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# Fiscal Crisis, Social Security Reform and Vulnerable Population

**Summary:** The aging process we are witnessing in the majority of developed countries is raising financial sustainability problems in the pay-as-you-go pension system. The reforms designed to re-establish the financial equilibrium of pension systems may put one of the most important objectives of these systems at risk: to reduce the poverty rate among the elderly. This paper studies the effects that the reforms implemented in the Spanish pension system would have on the poverty rate of the retired population. The two main novelties presented are the following. First, the collective under study is focused on the most vulnerable workers. Second, the effects of the reforms are studied taking into account the labour market situation of the individuals in the years prior to retirement.

**Key words:** Dynamic analysis, Labour market situation, Social security reform, Vulnerability.

**JEL:** H55, I38, J14.

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The aging process we are witnessing in the majority of developed countries is raising financial sustainability problems in the pay-as-you-go pension system. The problem that these countries are facing can be summarised as follows: The expected growth in pension expenditure, induced by an increase in the number of pensioners, is substantially higher than the future income provisions that are expected to be received from social contributions. Moreover, expected productivity changes over the next decade, at least in EU countries, would not be sufficient to compensate for the reduction in labour supply (future contributors) induced by low fertility rates (European Commission 2012a).

As a result of these estimates for the EU countries, which have different timing and intensities, several reforms are being implemented to recover financial equilibrium of these countries in the future. The reformist strategy is framed within the EU's fiscal policy, which is centred in fiscal adjustment. In the case of social security systems, reforms are oriented to constrain the growing expenditure of pensions by: i) raising the retirement age; ii) tightening the eligibility criteria; iii) lowering indexation. To avoid the possible negative effects that these reforms may have on the economic welfare of the future cohorts of pensioners, countries are fiscally encouraging individual savings, either voluntarily or by constituting mandatory funded systems. In this manner, the future pensioners would complement the pension they draw from

public systems with some other income derived from savings; therefore, their levels of economic welfare are not substantially altered.

Attaining information about these possibly negative effects is particularly relevant for populations with the lowest incomes, given that their savings opportunities may be limited due to a lack of resources. If, as a result of the reforms, diminutions in the replacement rate (pension/wage) are high and the opportunities for retirement saving are scarce for this population group, there could be a future increase in the poverty rate associated with the retired population. The reforms designed to re-establish the financial equilibrium of pension systems may then put one of the most important objectives of these systems at risk: to reduce the poverty rate among the elderly (Kenneth Nelson 2004; European Commission 2012b). The aim of this paper is to study the effects that the reforms implemented in the Spanish pension system would have on the poverty rate of the retired population.

The vast majority of research on the effects of pension system reforms on the welfare of the retired population, i.e., on their future income, is aimed to simulate the *answer* of workers to the changes made. This answer may be of two different types. On the one hand, individuals, as it has been previously stated, may increase their savings rate for retirement. On the other hand, they may enlarge their permanency in the labour market, compensating for the loss of income induced by the reforms.

Empirical evidence has been primarily focussed on investigating this second alternative. The primary conclusion drawn is that the reforms do not necessarily diminish welfare, which for some groups may be even higher. This conclusion is reached by assuming that individuals, when the reforms diminish the present discounted value of their future social security income, increase their inclusion in the labour market (see, for instance: Courtney Coile and Jonathan Gruber 2007; George Kudrna and Alan D. Wooldland 2011). This outcome, however, is contingent on the response that elderly workers may encounter in the labour market. Empirical evidence on labour inclusion has shown that it is not always possible to extend one's working life (Daniel van Vuuren 2013). If elderly workers have problems continuing in the labour market, then the reforms may negatively affect their future economic welfare, given that the reforms may not compensate for the income received by extending their working life<sup>1</sup>. In this context, we find it particularly relevant to measure the direct effect, i.e., the effect that may take place if the worker does not respond and the effect that different reformist measures may have on the welfare of individuals.

Among the research that has addressed these direct effects, the contribution by Frédéric Gonand and Florence Legros (2009) for the case of France and the work developed by Patricia Peinado and Felipe Serrano (2012) for the case of Spain should be highlighted. In these works, the poverty rate is used as a means to quantify the variations on welfare induced by the different reforms. In the first work, the effects are simulated using a dynamic general equilibrium model, while in the second study, the effects are estimated by applying duration analysis. The group of people under study is the group of pensioners. The conclusions drawn in both works are very simi-

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<sup>1</sup> The strategy followed in the EU to fiscally encourage savings for retirement seems to be implicitly based on this hypothesis.

lar: a) tightening eligibility criteria increases poverty rates among the future generations of pensioners, whereas, b) increasing the retirement age diminishes the poverty rate.

