovering from the crisis (2012 was the worst year in terms of unemployment rates and other macro indicators). From 2015 on the model projects in the baseline scenario (in the absence of 2013 reform) an increase of pensions' growth rates recovering the pre-crisis levels. Obviously this increase is moderated by the application of the 2013 reform, so that pensions and wages grow quite similarly along the projection period. Finally, the non-limited UIUI follows the expected path. It experiences a sharp decline during the crisis. Then it recovers to fall again for a prolonged period during the retirement of baby boomers. The value increases at the end of the projection period, but calculations are not reliable anymore in the last five years of the projection period (there is no future data available to compute it).

At this point it is worth decomposing the factors producing pension's growth, attending to the effect of the new pensions (substitution effect). Figure 8 reproduces the evolution of pension growth above (Figure 6), along 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 basically captures the growth in pensions due to the fact that new pensions are, on average higher than the old ones. It is interesting to notice that, as expected when obtaining the UI value (fixed in the lower band along the whole period), most of the projected pensions' growth is caused by the substitution effect.

**Figure 8. Substitution effect**




***Intragenerational equity***

As said above the microsimulation model we have developed allows as to implement indicators of both inter and intragenerational income redistribution. In the following we show the evolution of two indicators of intragenerational redistribution: The Gini index and the income quintile ratio for pensioners. This will allow having a close look at 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 9. This indicator is decreasing along the projection period, with a period of slight increase from 2010 to 2013. The introduction of both sustainability factors unambiguously increases inequality according to this index. The effect is notoriously higher when the UI is not limited and hence the cut in pensions is higher. It is important to remark here that the meaningful results of our projections are those that compare between scenarios (that is, that compare scenarios with and without reform). Despite the projected wage growths (and therefor RB and pensions) include a random term (variance), the model does not project wage shocks and, in consequence, projected pensions' inequality captures less variability (lower Gini index) than the expected in the reality. The model reproduces the economic crisis, and therefore the increase in labour income inequality and (later) the increase in pensions Gini. Figure 9 compares Gini index for labour income and pensions, and adds the ratio 80/20 of pensions for the baseline scenario.

