Spanish Minimum Pensions after the 2013 Pension Reform*

Javier Díaz-Giménez
IESE Business School
<jdiaz@iese.edu>

Julián Díaz-Saavedra
Universidad de Granada
<julianalbertodiaz@ugr.es>

August 18, 2015

Abstract

In this article we explore the consequences of exempting minimum pensions from the Pension Revaluation Index (PRI) introduced by the 2013 reform of the Spanish pension system and making their real value a constant share of per capita output instead. We find that this change essentially implies trading-off higher minimum pensions against a lower PRI —which reduces the real value of all other pensions— and against the higher consumption tax rates that are needed to finance them. When faced with these trade-offs, the optimal responses of the households in our model economy are to work shorter hours, to retire earlier, and to save less. They also consume less to avoid paying some of the higher consumption taxes. These responses imply that preserving the real value of minimum pensions makes the growth rates of output smaller. We also find that this change compresses the range of pensions, and that as many as 48 percent of the retirees in our model economy collect the minimum pension in 2050. This share is 28 percentage points higher than the share of 2010. It also implies that pensions are more equally distributed because the bottom tail of the pension distribution collects a larger share of the total. Interestingly, we also find that preserving the real value of minimum pensions brings about large welfare gains.

Keywords: Computable general equilibrium, social security reform, retirement

JEL classification: C68, H55, J26

*We thank Juan Carlos Conesa for an early version of the code. Díaz-Giménez gratefully acknowledges the financial support of the Spanish Ministerio de Ciencia y Tecnología (ECO2012-37742) and of the Center for International Finance of IESE Business School. Díaz-Saavedra gratefully acknowledges the financial support of the Spanish Ministerio de Ciencia y Tecnología (ECO2011-25737).

1 Introduction

In 2011 the Spanish Parliament approved a parametric reform of the Spanish pay-as-you-go public pension system. This reform delayed the retirement ages and improved the contributivity of the system. The early retirement age was delayed from 61 to 63 and the normal retirement age was delayed from 65 to 67. The contributivity of the system was improved increasing from 15 to 25 the number of years of contributions that are taken into account to compute the retirement pension. The adoption of these changes was gradual and it started in 2013.[1] In that same year, the Spanish government enacted three additional parametric changes. The early retirement age was delayed once again, this time from 63 to 65 years; a new Sustainability Factor (SF) was introduced to reduce the value of new pensions according to the expected duration of retirement; and, a new Pension Revaluation Index (PRI) was adopted to make the pension system sustainable. This index reduces the real value of all pensions in payment in an amount that equates average past and future pension system outlays with average past and future pension system revenues. The adoption of the SF and the PRI effectively transform the Spanish traditional pay-as-you-go system from a defined-benefit system into a defined-contribution system.

In Díaz-Giménez and Díaz-Saavedra (2015) we have studied the aggregate, distributional, and welfare consequences of these reforms in detail. In that article we found that the 2011 and 2013 Reforms improve the future financial condition of the Spanish pension system substantially and that they reduce the need for future tax increases to finance the pensions. Unfortunately, this result is achieved at the expense of a severe reduction of the real values of the average pension and, more importantly, of the minimum pension. Specifically, in that paper we find that, between 2015 and 2050, the reforms reduce the real value of the average pension by about 33 percent, and the real value of the minimum pension by about 41 percent by 2050, when compared to the values that would have obtained without the reforms. This means that the current minimum retirement pension would be reduced from the current 783 euros to 457 euros in 2050 in real terms.[2]

This reduction of the real value of minimum pensions is so large, that we find it hard to believe that it will be politically sustainable in the future. Therefore, we conjecture that minimum pensions will be exempted from the PRI, sooner rather than later, and that their real value will be increased to stay aligned with output per capita. In this article we study the consequences of this conjecture.

To this purpose, we simulate and compare two model economies. In the first model economy, which we label Model Economy R2013, we simulate the 2011 and 2013 pension system reforms *verbatim* and we use the PRI to revaluate every pension in payment, including the minimum

[1] See http://www.seg-social.es/prdi00/groups/public/documents/normativa/150460.pdf for the details of these reforms.

[2] De la Fuente and Domenech (2013), Conde-Ruiz and González (2013), and Moral-Arce (2013) also study the 2011 reform of Spanish pensions, and Sánchez-Martín (2014) studies the 2013 reform. In the Appendix of Díaz-Giménez and Díaz-Saavedra (2015) we review the contributions of these articles.

pensions. In the second model economy, which we label Model Economy R2013*, we exempt minimum pensions from the PRI and, instead, we revaluate them so that their share of per capita output remains unchanged at its 2011 value. In both model economies we adjust the consumption taxes as needed to finance the pension system once the pension reserve fund runs out.

Our model economies are identical to the model economy that we have described in Díaz-Giménez and Díaz-Saavedra (2015) and in its on-line technical appendix.[3] This model economy is a general equilibrium, multi-period, overlapping-generation model with heterogeneous households, a standard representative firm, and a government. The labor and retirement decisions are endogenous, and the households are fully forward-looking and they take into account the connection between their current labor decisions and their future pensions.

Exempting minimum pensions from the PRI essentially implies trading-off higher minimum pensions against a lower PRI —which reduces the real value of all other pensions— and against the higher consumption tax rates that are needed to finance them. The PRI is lower in Model Economy 2013* because exempting the minimum pensions from the PRI increases the pension system deficits and makes the pension system less sustainable. The consumption tax rates are higher in Model Economy 2013* because the pension system deficits are so large that the PRI hits its lower bound almost every year and, once the pension reserve fund runs out, the consumption tax rates must be raised to finance the pensions.

