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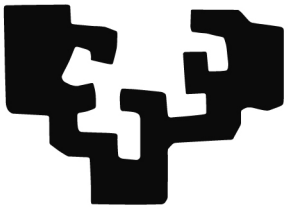

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PENSION SYSTEM'S REFORM IN SPAIN: A DYNAMIC ANALYSIS OF THE EFFECTS ON WELFARE

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P.Peinado

to my parents

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INTRODUCTION

The doctoral thesis presented in this work is twofold. On the one hand, it is proposed a methodology to estimate the effects that the current parametric reforms of the public pension systems may have on the well-being of the retired population. On the other hand, taking Spain as a case of study, it is tested the effect of some of these reforms. The reforms selected are the ones which have been so far announced by the government such as an increase in the retirement age, an increase in the number of years included for the computation of the regulatory base of the pension and an increase in the number of years of contributions which are necessary to have access to the whole pension benefit.

The methodology serves as a nexus for the three dissertations. It is a duration dynamic analysis. In the first dissertation, it has been estimated the effects on the well-being of the pensioners as a whole. In this dissertation two parametric reforms are tested: an increase in the retirement age and an increase in the number of years included for the computation of the regulatory base. In the second dissertation it has been estimated the effects on the welfare according to gender differences. In this dissertation, it has been tested, apart from the two reforms mentioned above, a third one: an increase in the number of years required to be entitled to the whole pension benefit. This second research is motivated by the existing gender differences in labour careers between men and women, which in the moment of retirement are finally reflected in the different benefit they received. Consequently, it turned out to be necessary to study the effects of the reforms taking into account these differences. In the third dissertation, it has been tested the effects that the reforms may have on the most important "derivated pension": widow's pensions. In this case it has been only estimated the effects that the increase in the number of years included for the computation of the regulatory base of the pensioners may have on the welfare of the corresponding pensioners. This third research has been limited by the lack of information, which has prevented from testing the rest of the reforms.

This work is subscribed in a research tendency which the economic science started to develop some decades ago: the economy of pensions systems. This work makes a contribution to a new type of research within this tendency: the study of the effects of the parametric reforms of public pension systems on the welfare of the next generations of retired people. As pointed out in the first of the dissertations this line is currently practically unexplored, even if it is of relevance for the design of the reforms.

The reasons for the delay of the development of this line of research until the present time has very much to do with the way in which initially the economic reflection on the reform of the pension systems was put forward.

1.- The reforms of pension systems

The neoclassical theory studied the problem according to the traditional instruments of the economic equilibrium, which were perfect information, instrumental rationality, optimization of the individual decisions and complete

markets. The aim was to demonstrate that public pension systems generated inefficient assignations, and as a consequence, the best solution would be to substitute them with private savings, both from the micro and macroeconomic perspective. The two topics that are the focus of attention of this first tendency of works regarding the economics of social security were, on the one hand, its effects on savings and, on the other hand, its effects on labour supply. The central argument was that public pension systems based on pay-as-you-go diminished the saving rate of the economy (compared to the one that would be obtained in a system based on individual savings) and, as a consequence, of the investment and economic growth rate (Feldstein, 1976). As far as labour supply is concerned, it was assumed that these systems had also a depressive effect (Feldstein, 1974). The lack of concluding empirical evidence contributed to debilitate this line of research, although its central arguments, however, still remain as a part of the literature within this subject, specially the one that studies the plus points of one system against the other.

On the other hand, as Feldstein (1997) pointed out, it was held that "systems based on capitalization could give any level of profits given a lower cost for the workers of an unfunded system" (p.3). This assertion stemmed from the simple comparison of the profitability rate provided by each system, that is a comparison which did not take financial risk into account. However, even when the problem of risk is omitted, Shiller (2006) showed that such statement had nothing to do with the empirical evidence when the historical series of profitability were taken. Even in this context, the belief that capitalization provides higher profitability continues to be an argument that has not abandoned the debate over the reform of the pension systems, even after the "havoc" caused by the current financial crisis on the capital accumulated by pension systems.

Considering the problem of an ageing population opened a new line of research focused on the study of the effects that such ageing process might have on the future financial sustainability of the public pension systems. During this second tendency of works regarding pensions, attention was paid to sharpen the estimation methods of the future unbalances of the system, at the same time as capitalization was presented as the natural antidote to the problems that the ageing process would have on the financial stability of systems. While these methods of estimation were being made more accurate academic and political debate was centred on the orientation of the reforms.

On the one hand, it was highlighted that the theoretical framework proposed by the neoclassical thinking to guide the reform towards the change of the system was not the most appropriate, given that the real world is characterized by imperfections that are not taken into account in equilibrium models[1]. Individuals are endowed with limited rationality and, what is more, they are confronted with a problem of uncertainty to estimate the future events that they need to know at the present time in

[1] In Barr and Diamond (2008) and Serrano and Ferreiro (2007) the terms of the theoretical discussion here referred to are mentioned.

order to adequate their decisions of saving and consumption[2]. As a consequence, optimization is not the best way to approach the study of families' consumption and saving decisions. On the other hand, it was recognized that markets, in the real world, are not complete, in such a way that, even accepting the optimization method, individuals were not provided with the necessary instruments to optimally realize their inter-temporal endowments.