This paper is framed by the latter line of research. As in Peinado and Serrano (2012), duration analysis is used to estimate the effects of the reforms. In Peinado and Serrano (2012) the collective under study is formed by all the pensioners in social security scheme and there is no differentiation between labour market situation of the pensioners protected. The two main novelties presented are the following. First, the collective under study is focused on the most vulnerable workers, namely, those who present the lowest taxable-average-earnings. This group of workers, apart from having less opportunities to save, are also the most vulnerable to continue in the labour market because of their age. In other words, this group of workers could be the most affected by the reforms. Second, the effects of the reforms are studied taking into account two different scenarios. In the first scenario, we assume that the individuals do not have the possibility of correcting the effects of the reforms by staying in the labour market. In the second scenario, this hypothesis is relaxed so that the probability of the individuals in the collective being poor is estimated by modifying the parameters of the model to take into account an increase in the time that individuals spend in the labour market.

The paper is structured as follows. Section 1 describes the Spanish pension system and its main reforms. Section 2 defines the vulnerable pensioner. Section 3 is dedicated to data and methodology. The results are drawn in Section 4. The last section provides the most important conclusions of the paper.

## 1. Spanish Pension System and Main Reforms

### 1.1 The Rules before the Reform

The Spanish pension system is an unfunded pay-as-you-go social security system. While employed, individuals contribute a portion of their income to the pensions of the currently retired population, and while contributing, workers gain the right to draw a pension benefit when they retire in the future. The pension that individuals receive is the result of applying a coefficient,  $\tau_j$ , which is related to the number of years contributed by each pensioner,  $j$ , to the personal *regulatory base*  $RB_j$ , as in Expression (1):

$$Pension_j = \tau_j RB_j. \quad (1)$$

The regulatory base is obtained in accordance with Expression (2).  $TAE_i^j$  refers to the Taxable Average Earnings made by pensioner  $j$  in the  $i$ -th month prior to becoming retired, and  $CPI_i$  is the Consumer Price Index from the  $i$ -th month to the beginning of retirement. As may be drawn from the expression, only the last 15 years of contributions (14 months each given that, in general, workers draw 12 wages plus two additional payments known as extra-wages) made by the pensioner  $j$  are computed:

$$RB_j = \frac{\sum_{i=1}^{24} TAE_i^j + \sum_{i=25}^{180} TAE_i^j \frac{CPI_{25}}{CPI_i}}{210} \quad (2)$$

The coefficient  $\tau_j$  varies between 0.5 and 1, depending on the number of years the pensioner has contributed to the social security system (*contribution spell*). Those who have contributed for 15 years (minimum period of contribution required to draw a pension) are entitled to 50 per cent of the regulatory base (value of  $\tau_j$  equal to 0.5). From then on, each additional year implies a gain of 3 percentage points of the regulatory base until 25 years is reached. The years of contribution from years 26 to 35 imply an additional 2 percentage points each. Finally, the coefficient reaches its maximum value (unity or 100 per cent) for those pensioners who have contributed for 35 years or more.

The Spanish pension system is designed to ensure that the purchasing power of a pensioner is kept constant and equal to the purchasing power that she or he had in the year they retired. Thus, pensions are adjusted each year, according to the evolution of the Consumer Price Index (CPI). This actualisation is known as the *reassessment* of the pension.

The legal retirement age in Spain is 65. However, the legislation permits the population to retire after age 61. For each year between the ages of 61 and 65, however, people who opt to retire are penalised with a yearly reduction of 8 per cent above the pension to which they are entitled. The law also permits extending the working age beyond the legal retirement age for people who have not been contributing for 35 years when they reach the age of 65. In any case, the age limit for this time extension is 70. Because of this legislation, the effective retirement age varies between 61 and 70, inclusive; however, the average effective retirement age in the Spanish system is 64.

Therefore, the variables that define the pension are as follows: the “regulatory base”, the “contribution spell”, the “effective retirement age”, and the “reassessment” of the pension. These variables are the covariates included in the econometric model developed later in this paper. Specific features of these variables are presented in Table 1.

**Table 1** Covariates Included in the Model

Variable	Type	Description	Mean <sup>2</sup>
Regulatory base (RB)	Time-invariant	Value of the regulatory base.	657 Euros
Effective retirement age (ERA)	Time-invariant	Age at which the pensioner starts drawing the pension.	64
Contribution spell (CS)	Time-invariant	Number of years of contribution to the social security.	37
Reassessment	Time-varying	Actualization of the regulatory base according to the corresponding CPI.	