When faced with these trade-offs, the optimal responses of the households in Model Economy R2013* are to work shorter hours, to retire earlier, and to save less. They can afford to do so because their well-being during retirement is guaranteed by the higher minimum pensions. They also consume less to avoid paying some of the higher consumption taxes. All this implies that preserving the real value of minimum pensions makes the growth rates of output smaller.

We also find that in Model Economy R2013* the range of pensions is compressed, and that as many 48 percent of the retirees collect the minimum pension in 2050. This share is 28 percentage points higher than the share of 2010. This implies that pensions are more equally distributed in Model Economy R2013* because the bottom tail of the pension distribution collects a larger share of the total. Finally, we find that preserving the real value of minimum pensions brings about substantial welfare gains.

2 The Model Economy

We study an overlapping generations model economy with heterogeneous households, a representative firm, and a government. Our model economy is identical to the one that we describe in

[3]Díaz-Giménez and Díaz-Saavedra (2015) is available at `www.javierdiazgimenez.com/res/PEN3-PAP.pdf` and its technical appendix is available at `www.javierdiazgimenez.com/res/PEN3-APP.pdf`.

Díaz-Giménez and Díaz-Saavedra (2015). For the sake of brevity, we offer only a brief summary of its main features here. A detailed description of this model economy can be found in an on-line technical appendix which is available at http://www.javierdiazgimenez.com/res/PEN3-APP.pdf.

2.1 The Households

Age and Education: The economy is populated by overlapping generations of heterogeneous households of age $j = 20, 21, ..., 100$. Each period the households face an age-dependent and time-varying conditional probability of surviving from age j to age $j+1$, which we denote by ψ_{jt}. The households can be either high school dropouts, high school graduates, or college graduates. This educational level, which we denote by h, is exogenous and it is determined forever when they enter the economy.

Labour Status and Endowments: Households in our model economy are either workers, disabled households, or retirees. Every household enters the economy as a worker and with no assets. Workers receive an endowment of efficiency labor units every period. This endowment has two components: a deterministic component, which we denote by ϵ_{jh}, and a stochastic, idiosyncratic component, which we denote by s. The deterministic component depends on the household age and education, and we use it to represent the life-cycle profiles of earnings. The stochastic component is independent and identically distributed across households, it follows a first order, finite state Markov chain, and we use it to generate earnings and wealth inequality within the age cohorts. The labor income of workers is $y_t^l = \epsilon_{jh} \times s \times w \times l$, where w is the market wage and l is the time devoted to working in the market, which is endogenous.

Workers of age j and educational level h face a probability φ_{jh} of becoming disabled from age $j+1$ onwards. The disability shock is realized at the end of each period, once workers have made all their labor and consumption decisions. When a worker becomes disabled, she exits the labour market and receives no further endowments of efficiency labour units, but she is entitled to receive a disability pension until she dies.

Workers of age R_0 or older observe their realizations of the two components of their endowment of efficiency labor units and their pensions, and they decide whether to remain in the labour force for that period, or whether to retire and start collecting their retirement pension. Both the disability shock and the retirement decision are irreversible and there is no mandatory retirement age.

Preferences: The households order their sequences of consumption and leisure according to a standard, constant returns-to-scale utility function, $u(c, 1-l)$, where c denotes consumption and $1-l$ denotes leisure.

Technical assumptions: We assume that there are no insurance markets for the stochastic component of the endowment shock and that the households cannot borrow.

2.2 The Representative Firm

In our model economy there is a representative firm. Aggregate output, Y_t, is obtained combining aggregate capital, K_t, with the aggregate labor input, L_t, through a Cobb-Douglas, aggregate production function which we denote by $Y_t = K_t^{\theta}(A_t L_t)^{1-\theta}$. In this expression, A_t is an exogenous labor-augmenting productivity factor whose law of motion is $A_{t+1} = (1+\gamma_t)\, A_t$, and $A_0 > 0$. We assume that factor and product markets are perfectly competitive and that the capital stock depreciates geometrically at a constant rate, which we denote by δ.

2.3 Government Policy

The government in our model economy taxes capital income, household income, and consumption, and it confiscates unintentional bequests. It uses its revenues to consume, and to make transfers to households other than pensions. In addition, the government runs a pay-as-you-go pension system. The consolidated government and pension system budget constraint is

$$(G_t + Z_t) + P_t = (T_{kt} + T_{yt} + T_{ct} + E_t) + [T_{st} + F_t(1+r^*) - F_{t+1}] \tag{1}$$

In the expenditure side, G_t denotes government consumption, Z_t denotes government transfers other than pensions, and P_t denotes pensions. And, in the revenue side, T_{kt}, T_{yt}, and T_{ct}, denote the revenues collected by the capital income tax, the household income tax, and the consumption tax, E_t denotes unintentional bequests, T_{st}, denotes the revenues collected by the payroll tax, $F_t > 0$ denotes the value of the pension reserve fund at the beginning of period t, and r^* denotes the exogenous interest rate that the government obtains from the pension reserve fund assets. Consequently, $[F_t(1+r^*) - F_{t+1}]$ denotes either the revenues that the government obtains from the pension reserve fund or the funds that it deposits into it. The pension reserve fund must be non-negative, and we assume that G_t and Z_t are thrown into the sea so that they create no distortions in the household decisions. Finally, we assume that the capital income tax rate is constant, that the household income tax rate is progressive, and that, when the pension reserve fund runs out, the government changes the consumption tax rate as needed in order to finance the pensions.

2.4 The Pension System

In our benchmark model economy we choose the payroll tax and the pension system rules so that they replicate as closely as possible the *Régimen General de la Seguridad Social* of the Spanish pay-as-you-go pension system[4]. The payroll tax is capped and workers older than 65 are exempt from paying payroll taxes.