On the other hand, the conviction that the ageing process is a phenomenon that affects both funded and unfunded systems. Pension systems, either unfunded or funded, are instruments to transfer income from working population to retired population. In unfunded pension systems the transference is made by means of social contributions whereas in funded pension systems the transference is more opaque. Retired population sells assets (decummulate) that are bought by working population. In a context of ageing, as a consequence, a lower share of population contributing (compared to the number of pensioners) is equivalent, in a funded system, to a lower number of people demanding financial or real assets[3]. As a consequence, income, and not population, is the variable which determines any pension system.

Obviously this last statement is only valid under the hypothesis of a closed economy, which is not opened to foreign transferences, in terms of immigrants or in terms of the income generated by foreign investment in assets. The debate, as a consequence, over the relationship between ageing and the optimal model of assurance against aging was not completely closed pointing out that both systems were equally affected by the demographic variable.

Then, the research on the positive immigration effects for the maintenance of public pension systems turned out to be a new line of research. This line of research, up to relatively recent days, has been concentrated on showing the conditions to be fulfilled so that the effect of immigration should be positive, that is to say, it has been a line characterized by a high bias towards theory. The canonical model for the effect of immigration on pension systems to be studied was established by Razin and Sadka (1999). In a dynamic model, in which immigrants are considered together with their descendants, and assuming that the arrival of immigrants has no negative effect on native workers' wages[4], they concluded that immigration did positively affect the pension system, immigrants did contribute more than what they received and, as a consequence, they helped compensate the effect of ageing on such system.

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[2] The behavioural economics literature has shown the problems generated by the existence of limited rationality in the field. For a survey about how the results drawn in this literature have been transferred to the legislation which regulates pension plans, see Tapia and Yermo (2007). For the relation between uncertainty and saving for reasons of retirement, see Ferreiro and Serrano (2010)

[3] In Brooks (2002); Geanakoplos *et al.(*2004); Takáts (2010) it is shown how population aging negatively affects profitability of finacial and real assets.

[4] This hypotesis has proved to be restrictive, that is to say, the effect of immigrant population on native workers´salaries is not significant (Borjas, 1999; Addison and Worswick, 2002; Angrist and Kugler, 2003; Zorlu and Hartog, 2005; Carrasco et al, 2008)

After the work by Razin and Sadka, it was still unknown whether the volume of immigrants that could arrive in developed countries (which in this moment are the most aged ones) would be sufficient to totally compensate the effect of ageing. Below, when talking about the case of Spain, it will be shown that the few simulations which have been implemented are not optimistic with regard to the problem.

Capital export, in a context of financial globalization and in a context where the theory of capital markets' efficiency dominates, appeared to be the main weapon to defend the benefits of the funded method against the unfunded method. This solution, however, was not exempt from risks. Capital export, as pointed out by Reisen (2000), could only be implemented, to escape from the problem of ageing, to emerging economies with high levels of growth, which increased financial risk, as was proven in the crisis in the southeast of Asia in the year 1997. On the other hand, there were also doubts about the solvency of the international financial system which the current crisis has dramatically shown up[5].

While these academic reflections were taking place the countries were implementing reforms in their pension systems which, to some extent, reflected some of the proposals that were coming up within such reflections. The vast majority of developed countries were adopting parametric-like reforms oriented to constrain the rhythm at which pension expenditure was expanding. These measures, additionally, were complemented by fiscal incentives of saving plans for retirement, given rise to multi-pillar assurance systems. In other developed countries (Australia, Denmark and Sweden) fiscal incentives were substituted by mandatory funded pension plans and, finally, in other countries, most of them in Latin America, but also in Asia such as the case of India, or in some counties in the East of Europe (Bulgaria, Estonia or Slovenia), the former public pension systems have been substituted by systems in which mandatory funded pension plans dominate.

It could be said that the current reflection regarding the reform of pension systems has entered a period of deeper calm, at least, from the perspective of economic research. Several elements have contributed to reach this calm. On the one hand, the results drawn from the research implemented during the past years have helped delimit in a more clear way the terms under which the reflection must be made, rejecting methodologies that raised the debate in excluding terms of one assurance system against the other. The results observed in the countries that had tackled radical reforms with more anticipation have also contributed to reach the calm. Research[6] on these results has shown some important flaws (high cost of management for private firms of assurance, drops in coverage rates or myopia in the

[5] In this regard, it is interesting to refer to the report of the BIS (1998) about the need to reinforce the performance of the present international financial system in order to tackle a thorough reform of pension systems, in order to give capitalism more prominence. For a first quantitative analysis of the effects of the financial crisis upon pension funds see Impavido and Tower (2009).

[6] Arenas and Lago (2006) present a good analysis of these results, in the case of Latin America.

selection of the portfolios), which has demanded new regulations, as well as the more or less explicit acknowledgement of the convenience of maintaining a multi-pillar system.

As a consequence, the beliefs at present could be summarized in the following terms. First of all, there is clear consciousness of the fact that the ageing process of population implies a risk for the future of pension systems. Even admitting that the variable determining such future, as was previously pointed out, is the income evolution, with the information available at present it seems reasonable to assume that this evolution will not be sufficient to compensate the effect that ageing may have on future expenditure on pensions. The necessity to implement reforms, as a consequence, turns out to be an obligation for public powers.