Source: Authors' estimates.

<sup>2</sup> Averages from the sample in the study.

## 1.2 The New Rules

The reform of the Spanish pension system is currently under debate. However, until the present time, two major reforms have been implemented. The first one consists of delaying the retirement age from 65 to 67 after a period of transition, which started on January 1, 2013 and will finish in 2027.

The second reform consists of a set of changes related to the eligibility criteria. The main reform is an increase in the number of years computed to obtain the regulatory base. After the reform, the regulatory base of the individuals is computed according to Expression (3). While in the previous framework (Expression (2) above) only the last 15 years of contributions were taken into account, the last 25 years of contributions (14 months each) made by the pensioner  $j$  are now computed:

$$RB_j = \frac{\sum_{i=1}^{50} TAE_i^j + \sum_{i=50}^{300} TAE_i^j \frac{CPI_{25}}{CPI_i}}{350}. \quad (3)$$

## 2. Definition of Vulnerable Pensioner

We consider the “vulnerable population” to be those people who are especially willing to undergo a situation of poverty in the years of retirement.

The poverty index that we use is the *standard* in the EU, i.e., an individual enters a poverty situation when the income she enjoys is lower than 60 per cent of the median equivalised income. The only source of income that we take into account is that coming from the pension system. Although this fact limits our analysis, there is no data available to extend the analysis.

The group of people studied, which we call “vulnerable”, is formed by the individuals who, at the date of retirement show the lowest regulatory bases. Given the features of the pension system, these individuals are in this situation because they have contributed based on low taxable average earnings during their working life.

From a statistical point of view, we have identified this collective as the first tertile of the regulatory bases in each generation of retirees. This selection is the result of non-parametric estimates that compute the cumulative probabilities of poverty for the different collectives that constitute the system. Failure functions from Kaplan Meier and Nelson Aalen have been estimated. Results reveal that the cumulative probability of being poor by the end of the period for this vulnerable population group is three times (around 30 per cent) the probability estimated in Peinado and Serrano (2012) for the whole collective of pensioners, which was estimated to be around 10 per cent. Accordingly, it is proven that for the chosen collective, the cumulative probability of entering a poverty situation is triple the probability estimated for the global group of pensioners.

If we take into account that currently more than three million people are enjoying a retirement pension within the general scheme, then the collective we are studying would be more than 1,000,000 people.

The features of the average individual in this collective are the following:

- 1) During her working life, she has made 36.9 years of contributions to the system;
- 2) She retires when she is 63.9 years old;
- 3) Her regulatory base represents 60 per cent of the average regulatory base for the system;
- 4) She has incurred a penalisation for early retirement of 13.8 per cent.

### 3. Data and Methodology

#### 3.1 Data

The data source is the Continuous Survey of Working Lives (2007), compiled each year by the Spanish Ministry of Immigration and Social Security. This sample, which has been produced each year since 2004, provides information about the working lives of 1,170,000 pensioners and employed workers. The Spanish social security system comprises the General Social Security Scheme, with which salaried workers as a whole are affiliated (71% of the total number of those affiliated), and a Special self-employed Workers' Scheme, with which those who are self-employed are affiliated (15% of the total number of those affiliated). The remainder of the system comprises several minor populations, such as fisheries workers or mine workers. This study focuses exclusively on pensioners who are part of the General Social Security Scheme.

The analysis is conducted using the information from 2007. From this data, the complete path of pension benefits is calculated by applying the formula implemented by the administration and allows the extension of the panel to the workers who entered the system until 1986. Thus, the study has been implemented using unbalanced, right-censored panel data from 1986 through 2007. This extension of the data allows extrapolation of the information to the maximum extent possible and, thus, provides a gain in terms of efficiency. The calculation of the benefit uses the initial pension benefit entitled to the pensioner when she or he began to draw the benefit (that is, when no reassessment had yet been applied to the pension), and then it is adjusted to current rates from the starting date to the last year available (2007) by multiplying by the corresponding actualization factors, which are the corresponding Consumer Price Indexes for each year from 1986 to 2007.

Each pensioner enters the panel in the year in which the pensioner's benefit is recognised and is recorded until 2007. After debugging the database, the total number of individuals included in the study is determined to be 11,984 individuals.