[4] The Régimen General de la Seguridad Social is the most important pension program in the Spanish Public Pension System. For instance, 82.1 percent of the affiliated workers and 54.9 percent of existing pensions belonged to this program in 2010.

Retirement pensions. A household of age $j \geq R_0$, that chooses to retire, receives a retirement pension, p_t, which we compute following the Spanish pension system rules. The main component of the retirement pension is its *regulatory base* which averages labor earnings up to the maximum covered earnings, during the N_b years prior retirement. If a household has not reached the full entitlement retirement age, which we denote by R_1, its pension is subject to an early retirement penalty. If the household is older than R_1, its pension claims are increased by 3 percent for each year worked after this age. The regulatory base is multiplied by a pension replacement rate which we use to replicate the pension expenditures to output ratio. Finally, retirement pensions are bounded by a minimum and by a maximum pension.

Disability pensions. To replicate the current Spanish rules, we assume that there is a minimum disability pension that coincides with the minimum retirement pension, and that the disability pension is 75 percent of the household's regulatory base.

2.5 Equilibrium

A detailed description of the equilibrium process of this model economy can be found in the technical appendix to Díaz-Giménez and Díaz-Saavedra (2015) which can be downloaded from `www.javierdiazgimenez.com/res/PEN3-APP.pdf`.

3 Calibration

To calibrate our model economy, we choose 2010 as our calibration year. Then we choose the initial conditions and the parameter values that allow our model economy to replicate as closely as possible selected macroeconomic aggregates and ratios, distributional statistics, and institutional details of Spain in 2010.

More specifically, to characterize our model economy fully, we must choose the values of 5 initial conditions and 50 parameters. To choose the values of these 50 parameters, we need 50 equations which formalize our calibration targets. We determine the values of 31 of those parameters directly because they involve either a single parameter or a single parameter and our guesses for the values of aggregate capital and aggregate labor. To determine the values of the remaining 19 parameters, we solve a system of 19 non-linear equations. We describe these steps and our computational procedure in the on-line technical appendix which is available at http://www.javierdiazgimenez.com/res/PEN3-APP.pdf.

In that appendix we show that our model economy succeeds in replicating most of the aggregate and distributional statistics that we target, and that it also replicates the retirement behavior of

Spanish workers very accurately. This last result is particularly remarkable, since we intentionally exclude the statistics that describe retirement from our set of calibration targets.

4 Simulation

We use our model economy to simulate two pension system reforms. In the first reformed model economy, which we label Model Economy R2013, we replicate the 2011 and 2013 Spanish pension system reforms *verbatim* with all their details. Specifically, we extend the number of years of earnings that we use to compute the pensions, we delay the retirement ages, and we apply the pension revaluation index and the sustainability factor to every pension including minimum pensions. In the second reformed model economy, which we label Model Economy R2013*, we also replicate the 2011 and 2013 Spanish pension system reforms but we exempt minimum pensions from the Pension Revaluation Index and we assume that the minimum pensions are revaluated so that they remain a constant share of per capita output every period.

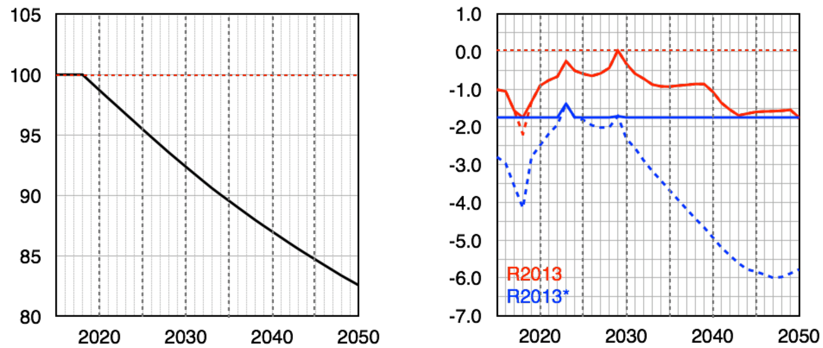
The 2011 and 2013 Reforms in the Model Economies. In our two model economies we extend the number of years of earnings that we use to compute the pensions, from the 15 years previous to retirement in 2012 to 25 in 2022, at a rate of one year every year. In 2012 we delay the early retirement age from 60 to 61; in 2018 we delay the early retirement age from 61 to 62 and the normal retirement age from 65 to 66; and in 2024 we delay them again to 63 and to 67. Finally, we apply the Pension Revaluation Index from 2014 onwards and the Sustainability Factor from 2019 onwards. Since in our model economy pensions are defined in real terms, we modify the Spanish Pension Revaluation Index bounds subtracting an estimate of the inflation rate, according to the inflation rate scenario that we describe below. In Figure 1 we plot the Sustainability Factors and the Pension Revaluation Indexes that we obtain in Model Economies R2013 and R2013*. As we have already mentioned, in Model Economy 2013* minimum pensions are revaluated so that their value is a constant share of per capita output. Both model economies have exactly the same initial conditions and they share the demographic, educational, growth, inflation, and fiscal policy scenarios that we describe below.

The Demographic Scenario. The demographic scenario replicates the demographic projections for Spain for the period 2010–2052 estimated by the *Instituto Nacional de Estadística* (INE) in 2012.[5] In Panel A of Figure 2 we plot the changes in the 65+ to 20–64 dependency ratio that result from this scenario. This ratio increases from 26.5 in 2010 to 77.6 in 2050.

The Educational Scenario. The initial educational distribution of our model economies replicates the educational distribution of the Spanish population in 2010, as reported by the INE in 2012. After 2010, we assume that the educational shares for the 20-year old entrants are 8.65 percent,

[5]These projections can be found at $http://www.ine.es/inebaseDYN/propob30278/propob_enlaces.htm$.