Secondly, there is also a growing awareness of the reforms that are to fulfil the different objectives. On the one hand, they have to clearly contribute to the attainment of future financial stability of the system. But, additionally, they have to take into account the well-being of the future cohorts of retired people. Public pension systems have appeared to be a powerful instrument to reduce poverty among aged population and this is an aspect we should not renounce. As a consequence, the parametric reforms must try to simultaneously satisfy these two objectives.

Of course, there are already differences in many other aspects. As an example, and making reference to the debate that is taking place in Spain, it could be said that there is not a unanimous agreement on whether the reforms must just affect the expenditure, avoiding reforms in the sources of income. There are also differences regarding the best way to check the growing tendency of expenditure on pensions (the way in which labour career is calculated and enlargement of the retirement age). The role of private forms of assurance is not clearly defined, either. Must individual savings be voluntary or compulsory? In a context of compulsory saving, must it be financed by means of an increase in contributions or, on the contrary, by means of the deviation toward private funds of part of the current contributions? Even the model is subject to critic. Should the Spanish model advance towards "notional" accounts as in the case of Sweden, that is, with automatic adjustments to guarantee the financial equilibrium, or should it be approached as in the case of Italy, that is, with "notional" accounts with no automatic adjustment?

The most probable thing to happen is that these queries will remain for the next years, and the reform that the government has committed to tackling without delay is likely to be complemented with later reforms. Pension systems are institutions that must be adapted to social changes to meet social demands adequately. While these changes still take place, the reforms of such systems will continue to exist.

As a consequence, this work may be situated in a cycle of the research where, for the first time since the debate of the reforms of the pension systems started, it is considered relevant to know its effects, not only in terms of the aggregate, in this case the financial equilibrium, but also in microeconomic terms, that is, how they could affect the future well-being of retired population. The knowledge of the costs

in terms of welfare combined with the necessities demanded by financial equilibrium may, additionally, help to answer some of the questions above mentioned.

Throughout the rest of the introduction it will be provided, on the one hand, the fundamental data to support the hypothesis that the reform is necessary. It will be shown what is understood by the term "parametric reforms" starting from the reforms that are being developed in the countries of the EU and, finally, it will be presented the methodology proposed to analyse the impact of the future cohort of retired population on the welfare.

2.- The challenge of ageing

According to the European commission Ageing Report (2009) "*Demographic change is transforming the European Union: Longer lives, low fertility and inward immigration are its key aspects. The extent and speed of population ageing depend on future trends in these three factors."*

The European Union's life expectancy at birth, that is the length of time that individuals are supposed to live when they are born, is predicted to increase from 76 years in 2008 to 84.5 in 2060 for men and from 82.1 years in 2008 to 89 in 2060 for women. As a consequence, men are predicted to live 8.5 years more while women are predicted to live 6.9 years more than at present. As a result, the number of people aged 65 or more is predicted to increase in the future, that is to say, the number of retired people (defined as those aged 65 or more years old) would increase in the future as a consequence of the increase in life expectancy.

In order to face the challenge of softening the impact of aging, fertility rates for the EU (the average number of births per woman over her lifetime) are assumed to increase from 1.52 births in 2008 to 1.57 by 2030 and 1.64 by 2060. However, in all countries the fertility rate would remain below the natural replacement rate, which is estimated to be 2.1 births per woman. As a result, population growth is likely to be slow and, consequently, native working-age population is predicted to decline in most cases. The diminution of working-age population leads to a diminution of pay-roll taxes or contributions to pension systems, which, especially for pay-as-you-go social security systems creates (*ceteris paribus*) a new challenge to be faced: the funding of the protected elderly.

The development of migration inflows has become a determining factor in population growth. For many Member States it is net migration that determines whether the population still grows or has entered a stage of decline. In absolute terms, annual net inflows to the EU are assumed to be 59 million people. The trend is expected to decelerate from 1,680,000 people in 2008 to 980.000 by 2020 and 800,000 people by 2060. Regarding the location of net migration flows, they are assumed to be concentrated in a few destination countries such as Italy, Spain, Germany and UK. The phenomena of net migration may, depending on the age and

economic status of the gained population, act as a solution for the needed contributions to be complemented.

The increase in elderly people together with the trend in fertility rates and net migration inflows would generate a final increase in the population of the EU, which as a whole would be slightly larger in 2060 than today, but *much older*. The number of elderly people aged 65 or above in 2008, is still higher than children below 15, although it remains very close to the latter. As time passes by, elderly population is likely to represent more than twice the number of children in the EU by 2060. As a consequence, elderly people would account for an increasing share of the population while the projections show that working-age population (aged between 15 and 64) would drop for every member states but for 7 (Belgium, Ireland, France, Cyprus, Luxemburg, Sweden and UK) where migration and fertility would absorb the trend.

Projection shows that the number of elderly people will almost double, rising from 85 million in 2008 to 151 million in 2060. What is more, the oldest-old (80 years and above) is projected to increase even more rapidly from 22 million in 2008 to 61 million inn 2060. As a result, the old-dependency ratio (ratio of people aged 65 or above relative to the working-age population aged 15-64), is predicted to more than double in the period. In other words, the EU would move from having 4 people on working-age for every person aged 65 or above at a ratio of 2 to 1[7].