**Figure 9. Pensions Gini index**

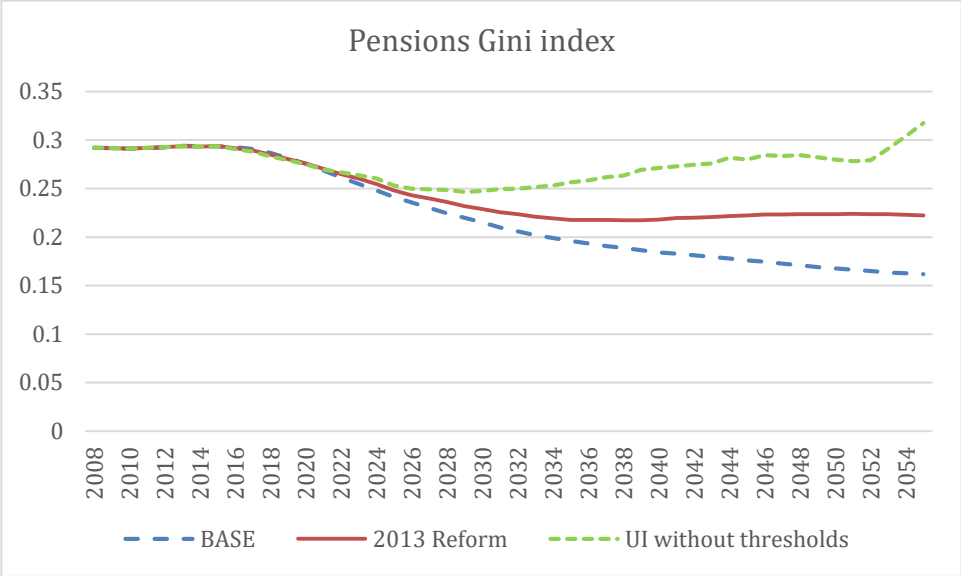



**Figure 10. Labour income Gini, pensions Gini and pensions ratio 80-20**

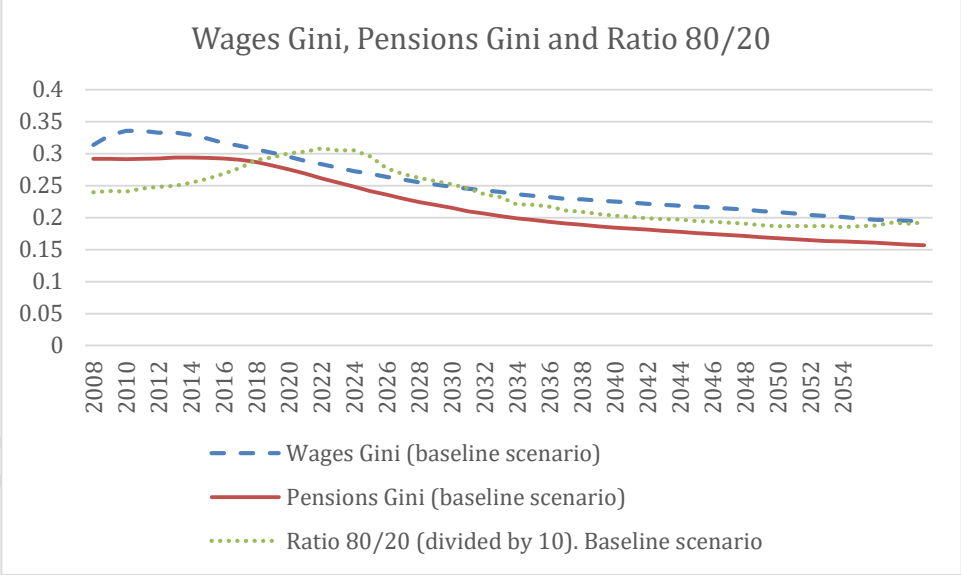
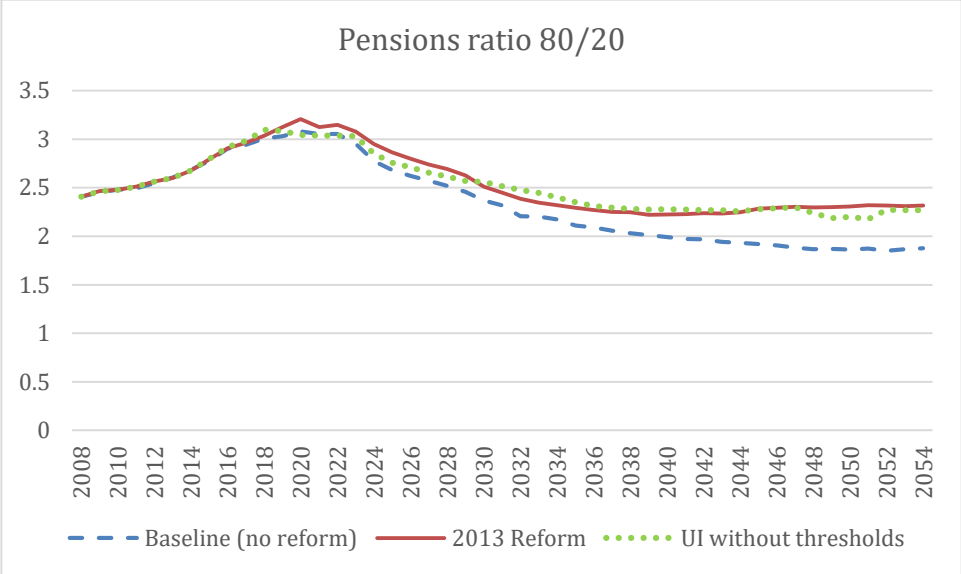



Figure 11 shows the changes in the pensions 80/20 ratio. Contrary to what occurs with the Gini index, the income quintile ratio (S80/S20) is closely related to the introduction of the UI of the 2013 reform, being this link mediated by the existence of lower and upper thresholds. The application of the update index (UI) strongly affects the amount of people

receiving maximum and minimum pensions (as explained in detail below) and, in consequence, it has a significant impact on the extremes of the distribution. The 80/20 pensions ratio relates total income received by the 20 percent of pensioners with the highest income (the top quintile) to the total income received by the 20 percent of the pensioners with the lowest income (the lowest quintile). Hence, if the S80/S20 ratio is, for example, four, then it implies that 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 to measure 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 goes up from 2.5 to 3 until 2022 –when baby boomers start retiring- and then it starts falling up to 2 in the long run. In coherence to what occurs with the Gini index, the introduction of the 2013 (in both cases, with and without thresholds) increases pension inequality.