Figure 1: The Revaluation of Pensions in Model Economies R2013 and R2013*



A: The Sustainability Factor (%) B: The Pension Revaluation Index[a]

[a]The solid series represent the bounded versions of the PRI and the dotted series the unbounded versions.

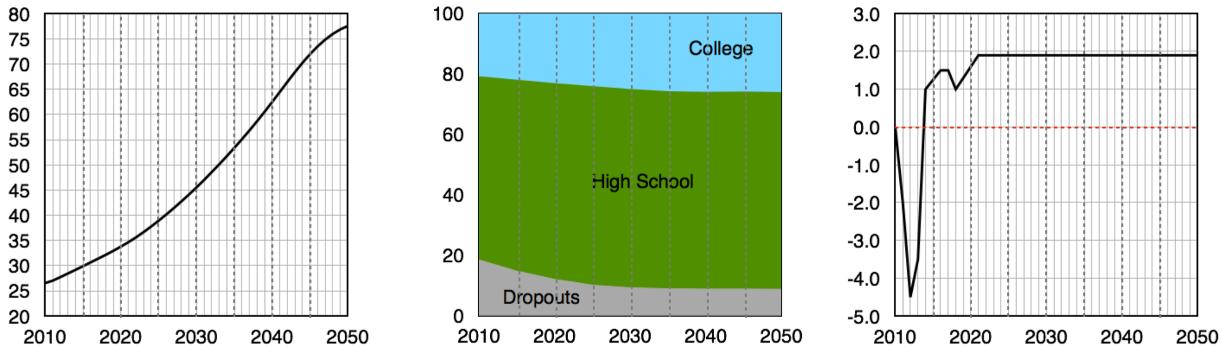
63.53, and 27.82 percent forever for drop-outs, high school graduates, and college graduates. Those shares are the educational shares of the most educated cohort ever in Spain, which corresponds to the 1980 to 1984 cohort.[6] In Panel B of Figure 2 we plot the changes in the distribution of education shared by Model Economies R2013 and R2013*. The shares of high school drop-outs, high school graduates, and college graduates change from from 18.7, 60.6, and 20.7 percent in 2010 to 8.9, 65.1, and 26.0 percent in 2050.

The Growth Scenario. Between 2010 and 2014 the growth rates of output at market prices in our model economy replicate the growth rates of Spanish GDP, which were 0.2, –0.6, –1.9, –0.6, and 1.4 percent. For 2015, we target a growth rate of 1.7 percent. This was the growth forecast for Spain published by the International Monetary Fund in the October 2014 issue of its *World Economic Outlook.* In our model economy there are three sources of output growth: the changes in the labor-augmenting productivity factor, γ_t, the changes in the demographic and educational distributions, which are exogenous; and the changes in labor hours and savings brought about by the changes in prices, pensions, and consumption tax rates, which are endogenous. To replicate the IMF's growth scenario we choose the sequence of γ's that we plot in Panel C of Figure 2. Between 2015 and 2050, this sequence and the endogenous responses result in average growth rates of output of 1.8 percent for Model Economy R2013, and of 1.7 percent for Model Economy R2013*.

The Inflation Rate Scenario. The exogenous yearly inflation rates in our model economy for the 2010–16 period are 1.8, 3.2, 2.4, 1.4, –1.1, 1.4, and 2 per cent. Between 2010 and 2013, the inflation rate is irrelevant because the Pension Revaluation Index (PRI) only applies from 2014 onwards. After 2016, we assume that the inflation rate in our model economy is 2 percent because that is the inflation rate targeted by the European Central Bank. This inflation rate scenario has three

[6]Conde-Ruiz and González (2013) also use this educational scenario.

Figure 2: The Simulation Scenarios in Model Economies R2013 and R2013*



A: The Dependency Ratio[a] B: The Distribution of Education[b] C: The Exogenous Growth Rates (γ)

[a]This is the ratio between the number of households in the 65+ age cohort and those in the 20–64 age cohort in Model Economies R2013 and R2013*.
[b]This is the distribution of education of the households in the 20–64 age cohort in Model Economies R2013 and R2013*.

implications: first, since in 2014 the Spanish government increased the nominal value of pensions by 0.25 percent the value of the PRI that year was 1.35 [$= 0.25 - (-1.10)$] percent; second, the real value of the lower bound of the PRI is -1.15 ($= 0.25 - 1.40$) for 2015 and -1.75 ($= 0.25 - 2.00$) percent thereafter; and, third, from 2015 onwards, the real value of the upper bound of the PRI is 0.5 percent.

The Fiscal Policy Scenario. Recall that the consolidated government and pension system budget constraint in our model economy is given in Expression (1) In that expression G_t is exogenous and the remaining variables are endogenous. In Model Economies R2013 and R2013* the capital income tax rates and the parameters that determine the payroll tax function and the household income tax function are identical and they remain unchanged at their 2010 values. The consumption tax rates differ across both economies because we adjust them to finance the pensions once the pension reserve fund is exhausted. Every other variable in Expression (1) varies with time and differs across both economies because they are all endogenous.

Reform Announcements. We assume that the pension system reforms are announced at the beginning of 2011 and that they affect every household that had not retired by the end of that year.