As far as effective old-age dependency ratio is concerned, that is, the ratio of elderly non-workers to workers, it is projected to rise sharply from 37% in 2007 to 72% in 2060. The implication of this result is that Europe would move from having a ratio of nearly 4 elderly non-workers to 10 workers at a ratio of more than 7 to 10.

As may be derived from the data above, especially from the results regarding dependency ratios, European Union members are predicted to withstand an increasing expenditure on ageing-related concepts.

Within the European Union member states, the case of Spain is of relative importance concerning the challenge of ageing, since it is predicted to shelter one of the oldest populations in the world. According to the projections, in Spain, the number of people at working age (15 to 64) would decrease from 30.6 million in 2007 to 28.4 in 2060, while the number of elderly people (65 and above) would increase from 7.4 million in 2007 to 16.8 million. As a consequence, the dependency ratio in Spain would increase from 24.20% in 2007 to 59.07% in 2060. This means that Spain would fall from having more than 4 people on working-age for each person aged 65 or above to a ratio of less than 2 to 1 (MTI, 2008; EU, 2010).
In sum, greater life expectancy, higher fertility rates and net positive migration inflows predict a slight increase in the population in the European Union, although this population is projected to be older than at present. As a member state, this would

[7] Including the number of children in the calculation, the ratio of dependent to active is projected to rise by nearly 30 percentage points.

also happen in the case studied in this work: Spain, which is expected to challenge one of the oldest populations all over the world.

As a consequence of population ageing, the necessity for the public sector to provide transferences and services related to the aged is predicted to increase. According to EU (2009) "public expenditure in the EU due to population ageing is estimated to increase, on average, 4.75 GDP percentage points from 2008 to 2060. There are several differences in this increasing expenditure among the Member States. The increase in the expenditure is said to be very significant (equal or higher than 7 percentage points) for those 9 States which so far have made limited progress in reforming their pension systems or are experiencing their maturing process (Luxembourg, Greece, Slovenia, Cyprus, Malta, Romania, Spain, the Netherlands and Ireland). The costs of ageing will be lower (4 to 7 percentage points) for those countries which have taken significant steps in reforming public expenditure systems. These are Belgium, Finland, the Czech Republic, Lithuania, Slovakia, the UK, Germany and Hungary. Finally, the group of countries which have implemented substantial pension reforms is estimated to experience the lowest costs of ageing (equal or lower than 4 percentage points): Bulgaria, Sweden, Portugal, Austria, France, Denmark, Italy, Latvia, Estonia and Poland.
In the case of Spain, according to the Spanish Government (MTI, 2008), the contributions to the social security system would increase from 103,725.12 million euros in 2007 to 784,907.15 in 2060. This variation implies a diminution of the contributions with respect to the GDP, which would vary from 9.87 in 2007 to 9.74 in 2060. Simultaneously, the expenditure on contributory pensions would increase from 100,130.55 in 2010 to 1,137,201.06 in 2060. In relative terms to the GDP, this expenditure would almost double, rising from 8.34% of the GDP in 2010 to 14.11% in 2060.

As may be drawn from the data above, for the year 2060 the system would undergo a deficit given that the expenditure on pensions would be higher than the predicted contributions to the systems. According to the same report, it is in 2030 when system's contributions are, for the first time, lower than the expected expenditure. Concretely, the contributions to the system would be equal to 303,658.61 million euros while the expenditure in contributory pensions would represent 322,177.26 millions of Euros. As a result, the system would have entered a situation of financial unbalance between the 2020's (last year in which the surplus is shown in the list) and 2030's (next year listed). Similar conclusions had been recently shown by other researchers (De la Fuente and Doménech, 2009; Herce *et al.*, 2009).

On the other hand, migration is not the solution. According to the last research developed in Spain, migration inflows would delay the break out of the imbalance but would not avoid its appearance. In González, Conde-Ruiz and Boldrin (2009), for example, it is pointed out that the unsustainability of the system in the long run cannot be avoided by means of migration inflows, although the existence of immigrant population has allowed Spain to delay in five years its falling into deficit. A similar conclusion is drawn in Jiménez-Ridruejo *et al*. (2008) where it is estimated that in the absence of immigrants, the system would fall into a situation of deficit in

2015 whereas migration inflows allow the deficit to take place in 2020, five years later. Finally, the estimates in Serrano *et al.* (2011) allow concluding that, if the necessary reforms are not taken, immigration will not solve the future sustainability of the pension system, which would enter deficit around 2030's.

As a consequence of these data and research, it may be concluded that, if there are no reforms, pension systems are not likely to be able to withstand the increasing expenditure generated by an ageing population. As a result, the future provision of the goods and services needed by the increasing elderly people depends on the application of policy reforms, especially in the case of pay-as-you-go social security systems.

3.- The parametric reforms

European governments, driven by the challenge of an ageing population, started a series of reforms regarding pension systems design and labour market regulation. The measures regarding the design of pension systems, which are the centre of attention of this work, may be classified in four different categories according to EU (2010).
The first line of reforms is related to the *contribution period* taken into account to calculate the pension benefit contributors are entitled to. In the 1980's the earnings-related public pension systems in Europe tended to base their benefit calculations on earnings from five to twenty years of working careers. Several countries decided to extend these periods, that is, the periods of individual's earnings history used for calculating the pension entitlement in statutory pension schemes.