#### 3.2 Econometric Model

Vulnerability may be defined as a dummy variable  $V_j$  which takes value 0 for those pensioners who are not vulnerable and value 1 for those who are vulnerable. Let's define pensioners' Vulnerability Line  $VL_t$  as the value of the 33<sup>rd</sup> percentile of the Regulatory Bases' distribution for the generation  $t$ ; that is to say, for the group of people who start to draw a pension in year  $t$ . Then, the pensioner  $j$  of generation  $t$  will be identify as vulnerable when her associated regulatory base  $RB_j$  is equal or lower than the vulnerability line  $VL_t$  for such generation  $t$  as in Expression (4):

$$V_j = \begin{cases} 0 & RB_j > VL_t \\ 1 & RB_j \leq VL_t \end{cases} \quad (4)$$

Let  $PL_t$  denote the poverty line of the country under study. The poverty state for a vulnerable pensioner  $j$  in period  $t$   $PS_{jt}$  may be defined as a binary dummy variable, which takes a value of zero for pensioners whose pension  $p_{jt}$  is greater than or equal to the poverty line and a value of one for pensioners whose pension is below the poverty line.

$$PS_{jt} = \begin{cases} 0 & p_{jt} \geq PL_t \\ 1 & p_{jt} < PL_t \end{cases} \quad (5)$$

$$t \in [0, T).$$

Using the standard notation in survival analysis (see, for example, Tony Lancaster 1990 or Jeffrey M. Wooldridge 2002), let  $T \geq 0$  denote the duration, the length of time a vulnerable pensioner draws a pension above the poverty line. Then, the cumulative distribution function  $F(t|Z(t))$  of the duration  $T$  or, as may be interpreted here, cumulative probability of being poor  $P(T \leq t|Z(t))$  conditional on vector  $Z_j(t)$  of possibly time-varying covariates is defined as:

$$F(t|Z(t)) = P(T \leq t|Z(t)) \quad (6)$$

$$t \geq 0,$$

with the associated density function  $f(t|Z(t))$ .

$$f(t|Z(t)) = \frac{\partial F(t|Z(t))}{\partial t} \quad (7)$$

$$t \geq 0.$$

The survival function  $S(t|Z(t))$  is defined as the conditional probability of not being poor at time  $t$  given that, until that time, the pensioner has not entered poverty. Thus:

$$S(t|Z(t)) = 1 - P(T \leq t|Z(t)) = P(T > t|Z(t)) \quad (8)$$

$$t \geq 0.$$

The hazard function  $h(t|Z(t))$ , is defined as the conditional probability of entering poverty from a non-poverty situation in the time interval  $[t, t+h)$  given the length of time spent above the poverty line:

$$h(t|Z(t)) = P(t \leq T < t+h | T \geq t, Z(t)) = \frac{f(t|Z(t))}{S(t|Z(t))} \quad (9)$$

Duration dependence is said to exist if  $\partial h(\cdot)/\partial t \neq 0$  for any  $t$ . If  $\partial h(\cdot)/\partial t > 0$ , duration dependence is positive. In this case, the longer a pensioner remains above the poverty line, the more likely the pensioner is to become poor. If  $\partial h(\cdot)/\partial t < 0$ , duration dependence is negative. In this case, the longer a pensioner remains above the poverty line, the less likely the pensioner is to become poor.

For the estimates to be implemented, a log-logistic functional form is assumed for the hazard function. This selection has been made for two major reasons. First of all, the results obtained in the non-parametric estimates prove the existence of a non-monotonically increasing and then decreasing hazard rate. Hazard rate's functional shape informs of the type of relationship between the probability of entering poverty and time. In this case the function, when no control variable is included reveals a log-logistic shape. Additionally, among the attractive features of this distribution with respect to the estimates originally proposed by David R. Cox (1972), in which no assumption is made about the form of the hazard, is that it allows the estimation of the baseline hazard function, which is of direct interest here. Another attractive feature of this distribution is that the impact of the distributional assumptions on the estimates is minimized because it is a flexible parametric functional form (non-monotonic), unlike other distributions commonly used in the literature, such as the exponential, Weibull or Gompertz distribution. Following Stephen P. Jenkins (2009), this hazard function  $h(t|Z(t))$  can be written as:

$$h(t|Z(t)) = 1 - \exp[-\exp(G(t))] \quad (10)$$

$$G(t) = D(t) + \beta'Z(t) + u$$

where  $D(t)$  represents the baseline hazard function as the logarithm of time,  $Z(t)$  is a matrix that includes all the covariates (possibly time-varying) in addition to an intercept. The time-varying covariate included is external in the sense of John D. Kalbfleisch and Ross L. Prentice (1980) because the complete path features in  $Z(t)$  are determined for the entire period analyzed, regardless of whether the pensioner has entered poverty or not. Finally,  $u$  is the error term with a mean of zero. Following Lancaster (1990), and to prevent estimates from being biased (to alleviate the problem of omitted variables), a Gaussian error component is assumed to control the

presence of individual unobserved heterogeneity, which could arise in the absence of other important information regarding the pensioner, such as personal characteristics, that was not gathered in  $Z(t)$ .