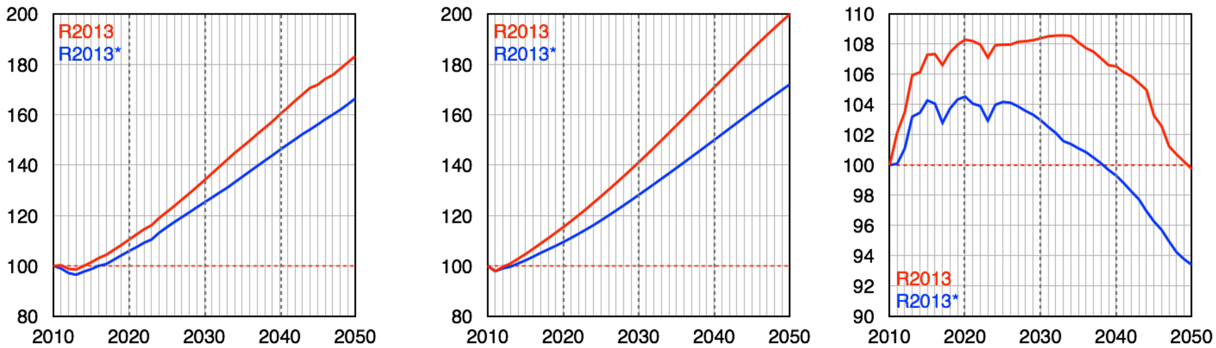
5 Results

We simulate our model economies using the demographic, educational, growth, fiscal, and inflation rate scenarios that we have described in Section 4, we report the main results of our simulations in Tables 1 and 2 and we illustrate the main results of our simulations in Figures 3 and 4.

Table 1: The Consequences of the R2013 and 2013* Pension Reforms

	2010	2020	2030	2040	2050
	The Minimum Pension				
R2013*	100.00	108.28	127.95	151.67	179.65
R2013	100.00	89.57	85.37	78.27	66.81
	The Pension Revaluation Index (%)				
R2013*	N.A.	–1.75	–1.75	–1.75	–1.75
R2013	N.A.	–1.33	–0.33	–1.06	–1.75
	The Consumption Tax Rate (%)				
R2013*	21.17	23.79	22.93	25.21	27.29
R2013	21.17	21.17	21.49	21.91	22.64
	Output				
R2013*	100.0	105.9	125.2	146.2	166.4
R2013	100.0	110.4	134.0	160.1	183.2
	Consumption				
R2013*	100.0	97.9	115.9	136.2	157.4
R2013	100.0	97.9	118.2	142.7	166.7
	Capital				
R2013*	100.0	109.4	128.1	149.9	172.0
R2013	100.0	125.4	146.1	170.8	199.8
	Labor				
R2013*	100.0	104.5	103.0	99.3	93.4
R2013	100.0	108.3	108.4	106.5	99.7
	Average Pension				
R2013*	100.00	101.48	102.80	108.41	120.30
R2013	100.00	103.70	111.57	115.54	120.73
	Average Retirement Age (Years)				
R2013*	63.6	64.2	66.2	67.4	67.8
R2013	63.6	65.3	67.5	69.3	69.9
	Retirees with the Minimum Pension (%)				
R2013*	20.4	29.8	40.5	45.8	47.5
R2013	20.4	12.7	10.5	7.0	4.3
	Gini Index of Pensions				
R2013*	0.36	0.34	0.31	0.26	0.24
R2013	0.36	0.37	0.35	0.31	0.28
	Pension System Deficit (% Y)				
R2013*	0.20	1.12	0.76	1.75	2.69
R2013	0.20	0.31	0.13	0.30	0.62
	Accumulated Pension System Debt (% Y)				
R2013*	–6.7	5.2	16.6	34.0	67.6
R2013	–6.7	1.8	1.0	3.5	9.3
	Aggregate Welfare Gains (% CEV)				
R2013*	0.00	6.59	7.36	8.30	9.87

Figure 3: The Aggregate Consequences of the 2013 and 2013* Reforms



A: Output Index B: Capital Input Index C: Labor Input Index[a]

[a]This measure of the labor input does not include the exogenous, labour-augmenting productivity factor, A.

Aggregate Consequences: In Figure 3 we plot the time series of output and the capital and labor inputs. We find that exempting minimum pensions from the Pension Revaluation Index (PRI) reduces the incentives to work and to save and, consequently, it also reduces the growth rates of output. Panel A of Figure 3 shows that in 2050 output is 16.8 percentage points smaller in Model Economy R2013* than in Model Economy R2013, Panel B shows that the capital input is 19.8 percentage points smaller, and Panel C shows that the labor input is 6.3 percentage points smaller. As we discuss below, this is because in Model Economy R2013* a large share of the population takes advantage of its generous minimum pensions and reduces its savings for old age and its labor market effort —working less hours during their working-lives and retiring earlier (see Panel F of Figure 4).

Minimum Pensions: Panel A of Figure 4 shows the real value of minimum pensions and Panel B shows the ratio of minimum pensions to per capita output. The differences between both model economies are large. In Model Economy R2013* minimum pensions grow by approximately 80 percent between 2010 and 2050 while in Model Economy R2013 they shrink by about 33 percent. In terms of per capita output, in Model Economy R2013* minimum pensions are a constant share of per capita output by construction and in Model Economy R2013 their relative value plummets from 19.0 percent in 2010 to 6.5 percent in 2050. As we have already mentioned, we think that this large reduction in the value of minimum pensions is politically unsustainable and we conjecture that minimum pensions will be exempt from the PRI, sooner rather than later.

In Panel C of Figure 4 we represent the share of the retirees who collect the minimum pension. Interestingly, the time paths of these shares in both Model Economies diverge. In Model Economy R2013* the share of retirees who collect the minimum pension increases from 20.4 percent in 2010 to 47.5 percent in 2050, while in Model Economy R2013 it falls from 20.4 percent to 4.3 percent. As we have already mentioned, in Model Economy R2013 minimum pensions are so small that workers work more to supplement their income during their old age and they retire later. This implies that almost every retiree earns more than the minimum pension. In sharp contrast, in Model Economy R2013* the relative generosity of minimum pensions is such that, in 2050, making do with the minimum pension is part of the optimal life-time plan for almost half of the population.