The second line of reforms consists of increasing the age at which the worker is entitled to the pension, this is the *retirement* or pensionable age. Some of the countries where pensionable age was different for men and women have decided to equalise retirement ages for both genders by 2020's. This is the case of Greece, Austria, Czech Republic, Slovakia, Romania, Estonia and United Kingdom. Complementarily, other countries such as Germany, Ireland, Lithuania, Hungary, Malta, Netherlands or United Kingdom, have decided to increase the retirement age after the 2020's. Finally, there are some Member States, among them, Bulgaria, Portugal or Luxembourg, which still have not developed any reform in this direction.

A third line of reforms consists of establishing *automatic adjustments* or periodic review mechanisms that imply a sharing of the financial costs of demographic changes between generations. Some countries have linked life expectancy to pension eligibility (Denmark,France,Italy) or replacement rates (Bulgary, Estonia, Latvia, Lithuania, Hungary, Romania, Sweden, Italy, Poland, Germany, Portugal, Finland). Other countries have linked economic performance in terms of GDP growth with indexation of benefits (Hungary, Portugal) or labour market performance with valorisation of entitlements (Italy, Latvia, Poland, Sweden). In other cases, the link has been between the balance of the system to valorisation of entitlements (Sweden)

or indexation of benefits (Germany, Sweden, Netherlands). Finally, in the case of Germany, contribution rates have been linked to indexation of benefits.

The last line of reforms worth mentioning so as to face the challenge of ageing population is *greater pre-funding*. This policy has been implemented by introducing new defined-contribution (DC) schemes, by expanding the existing occupational schemes, by setting up of pension reserve funds or, by paying down of national debt.

Spanish framework is that of pay-as-you-go social security system. As a result, pensions are based on the working-earnings of the subjects and the pensions of each generation are funded by means of the contributions of the generations of workers at that particular time. Additionally, as it has been pointed out, Spain is predicted to represent one of the oldest economies in the world in the near future.

The reforms in Spain respond to the first two lines of reforms above mentioned, which are being implemented in the whole European Union. The reform[8] of the pension system in Spain in the year 2002 (law 35/2002) abolished mandatory retirement age (65) in the private sector. People who decided to retire later would obtain a 2% premium on the pension benefit for each additional year. Early retirement was possible from the age of 61 with a penalty from 6% to 8% per year depending on the number of years of contribution (at least 40 or 30, respectively). At the same time, pensions became compatible with part-time work although the benefit was reduced according to the length of the working day.

In 2007 a new law on Social Security measures was enacted. The main measures contained were the increase in the effective contribution period to be eligible for a retirement pension, the partial retirement from age 61 instead of 60 for people entering the system after 1967 with a minimum of 30 years of contribution, incentives for people working after age 65 and more restrictive rules to get an invalidity pension.

Additionally, while the present introduction was being written, the government announced new terms of reform, although in this case, they did not specify the measures that would be implemented. So far, the information that has leaked out is on the two reform announcements previously cited of the extension of the retirement age with or without the extension of the contribution spell and the increase in the number of years included to compute the regulatory base. The three researches that build up the present dissertation are centred on these effects.

4.- Scope of the research and methodology

As said before, the thesis that will be presented in the following part, aims to study the effects of the reforms on the well-being of retired population.

[8] See Carone and Eckefeldt (2009) for the "2009 Ageing Report" European Union.

Pension systems, and particularly, social security systems, have proven to be powerful instruments to alleviate poverty among elderly people (Dang *et al.,* 2006; Engelhardt and Grubert, 2004; Nelson, 2004; Sainsbury and Morissens, 2002). However, despite the existence of social protection systems, poverty risk remains high for this population group (Dang *et al.,* 2006; Sùcur, 2005; Sainsbury and Morissens, 2002), especially for women who are beneficiaries of a widow's pension (Angel, J.L. *et al.,* 2007, Karamcheva and Munell, 2007, Dang, Immervoll, Mantovani, Orsini and Sutherland, 2006; Whitman and Purcell, 2004; Burkhauser and Smeeding, 1994; Burkhauser, Butler and Holden, 1991, Boskin and Shoven, 1986).

Poverty, however, is a concept that comprises a wide range of shades of meaning. The concept of poverty, thus, depends on what is to be studied and, as a consequence, the responsibility behind the definition of poverty lies on the research group conducting the study. From an economic perspective, poverty has been graded according to the income or wealth of the subjects, or alternatively, according to the number of specific goods enjoyed by the population under study (the phenomena of deprivation). In both cases, there is a threshold defined that establishes the line below which people are classified as poor.

Among the concepts of poverty, there is one that should be highlighted in this work: monetary poverty. It is said that a person is poor in monetary terms when the wealth he or she owes falls below the poverty threshold selected. In the case of the European Union, the poverty threshold more widely accepted that could be regarded as the "standard" is defined as 60 per cent of the mean equivalised income.