Finally, let  $P^0(t|Z(t))$  denote the value of the cumulative probability of being poor when no reform is implemented and  $P^k(t|Z(t))$  the value of the cumulative probability of being poor after reform  $k$  is implemented. Then, the effect of a given policy reform  $k$  at time  $t$   $ER^k(t|Z(t))$  is defined as one minus the ratio between the value of the probability after the reform and the value of the probability when no reform is implemented (without any reform):

$$ER^k(t|Z(t)) = 1 - \frac{P^k(t|Z(t))}{P^0(t|Z(t))} \quad (11)$$

$$t \in [0, T).$$

And the average effect of each reform  $k$   $AER^k$  is defined as minus the average of the effects for the respective reforms over the whole period analyzed:

$$AER^k = -\frac{1}{T} \sum_{t=1}^T ER^k(t|Z(t)) = -\frac{1}{T} \sum_{t=1}^T \left( 1 - \frac{P^k(t|Z(t))}{P^0(t|Z(t))} \right) \quad (12)$$

$$t \in [0, T).$$

## 4. Results

We have estimated three different scenarios. In the first scenario, which is called the baseline scenario, the cumulative probability of the average vulnerable pensioner being poor is estimated by computing the pension according to the rules existing before the reform. In the second scenario, the cumulative probability is estimated under the new rules, where it is assumed that the individual fails to continue working until reaching the new legal retirement age. It should be highlighted here that the effect on the regulatory bases of the increase in the number of years included to compute the regulatory base has been implemented according to the results obtained by Rafael Muñoz de Bustillo et al. (2011). Each additional year decreases the regulatory base, on average, by 1 percentage point. For the collective studied in this paper, the decrease is said to be approximately 0.514 percentage points for each additional year of taxable average earnings included. Finally, in the third scenario, this restriction is relaxed so that it is assumed that the individual continues working until she fulfils the new retirement conditions to be entitled to her entire pension.

Table 2 presents the estimates from the parametric estimates used to estimate each scenario. They are explained in two different ways. On the one hand, the left

hand column presents the estimates of the coefficients in the model, with their respective standard deviations in parenthesis. On the other hand, the baseline hazard and hazard ratios corresponding to the different determinants of the pension formula are included in the right hand column<sup>3</sup>.

**Table 2** Results from Parametric Estimates

Covariate	Coefficients ( $\beta$ )	Hazard ratios
	Slope	
Baseline hazard	2.980172* (0.1459)	4.94e-04
Regulatory base (RB)	-0.00059** (0.0002)	0.9290
Effective retirement age (ERA)	-0.152349* (0.01499)	0.8587
Contribution spell (CS)	-0.040444* (0.00300)	0.9604
Reassessment	-0.016194* (0.00099)	0.2590
Constant	2.80545* (1.09993)	-
Std_u <sup>4</sup>	0.0018173	-
rho <sup>5</sup>	2.01e-06	-

**Note:** \* Significant at 1%; \*\* significant at 5%.

Source: Authors' estimates.

The hazard ratios account for the effect of the covariates in terms of the baseline hazard (the value of the hazard when all covariates are equal to zero). A covariate that does not change the baseline hazard at all presents a value of 1. This value would be higher than 1 for covariates that have a positive effect on the hazard and lower than 1 for covariates that have a negative effect.

<sup>3</sup> A time-varying framework implies that some covariates change during each period. As a result, the hazard ratios concerning such types of covariates change each time the time-varying covariate changes. For this reason, and to simplify interpretation, the reported results show the average hazard ratio for the whole period analyzed; that is, the average over the hazard ratios of the period, as in Expression (12), where  $\hat{hr}_j^q(t|Z_j(t))$  refers to the hazard ratio corresponding to covariate,  $q$ ,  $\hat{hr}_j^q(t|Z_j(t))$  refers to the hazard estimate value corresponding to the covariate,  $\hat{h}_j^b(t|Z_j(t))$  represents the baseline hazard estimate and  $T$  is the total number of periods studied.

$$\hat{hr}_j^q(t|Z_j(t)) = \frac{\sum_{t=0}^T \hat{h}_j^q(t|Z_j(t))}{T} \quad (13)$$

This time-varying framework is present through the entire study. However, the values are presented as averages only in Table 2 because the remainder of the research presents the dynamics explicitly and as functions (Figures 1 to 3).