Average Pensions: Panel D of Figure 4 shows the real value of the average pension and Panel E shows the pension substitution rate which we define as the ratio between the average pension and the average salary of workers in the 60–64 age group. We find that the average pension is smaller in Model Economy R2013* almost every year between 2010 and 2050. Two reasons justify these findings: the weaker incentives to work and to save that we have already discussed, and the fact that in Model Economy R2013* the PRI is lower because its pension system deficits are bigger (see Panel B of Figure 1). The somewhat smaller pension substitution rate of Model Economy R2013* throughout the period confirms this result.

Retirement Ages: Panel F of Figure 4 shows the average retirement ages. As we have already mentioned, workers retire earlier in Model Economy 2013* and the differences in the retirement ages are roughly increasing. In 2010 worker retire at age 63.6 on average in both model economies by construction. But in 2050 the average retirement age in Model Economy 2013* is 67.8 years and in Model Economy 2013 workers delay their retirement until they are 69.8 years on average. This is because the generosity of the minimum pension in Model Economy 2013* and the fact that minimum pensions are exempt from early retirement penalties creates a strong incentive for workers in this model economy to retire early.

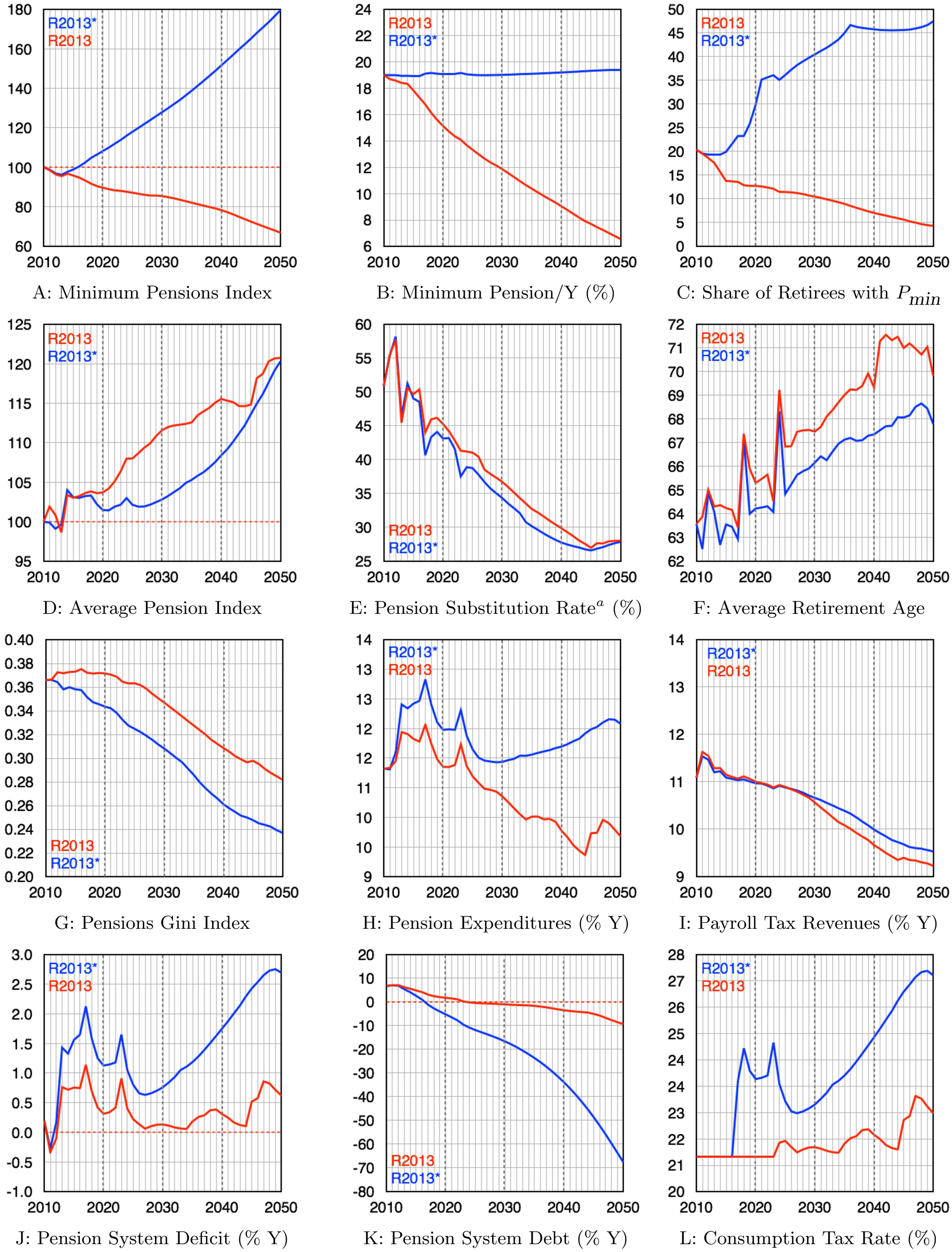
Table 2: The Distribution of Pensions in 2050

		Bottom Tail			Quintiles					Top Tail		
	Gini	1	1–5	5–10	1st	2nd	3rd	4th	5th	10–5	5–1	1
R2013*	0.237	0.6	2.6	3.3	13.1	13.1	15.2	21.8	36.8	9.8	8.9	2.5
R2013	0.282	0.2	1.0	1.5	7.3	13.7	18.4	25.0	35.6	9.1	7.3	1.8

The Inequality of Pensions: Panel G of Figure 4 shows the Gini indexes of the distributions of pensions in the model economies and Table 2 reports selected points of the Lorenz curves of the distributions of pensions in 2050. As expected, exempting the minimum pension from the PRI implies that pensions are more equally distributed in Model Economy R2013*. The Gini index in this model economy decreases from 0.366 in 2010 to 0.237 in 2050. In Model Economy 2013 it also decreases, but its value in 2050 is 0.282. As we report in Table 2, most of these changes are accounted for by increases in the share of pensions collected by the households in the bottom tail of the pensions distribution.