Household or individual wealth, however, comprises more elements than the income inflow received. For example, the income provided by the pension system is not the only source of wealth for the individuals in the household. There are also financial and real assets as well as other income sources that complement social security pensions and, as a consequence, must be taken into account to clearly identify the monetary poverty of elderly people. As a matter of fact, in Spain, the average pension in the year 2005 for the retirees of the general scheme was equal to 12,157 euros, while, according to the Spanish Survey of Household Finances (EFF) 2005, for the households comprising one non-working and retired individual older than 64, the average income was 19,707.47 Euros. That is, the pension benefit represents 64 per cent of the total income of retired people. Additionally, 80.6 per cent of the pensioners own a household. The household represents 73 per cent of the real assets (57 per cent of the total assets) for this population group. As this data proves, a research aimed to analyze the implications of the reforms on the poverty situation of elderly people should also consider, apart from the retirement income provided by the system, other factors such as the additional sources of wealth enjoyed by the population group studied.

The scope of this study, far from being a deep analysis of poverty phenomena, is useful to understand the effects of the different reforms proposed by the government on the welfare of retired population. As it will be noticed as this work is developed,

the poverty line is used as an instrument to classify the population and, finally, to evaluate the welfare consequences of the different policies. That is, the work, far from being a study of poverty, uses poverty threshold as a mean to identify the welfare enjoyed by retired population. This is in line with the argument in Cellini, McKernan and Ratcliffe (2008) who point out that one of the interesting points of using official poverty lines, is to measure the economic well-being of the population under study.

As a consequence of all this, in this research the welfare enjoyed by a pensioner is identified with the situation in which he/she is not poor. Poverty is particularly defined according to the standard criterion proposed by the European Union, that is to say, 60% of the mean equivalised income for households comprising one single person. This data, however, was only available in the statistics web page of the European Union (EUROSTAT) until the year 1995. As a result, for the period analysed up to 1995 the poverty line is defined as 60 per cent of the Mean Equivalised Income estimated in a research by Prieto and García (2007).

To sum up, it is said that social security system ensures a positive individual welfare as long as it provides an income flow (pension) which allows different individuals to keep their standards above the level of the poverty threshold.

The research may be classified in three different works. The first work aims to analyse the effects on pensioners' welfare of the social security reforms. The question that is answered in this research is: i) how much will the reform proposal affect the welfare enjoyed by pensioners if the measures are immediately implemented?; and ii) what would happen if the reforms are delayed?

The second work implements an alternative analysis to account for the gender dimension of the effect that social security reforms would have on pensioners. The questions in this case are: i) do gender differences exist in the current social security system?; ii) do the reforms increase or decrease these differences, and how much?

Finally, the last work treats the problem for the beneficiaries of a widow's pension. On this occasion the questions that are answered are: i) how much will the welfare level of widow's pensioners be affected by the diminution of the initial pension benefit of the pensioners that caused the widow's pension?; ii) how much should the benefit they receive increase to let such level of welfare remain the same?
The literature on the effects of social security reforms includes studies based on general equilibrium models which simulate the conditions under which the financial balance of the system is guaranteed and the effects on pensioners' welfare are quantified mainly through simulation techniques. Butrica et al. (2006) reveal, taking United States as a case study, that working life extension would be the most suitable reform, since it would increase the welfare of population at older ages, measured in terms of annual consumption increase. Lachance (2008) uses a life-cycle model to state that this welfare improvement could be lower than estimated if we take into account the cost caused by working life extension, in terms of less leisure. Gonand and Legros (2009) use a dynamic general equilibrium model in which they present

different simulations with different combinations of parametric reforms, oriented to balance the pension system in France. In the first scenario, the replacement rate is kept constant and the effective retirement age is delayed. The conclusion is that welfare, measured as a variation of poverty rates, would not be affected. In the second scenario, where retirement age is constant and the computed years for pension calculation are raised, which is equivalent to a reduction in the replacement rate, poverty rate among this population group increases considerably. Other researches, (Sutherland et al. 2008; Pfau, 2006) use the poverty rate to show the effects different indexes of pension updating have on welfare of retired population.

As regards the effect of the pension system's reforms on the gender differences, there are two researches to be mentioned. On the one hand, James, Cox and Wong (2003), who analyse the effects of the multi-pillar pension reforms for Chile, Argentina and Mexico, conclude that the targeting of public pillars towards the low earners and of regulations over payouts from the private pillar have redistributed and improved gender ratios. As a consequence, they point out that women have gained more than men from the reforms. On the other hand, Bonnet, Buffeteau and Godefroy (2006) implement an analysis for French private-sector pensions. The research concludes that pension reforms in France are tending to slow down the narrowing of the pension gender gap. They observe that the most negative effects of the reforms are linked to the increase in the number of years used to calculate the reference wage and the fact that some women are bringing forward their retirement age when fewer financial penalties are incurred.

This work uses duration analysis as a mean to estimate the effects that the different variables defining the pension have on the welfare and gender differences of pensioners.

Pensions in Spain are related to the working life of individuals. The benefit received is the result of applying a coefficient related to the number of years contributed by each pensioner to the personal *regulatory base*. The regulatory base is obtained in accordance to expression (10). TAE_i refers to the Taxable Average Earnings of 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:

$$RB = \frac{\sum_{i=1}^{24} TAE_i + \sum_{i=25}^{180} TAE_i \frac{CPI_{25}}{CPI_i}}{210} \tag{1}$$

The coefficient varies between 0.5 and 1 depending on the years the pensioner has contributed to the social security system (*contribution spell*). The minimum value (0.5) is applied to the people with a 15-year record. This coefficient rises until it reaches its maximum for those who have contributed for 35 years. Additionally, with the ultimate goal of maintaining the purchasing power provided by the initial pension, every year pensions are brought up-to-date according to the evolution of the Consumer Price Index (CPI). This actualization is known as the *reassessment* of the pension.