<sup>4</sup> Standard deviation of the heterogeneity variance.

<sup>5</sup> Ratio of the heterogeneity variance to one plus the heterogeneity variance. When the hypothesis that rho is zero cannot be rejected, then frailty is unimportant.

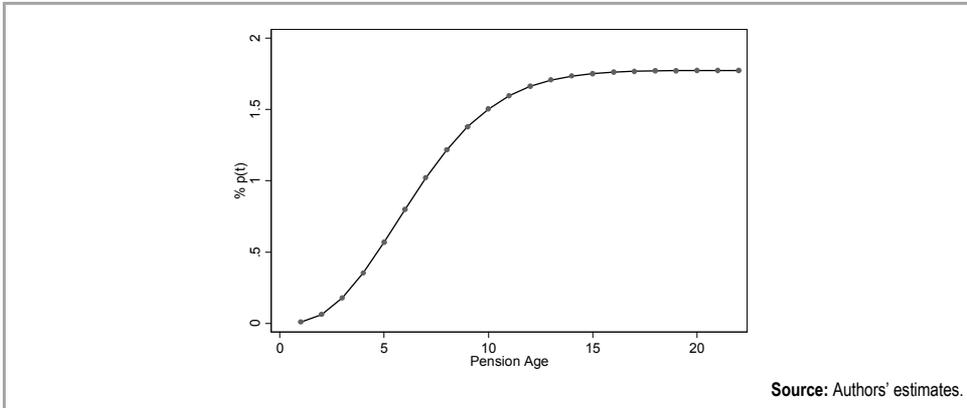
The positive value of the Pension Age coefficient indicates the existence of positive duration dependence for vulnerable population, which seems logical given the method used to actualize pension benefits in Spain. In a context of economic growth, in addition to adjusting workers' wages to current rates according to a given price index, changes in productivity are also included. Consequently, the speed at which the nation's average or median income grows will be faster than the speed at which pension benefits grow. Accordingly, although the welfare enjoyed by pensioners is kept constant in real terms, compared to the welfare enjoyed by workers (which grows in real terms), it will be relatively lower, as these positive duration dependences reveal. Consequently, estimates prove that, as expected, the method used to bring pensions up to date according to the CPI does not prevent the pensioner from entering poverty as the pension ages (as the number of years that the retiree draws the pension increase). This is in line with the results obtained by Peinado and Serrano (2011, 2012), and Peinado (forthcoming).

Regarding the effects of each of the covariates on the baseline hazard of entering poverty, all of the variables should be expected to be inversely related to the duration of the non-poverty situation. An increase in the regulatory base (RB), which ultimately translates to a higher pension benefit, should diminish the hazard. The same occurs with the variable of effective retirement age (ERA) given that pensioners who decide to retire before the legal retirement age (which is 65 in Spain) are penalized and are consequently entitled to a lower pension benefit. The variable contribution spell (CS) should also be inversely related to the hazard given that the pension benefit is higher for a greater number of years of contribution to the system (recall the coefficient applied to the regulatory base). Finally, variable reassessment, which contains the actualization component of the pension, should also be inversely related to the hazard of entering poverty because a higher quantity of reassessment leads to a higher benefit and, consequently, a lower likelihood of entering a poverty situation.

The results are as expected. A one-percent increase in the RB generates a 7 percent reduction of the hazard as indicated by the value 0.93 (recall that the effect is measured in terms of the baseline hazard and thus is compared to unity). A delay of one year of the ERA at which the pensioner is retired leads to a 14 percent decrease in the hazard. Regarding the CS, that is, the number of years the pensioner has been contributing to the system, one additional year of contribution diminishes the hazard by 4 percent, as indicated by the corresponding coefficient 0.96. The reassessment variable, which is a time-varying covariate, is the variable that most affects the hazard. A one percent increase in the reassessment generates a 74 percent reduction of the hazard.