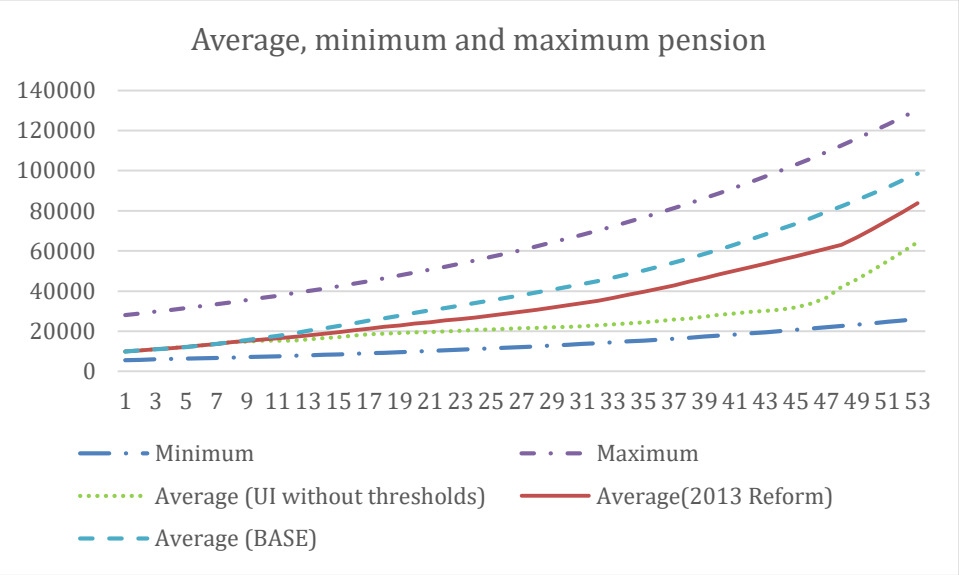
**Figure 11. Pensions' ratio 80/20**




In order to understand the changes in these inequality indicators it is worth considering the evolution of average pension together with the maximum and minimum threshold (shown in Figure 12) as well as the number of pensioners affected by these pension thresholds (Figure 13). Note that in the absence of a clear legal reference, we are updating pension's thresholds with inflation, while pensions grow in line with the past evolution of wages and the legal features of the pension formula. Despite the fact that pensions grow at a quite fast rate at the beginning, Figure 12 shows that, for the baseline, average pension is approaching more to the maximum pensions and as a result more pensioners are affected by the

maximum threshold (Figure 13).[6] Correspondingly, the share of pensioners receiving the maximum pensions goes up and the share of pensioners receiving the minimum goes down.