The legal retirement age in Spain is 65. However, the legislation permits population to retire from the age of 61. For each year between 61 and 65, though, people who opt to retire are penalized with a yearly reduction of 8% above the pension which would correspond to them. The law also permits extending the working age above the legal retirement age for those people who have not been contributing for 35 years when they reach 65. In any case, the limit age for this time extension is 70. As a consequence of this legislation, the effective retirement age varies between 61 and 70 inclusive, though the average effective retirement age in the Spanish system is 64.

In the case of widows and widowers, the benefit drawn is composed of the effective pension and the reassessment. The effective pension is the result of applying a coefficient equal to η_t to the *Regulatory Base* (the one corresponding to the retiree who caused the widow's pension). The *Reassessment* variable contains the amount of the pension arising as a result of the indexing of the pension to variations in the Consumer Price Index (CPI) since the date on which the pensioner who causes the widow's pension entered the system.

$$WidowPension_{it} = \eta_t \,\mathrm{Re}\, gulatoryBase_i + \mathrm{Re}\, assesment_{it} \qquad (2)$$

The widow's pension received at the moment *t* by the individual *i* is consequently the result of adding the amount of annual *Reassessment* to the effective pension.
Pension components in each research are used to estimate the effect of the different reforms on the welfare dynamics of the retired population. The duration analysis used along the whole research allows not only identifying the dynamics of welfare, but also defining a welfare path for any pensioner who enters the system. This estimate speaks about the evolution of welfare from the first year the pension is entitled until the end of the period analyzed, that is, the welfare dynamics of the pensioner is identified as pension becomes older, what we call the "ageing process of the pension".

The ageing process of the pension is of particular relevance depending on the method used to bring pensions up-to-date. In a context in which pensions are not brought up to date according to the evolution of productivity in the economy but according to the evolution of the consumer price index, as is the case of Spain, pensions are doomed to suffer from an ageing process, providing an income that, may guarantee the initial budget of goods and services the initial pension did but eventually will leave beneficiaries in a disadvantaged position with respect to the economically growing society in which they are living.

As a consequence, it turns out to be of particular interest to implement this technique which, on the one hand, identifies the importance of such an ageing process and, on the other hand, allows quantifying the dynamic effects of these reforms since the moment in which pensioners are entitled to the benefit.

The technique developed in this research may be classified in two types of duration analysis. The first one, which is known as non-parametric analysis, estimates the evolution of welfare in overall terms. The aim of this estimate is to draw the general framework of the phenomena under study. These estimates are closer to what is called descriptive statistics or estimates since they do not provide information about the causal relationship between, in this case, the welfare dynamics and its determinants.

This work presents non-parametric estimates by means of two different functions, which for large samples are proved to lead to equivalent results: the cumulative hazard function from the estimates of the Kaplan Meier survivor function (third research) and the Nelson-Aalen cumulative hazard function (first part of the first research). While Nelson-Aalen cumulative hazard function is estimated as usual, the Kaplan Meier survivor function is used in the third research as a mean to simulate what would be the welfare level of the population under study if the variables determining the function happen to change. That is, the traditional analysis is complemented with simulation techniques that do not allow identifying a causal relationship between the welfare function and the variables behind but allow quantifying the effects of a given change on one of those determinant variables.

Nelson Aalen cumulative hazard function measures the total amount of risk that has been accumulated up to time *t*. The estimator proposed by Nelson and Aalen can be described as in expression (3). Where n_j is the number at risk at time t_j, d_j is the number of failures at time t_j, and the sum is over all distinct failure times less than or equal to *t*.

$$\widehat{H}(t) = \sum_{j|t_j \le t} \frac{d_j}{n_j} \tag{3}$$

While Kaplan Meier survivor function is defined as in expression 4

$$\hat{S}(a_m) = \prod_{r=1}^{m} \left[\frac{(N_r - E_r)}{N_r} \right] \tag{4}$$

$$m = 1,...,M$$

where $\hat{S}(a_m)$ is the estimates of the probability of being enjoying a positive welfare in the moment *m*, N_r is the number of individuals who remain in the sample in the moment *r* (because they have not been censored or because they have not entered a welfare loss situation) and E_r is the number of people who precisely in the moment *r*

fall into a situation of welfare loss, where M represents the number of periods analyzed.

The second type of estimates is known as parametric analysis. Parametric duration analysis allows not only quantifying the welfare evolution but also estimating these welfare dynamics conditioned on the different variables that are major determinants for such evolution, and, as a consequence, estimating the effects of a change in any of them on such welfare dynamics. The methodology presented here, for the reasons exposed in each specific work, implements, as in expression 5, a complementary log-logistic maximum likelihood estimate of the hazard as proposed by Jenkins (2009)

$$h[t;X(t)] = 1 - \exp[-\exp(z(t))]$$
$$z(t) = D(t) + \beta' X(t) + u \tag{5}$$

Where *h[t;X(t)]* is the hazard function, *D(t)* represents the baseline hazard function as the logarithm of time, *X(t)* is a matrix which includes the covariates; that is, the determinants of the durability of pensioners' welfare ("regulatory base", "contribution spell", "effective retirement age", and "reassessment" of the pension) plus an intercept. Finally, *u* is the error term.