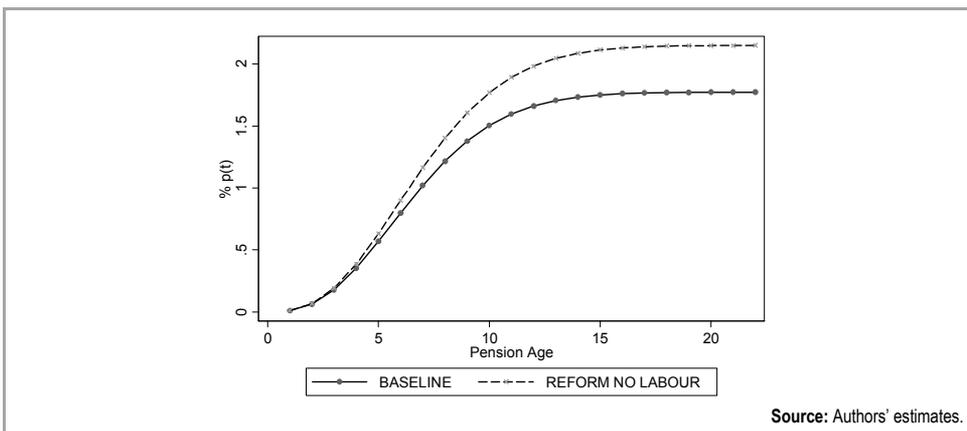
Figure 1 represents the evolution of the cumulative probability of being poor for the representative vulnerable pensioner in the baseline scenario. In the year she starts to draw a pension, the probability associated with being poor is almost equal to zero. The value of this probability increases as the pensioner gets older (the longer the pensioner is drawing the pension). According to this increase, the probability of being poor for the representative pensioner 5 years after she started to draw the pension is 0.6 per cent. After 10 years, it is 1.5 per cent, and after 15 years it is 1.8 per cent. The interesting feature of the evolution is that the probability increases over the

entire period, and consequently, we can conclude that regardless of the method followed by the system to bring pensions up to date (reassessment), the protection it provides is weaker the longer the pensioner is drawing the pension.



**Figure 1** Baseline: Poverty Dynamics of the Representative Vulnerable Pensioner

Figure 2 represents the dynamics of the cumulative probability of being poor for the representative vulnerable pensioner in the second scenario. The probability of being poor for the representative vulnerable pensioner increases for each period of time compared with the baseline case. The increase is almost zero at the beginning, and the probability for the pensioner who has been drawing the pension for 5 years is almost the same as in the baseline case (near 0.6 per cent). However, as the pension is drawn for more years, differences become greater. After ten years, the value increases from 1.5 to 1.8 per cent, and after 15 years the value increases from 1.8 to 2.1 per cent. This evolution implies an average increase of the cumulative probability of being poor of 16 per cent, as revealed by the value of the average effect of the reform *AER* (+16) in Table 3.



**Figure 2** Effect on Poverty Dynamics of the Reform without Labour

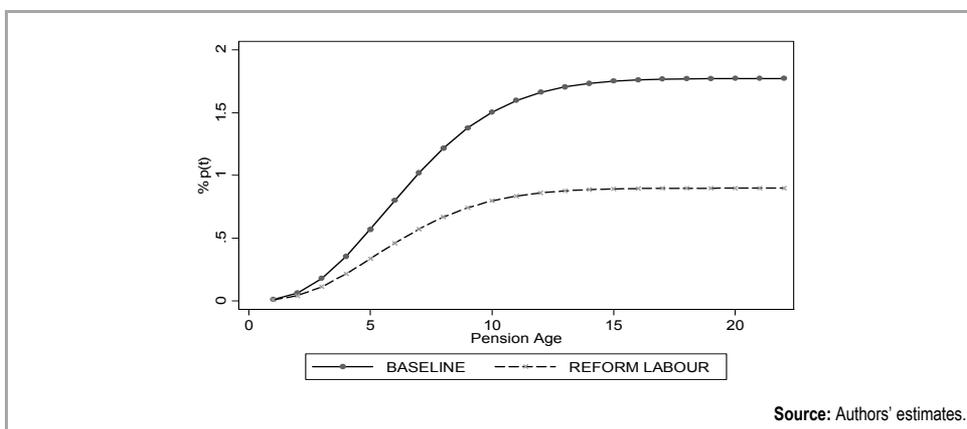
**Table 3** Results from Estimates (Average Effects of the Reforms (AER\*))

	Reform no labour	Reform labour
AER*	+ 16 %	- 45 %

Note: AER is defined in Expression (12) in the main text.

Source: Authors' estimates.

Figure 3 presents the dynamics of the cumulative probability of being poor for the representative vulnerable pensioner when the pensioner continues working. The probability of being poor for the representative vulnerable pensioner diminishes for each period of time in comparison to the baseline case. The probability of being poor for the representative vulnerable pensioner after 5 years diminishes, compared with the baseline case, from 0.6 to 0.3 per cent. The same occurs after ten years. In this case, the value diminishes from 1.5 to 0.8 per cent, and after 15 years from 1.8 to 0.9 per cent. This evolution implies an average diminution of the cumulative probability of being poor of 45 per cent, as revealed by the value of the average effect of the reform *AER* (-45) in Table 3.