The Sustainability of the Pension System: In Panels H through L of Figure 4 we report the pension

Figure 4: The 2013 and 2013* Reforms



A: Minimum Pensions Index; B: Minimum Pension/Y (%); C: Share of Retirees with P_{min}; D: Average Pension Index; E: Pension Substitution Rate[a] (%); F: Average Retirement Age; G: Pensions Gini Index; H: Pension Expenditures (% Y); I: Payroll Tax Revenues (% Y); J: Pension System Deficit (% Y); K: Pension System Debt (% Y); L: Consumption Tax Rate (%)

[a]This statistic is the ratio between the average pension and the average salary of workers in the 60–64 age group.

expenditures, the payroll tax revenues, the deficit of the pension system, the debt that would have been accumulated by the pension system, and the consumption tax rate needed to finance the pensions. We find that the higher minimum pensions in Model Economy 2013* increase pension expenditures from 11.3 percent of output in 2010 to 12.2 percent in 2050. In contrast, in Model Economy 2013 pension expenditures *decrease* from 11.3 to 9.8 percent of output. Since the payroll tax revenues are very similar in both model economies, the deficit of the pension system deficit and the debt that would have been accumulated by the pension system in Model Economy 2013* are higher. Specifically in 2050 the pension system deficits are 0.6 and 2.7 percent of output and the debts that would have been accumulated by the pension systems are 9.3 and 66.7 percent. Consequently, the consumption tax rates needed to finance the pensions are in Model Economy 2013* also higher (27.3 percent versus 22.6 percent in 2050). The pension system deficits in Model Economy 2013* are so high, that this economy's PRI reaches its lower bound almost every year between 2015 and 2050. In contrast, in Model Economy R2013, the PRI reaches its lower bound only in 2018 and 2050 (see Panel B of Figure 1).

6 Welfare

To quantify the welfare effects of the 2013 Reforms, we use a consumption equivalent variation measure (CEV). Specifically, we compute the percentage change in a household's yearly consumption that equates its expected lifetime utility in Model Economies R2013 and R2013*. We start our computations in 2011, which is the year when the reforms are announced, and we compute the CEV measure for all the households who are alive that year, and for those who enter the model economies between 2012 and 2070. Since we assume that new-entrants are 20 years-old, these cohorts of households would have been born between 1992 and 2050.

Formally, we do the following: Let $z \in \Re = J \times H \times \mathcal{E} \times \mathcal{A} \times B_t \times P_t$. Then, we define $v^B[z, \Delta(z)]$ as the equilibrium value function of a household of type z in Model Economy R2013, whose equilibrium consumption allocation is changed by a fraction Δ every period and whose leisure remains unchanged. Then, for the households alive in 2011:

$$v^B[z, \Delta(z)] = \max E\left\{\sum_{t=0}^{100-j} \beta^t\, \psi_{j+t,2011+t}\,(1-\varphi_{j+t,h})\, u[c^B_{2011+t}(z)[1+\Delta(z)], (1-l^B_{2011+t}(z))]\right\} \quad (2)$$

where $c^B(z)$ and $l^B(z)$ are the solutions to the household decision problem.

For a household born in year t, who enters to the economy in year $t+20$:

$$v^B[z, \Delta(z)] = \max E\left\{\sum_{j=20}^{100} \beta^{j-20}\, \psi_{j,t+j}\,(1-\varphi_{jh})\, u[c^B_{t+j}(z)[1+\Delta(z)], (1-l^B_{t+j}(z))]\right\} \quad (3)$$

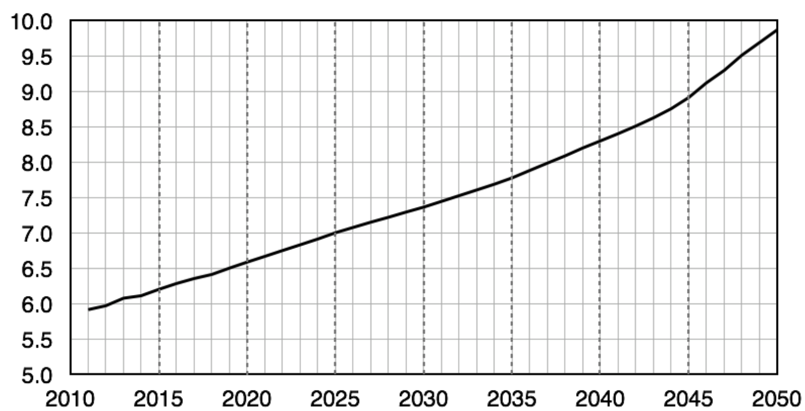
Then, $\Delta(z)$ is the number that solves

$$v^B[z, \Delta(z)] = v^R(z) \tag{4}$$

where $v^R(z)$ is the value of the optimal consumption and leisure allocations in Model Economy R2013*. For example, a CEV of 5 percent means that the life-time welfare of household of type z in Model Economy R2013* is the same as the lifetime welfare of a household of type z in Model Economy R2013 model economy provided that we increase its consumption by 5 percent every year and we leave its leisure unchanged.