**Figure 12. Average, minimum and maximum pension**

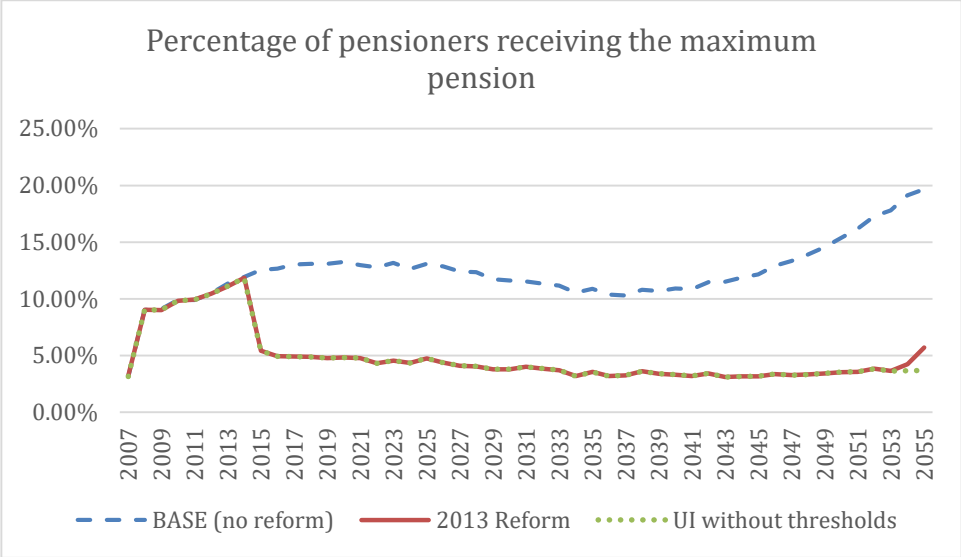


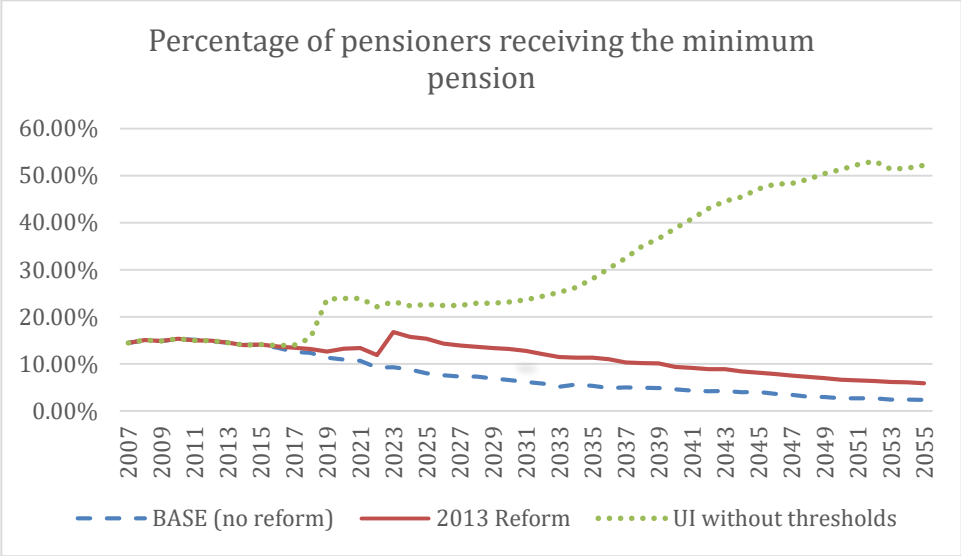

This situation changes when the reform scenarios (both with limits and no limits) are considered.[7] In the case of the 2013 reform, the pension cut implies that there is an initial decrease in the share of people reaching maximum pension and slightly more people receiving the minimum. The latter effects are amplified when the UI is applied with no limits, so that the share of people affected by minimum pensions reaches the 50%. This trends explain the ambiguous effects in redistribution. The Gini Index still shows a clear worsening in inequality, higher the stronger the pension cut (no limit versus limited SF scenario). The 80/20 Pensions Ratio –focused on extreme groups- indicates similar effects on inequality: The 2013 reform worsens inequality, while the non-limit UI scenario is close to the scenario in which the UI is applied with thresholds.



[6] Note that the mere evolution of the pension thresholds with inflation has no trivial redistributive effects of different sign.
[7] Note that the reform does not affect to the maximum and minimum pensions.