**Figure 3** Effect on Poverty Dynamics of the Reform with Labour

The results obtained show that if individuals succeed in continuing to work in the labour market, their welfare will increase significantly. Consequently, this result is consistent with that obtained in other research built under the same restrictions (these works have been referenced in the Introduction). However, if the individuals are fired and do not continue working, as empirical evidence seems to support, then their welfare would significantly diminish. In this case, the results obtained show that the poverty rate among the most vulnerable elderly population would increase approximately 16 per cent with respect to the current situation.

In summary, for the poverty rate not to increase among the most vulnerable elderly population, the reform of pension systems should be implemented along with some other policy measures aimed to promote the hiring of elderly workers.

## 5. Conclusions

This paper has shown the dynamic effects that pension system reforms would have on the most vulnerable pensioners. The reforms studied are, on the one hand, the increase in the legal retirement age from 65 to 67 years. On the other hand, an increase in the number of years contributed is used to compute the pension.

The results obtained show an increase in the cumulative probability of being poor for this population group when the labour market does not give them the opportunity to maintain their job. If, on the contrary, individuals succeed in continuing in the labour market, this probability diminishes significantly.

## References

- Coile, Courtney, and Jonathan Gruber.** 2007. "Future Social Security Entitlements and the Retirement Decision." *The Review of Economics and Statistics*, 89(2): 234-246.
- Cox, David R.** 1972. "Regression Models and Life Tables (with Discussion)." *Journal of the Royal Statistical Society*, 34(2): 187-220.
- European Commission.** 2012a. *The 2012 Ageing Report. Economic and Budgetary Projections for the 27 EU Member States (2010-2060)*. Brussels: European Commission and the Economic Policy Committee.
- European Commission.** 2012b. *Pension Adequacy in the European Union 2010-2050*. Brussels: Directorate-General for Employment, Social Affairs and Inclusion of the European Commission and the Social Protection Committee.
- Gonand, Frédéric, and Florence Legros.** 2009. "Pension Reforms in France: Impact on Growth and Intergenerational Effects." *The Geneva Papers*, 34(4): 639-659.
- Jenkins, Stephen P.** 2009. "Introduction to the Analysis of Spell Duration Data." Unpublished.
- Kalbfleisch, John D., and Ross L. Prentice.** 1980. *The Statistical Analysis of Failure Time Data*. New York: Wiley.
- Kudrna, George, and Alan D. Wooldland.** 2011. "Implications of the 2009 Age Pension Reform in Australia: A Dynamic General Equilibrium Analysis." *The Economic Record*, 87(277): 183-201.
- Lancaster, Tony.** 1990. *The Econometric Analysis of Transition Data*. Cambridge: Cambridge University Press.
- Muñoz de Bustillo, Rafael, Pablo Esteve, Fernando De Pedraza, José Ignacio Antón, Jaime Frades, and Jose M. Zufiaur.** 2007. "La cuantía de las pensiones a medio plazo, sus efectos sobre el sistema de pensiones y el estudio de alternativas." Spanish Government FIPROS/2006/61.
- Nelson, Kenneth.** 2004. "Mechanisms of Poverty Alleviation: Anti-Poverty Effects of Non-Means-Tested and Means-Tested Benefits in Five Welfare States." *Journal of European Social Policy*, 14(4): 371-390.
- Peinado, Patricia, and Felipe Serrano.** 2011. "A Dynamic Analysis of the Effect of Social Security Reform on Spanish Widow Pensioners." *Panoeconomicus*, 5(Special Issue): 759-771.
- Peinado, Patricia, and Felipe Serrano.** 2012. "A Dynamic Analysis of the Effects on Pensioners' Welfare of Social Security Reforms." *Journal of Pension Economics and Finance*, 11(1): 71-87.
- Peinado, Patricia.** Forthcoming. "A Dynamic Gender Analysis of Spain's Pension Reforms." *Feminist Economics*.
- Van Vuuren, Daniel.** 2013. "Flexible Retirement." <http://onlinelibrary.wiley.com/journal/10.1111/%28ISSN%291467-6419/earlyview>.
- Wooldridge, Jeffrey M.** 2002. *Econometric Analysis of Cross Section and Panel Data*. Massachusetts: Massachusetts Institute of Technology.

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