The Aggregate Welfare Gains: In Figure 5 we report the aggregate welfare gains brought about by exempting minimum pensions from the Pension Revaluation Index. To measure the yearly welfare gains we add the consumption equivalent variations of every household who is alive that year and we express them as a percentage of aggregate consumption that year. For example, consider an economy inhabited by to households, a and b. Suppose that a consumes 5, that b consumes 4 and that their consumption equivalent variations computed according to expression (4) are 10 percent and 5 percent. The total consumption needed to make them indifferent between the two model economies is 0.7 ($= 5 \times 0.10 + 4 \times 0.05$), and the aggregate welfare gains are 7.8 percent ($= 0.7/9$).

Figure 5: The Aggregate Welfare Gains of Revaluating Minimum Pensions (CEV, %)

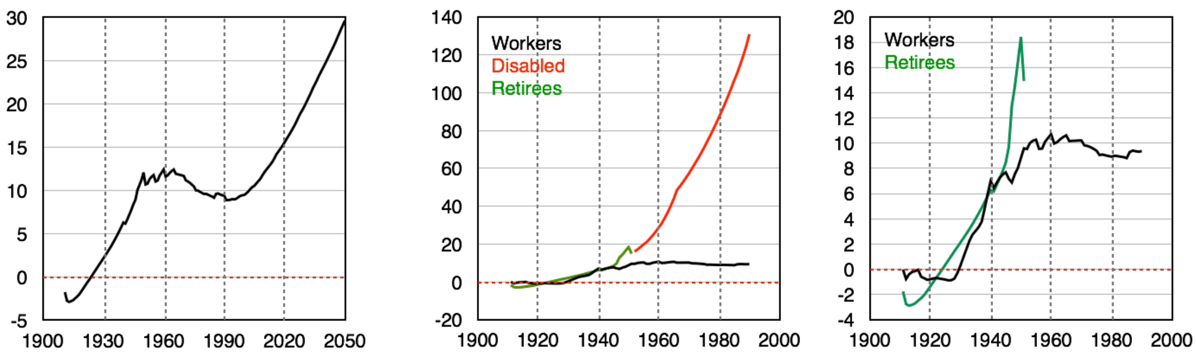


We find that the welfare gains range from 5.9 percent of aggregate consumption in 2011 to 9.9 percent in 2050. These numbers are large and increasing because the consumption equivalent variations of the younger households take into account the differences between the allocations of both model economies in the distant future —as distant as 2150 for the households who are born in 2050. And it turns out that after 2050 or so some of these differences become very large.

Individual Welfare Gains: In Figure 6 we report the average individual welfare gains of the household types. Panel A shows that only the households born between 1911 and 1923 are worse off in Model Economy R2013*. Their average welfare losses range from -2.9 percent to -0.3 percent. The spike in the consumption tax rate that occurs immediately after the reforms accounts for these losses. Every cohort born after 1923 enjoys a welfare gain. Except for the cohorts born between 1965 and 1990 these gains are increasing and by 2050 they reach almost 30 percent.

Panels B and C of Figure 6 show the average welfare gains of the households alive in 2011 when the reforms were announced. These households were born between 1911 and 1990 and some of the youngest households will survive until 2090. We find that the disabled households are the ones that benefit the most from the R2013* Reform because they receive a higher disability pension longer, and because most of these households collect the minimum pension which is substantially larger in Model Economy R2013*. For instance, in 2050 the minimum pension in Model Economy R2013* is 168 percent higher than in Model Economy R2013.

Figure 6: The Individual Welfare Gains of Revaluating Minimum Pensions (CEV%)*



A: All Households B: Households alive in 2011 C: Households alive in 2011

*The three panels of this figure report the welfare gains of the household-types organized by year of birth.

Workers born between 1930 and 2011 are also better-off under the 2013* Reform. The welfare gains are increasing for the cohorts born between 1930 and 1950. Thereafter, they are relatively constant and they range from 8.8 percent to 10.7 percent. Workers born before 1930 are worse-off because they have to pay higher consumption taxes, and they have little time to reoptimize.

Finally, the retirees who were born after 1923 are better-off under the 2013* Reform and those who were born before that year are worse-off. Old retirees are worse-off because they pay higher consumption taxes and they do not live long enough to take advantage of the higher minimum pensions.

Our findings lead us to conclude that a generous minimum pension financed with consumption taxes is an efficient way to ensure that every household will have a reasonable level of consumption during its old age.

7 Conclusions

We find that a hypothetical future parametric reform of the Spanish pay-as-you-go pension system that excludes the minimum pensions from the Pension Revaluation Index and that makes their real value a constant share of per capita output encourages workers to work shorter hours, to retire earlier, and to consume less. But, interestingly, we also find that this reform makes very few households worse off and that it brings about large aggregate welfare gains. Our results uncover an interesting dilemma for policy makers. What should they do: make the economy more efficient, or make its households better off?

References

[1] Conde-Ruiz J. I., and C. I. González, (2013). Reforma de Pensiones 2011 en España. *Hacienda Pública Española*, IEF, 204(1), 9–44.

[2] De La Fuente A., and R. Doménech, (2013). The Financial Impact of Spanish Pension Reform: A Quick Estimate. *Journal of Pension Economics and Finance*, 12(01), 111–137.

[3] Díaz-Giménez J., and J. Díaz-Saavedra, (2015). The Future of Spanish Pensions. Mimeo. Available at http://www.ugr.es/∼julianalbertodiaz/research/PEN3-F26.pdf

[4] Moral-Arce I., (2013). Aplicación de Factores de Sostenibilidad en el Sistema de Pensiones Español: Previsiones Para el Período 2012-2050. *Instituto de Estudios Fiscales*, P.T. 4/2013.

[5] Sánchez-Martín A. R., (2014). The Automatic Adjustment of Pension Expenditures in Spain: An Evaluation of the 2013 Pension Reform. *Banco de España*, Documento de Trabajo 1420.