**Figure 13. Percentage of pensioners with minimum and maximum pension**



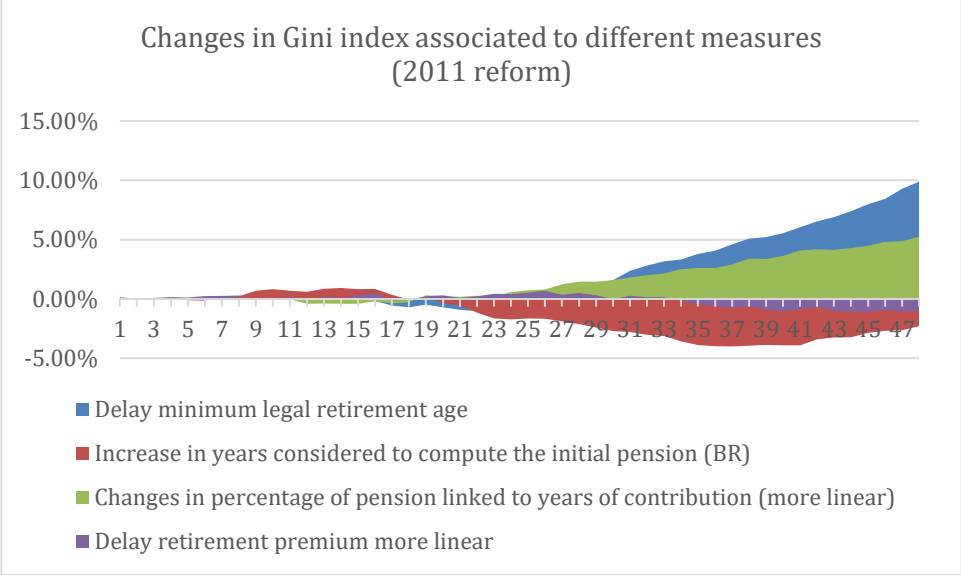




**Final remarks. Should we really redistribute with pensions?**

The results indicate that there are important redistribution effects of the 2013 reform, some of them unexpected/quite arbitrary. In this context it is worth considering the extent to which the pension system should redistribute. The Spanish pension system was stated as a *Bismarkian* (contributory) system. Nevertheless, some redistribution was introduced from the beginning, both in the form of non linearities of the *Bismarkian* parameters and adding contribution and pension thresholds. Since the Toledo agreement one of the main guidelines of the reform was strengthening the *Bismarkian* nature of the system. It is not clear the extent to which this was aiming to some extent at controlling pension expenditure, but it seems it should be producing less redistribution. Nevertheless, it turns out that the

*Bismarkian* reforms in the pensions system not always imply a less redistributive outcome. In the following we summarize the redistributive effects of the measures introduced in the 2011 reform.

In order to widen the picture, Figure 14 shows the changes in the Gini Index associated to the different components of the 2011 reform. The first reform measure –the one with more impact on pension expenditure– is the delay in retirement age. This is not usually considered a bismarkian reform, though it has some flavor of it as long as it tries to extend the working time as consequence of the increase in time spent as a pensioner due to the increase in life expectancy. Figure 14 indicates that this measure increases inequality, probably reflecting the fact that older pensioners usually have lower pensions. Further effects would require considering lifetime income, an approach that is beyond the scope of this paper.




The other three measures aimed directly to strengthen the link between contributions and pension benefits. Nevertheless, the only one that has the expected effect on income redistribution is the change in the share of regulatory base (RB) received as pension, which was changed to more proportional. The increase in the delayed retirement premium to make it more linear has erratic effects, rather small. The improvement in redistributing is probably reflecting the fact that workers with precarious working careers are able to improve their pensions. Interestingly, the increase in the years of past contributions considered to compute the RB has first a small negative and later a positive effect on income redistribution. At this point it is worth considering that the impact of this measure on both

sustainability and inequality deserves more attention. First, as long as the earnings profile is increasing along the working career, this measure would have the impact of cutting pensions. Second, if the earnings profile grows faster for high income earners, this measure would reduce more their pension entitlements, hence improving inequality. The results in Figure 14 corroborate this improvement in inequality but not for the first years of the projection. The opposite effect shown before 2025 is probably reflecting the effect of the crisis that worsens the working careers of many workers, especially those with precarious paths.

Overall, our results indicate that impact of reforms fostering sustainability has quite arbitrary effects on inequality. There is an immediate application for the case of Spain: It would have been recommendable completing the bismarkian reform, before introducing sustainability factors of any kind. Moreover, this fact also cast doubt on the appropriateness of using the pensions system as an income redistribution device.

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[i] Results are available from the authors upon request