From these estimates, the cumulative hazard functions are calculated. Cumulative hazard function measures the total amount of risk that has been accumulated up to time *t*. These last estimates are used in the second part of the first research to quantify the effect that each policy reform would imply in terms of welfare.

Since welfare is defined in terms of poverty, the effect of each possible reform is said to cause a welfare gain when the cumulative hazard function of such policy evolves below the cumulative hazard function currently existing in the system. Alternatively, when the cumulative hazard function of the policy evolves below the currently existing cumulative hazard function it is said that such policy brings about a welfare gain for the pensioners protected. The results are offered in terms of the percentage change on the cumulative hazard function caused by each policy reform with respect to the cumulative hazard function existing at present. The dynamics allow representing this change for the whole period analyzed since the moment the pensioner enters the system. As a consequence, for the results to be interpreted the average value of the whole dynamics is also computed.

The estimates of the cumulative hazard function are also used in the second research. In this case, the function serves as an instrument to identify the dynamics of gender differences between male pensioners and female pensioners, as well as to quantify the effect on such gender differences that each policy reform proposed by the government may cause as time passes by. In order to estimate the effects of these gender differences and policy reform, two new concepts are defined: the "gender welfare gap" and the "gender policy effect". The Gender Welfare Gap is defined as

the difference between welfare enjoyed by men and that enjoyed by women for each period analyzed. As explained above, the welfare is defined by means of the cumulative hazard function and, as a consequence, the difference between the cumulative hazard function for men and the cumulative hazard function for women allows finally estimating the defined Gender Welfare Gap[9].

Let $j=m$ denote the gender group formed by all the male pensioners and $j=w$ the gender group formed by all female pensioners (women). Then the Gender Welfare Gap (GWG) is defined as the gender difference of the value of the survival function, that is, the gender difference registered in each period t of the conditional probability of enjoying a positive welfare given that until that moment a welfare loss had not been experienced, so

$$\begin{aligned} GWG\left(t\middle|Z_w(t),Z_m(t)\right) &= -\left(S_w\left(t\middle|Z_w(t)\right)-S_m\left(t\middle|Z_m(t)\right)\right)= \\ &= -\left(P_m\left(t\middle|Z_m(t)\right)-P_w\left(t\middle|Z_w(t)\right)\right) \end{aligned} \tag{6}$$

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

As a result, the Gender Welfare Gap quantifies, for a given value of the variables determining the pension, the existing gender differences between men pensioners and women pensioners for each possible age of the pension. As a consequence, the whole path of gender differences is drawn so that it is possible to estimate the whole dynamics of pensioners' gender differences.

The Gender Policy Effect stems from the difference between the Gender Welfare Gap corresponding to each policy reform and the currently existing Gender Welfare Gap, that is to say, the difference between the Gender Welfare Gap estimated under the reforms' assumptions and the Gender Welfare Gap estimated for the current pensioners.

Let $GWG^c\left(t\middle|Z_w(t),Z_m(t)\right)$ denote the value of the GWG at the present time (current GWG) and $GWG^k\left(t\middle|Z_w(t),Z_m(t)\right)$ the value of the gap when a policy reform k is implemented, then the Gender Policy Effect (GPE) of policy reform k is defined as

$$\begin{aligned} GPE^k\left(t\middle|Z_w(t),Z_m(t)\right) &= GWG^k\left((t\middle|Z_w(t),Z_m(t))\right)- \\ &- GWG^c\left((t\middle|Z_w(t),Z_m(t))\right) \end{aligned} \tag{7}$$

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

As a result, each policy reform implemented leads to a different Gender Policy Effect, which describes the effect that the policy reform analyzed implies along the

[9] For further details see second research.

whole ageing process of the pension. In this last case, as a mean to better interpret the results from the research, reference is also made, not only to the change in magnitude caused by each policy reform but also to the percentage change generated by such reform with respect to the currently existing gender differences.

5.-Data

The researches have been implemented using the data from the Continuous Survey of Labour Careers (Muestra Continua de Vidas Laborales, MCVL) drawn up each year by the Spanish Ministry of Immigration and Social Security. This sample, which has been taken each year since 2004, provides information about the working life of 1,170,000 pensioners and employed workers within the Spanish social security system.

Spanish social security system comprises different schemes. On the one hand, the General Social Security Scheme to which salaried workers as a whole are affiliated accounts for 71% of the total number of affiliated. On the other hand, there is a Special self-employed Workers' Scheme to which those persons who are self-employed are affiliated. This scheme accounts for 15% of the total number of affiliated. Additionally, there are some minor schemes which account for the rest of affiliated workers. These are fishing-workers, miner-workers, house-workers and agrarian-workers.

Given the aim of the study, which is to account for overall welfare effects, and given the structure of social security schemes, the study here implemented is focused exclusively on pensioners that form part of the biggest scheme, that is, the General Social Security Scheme.

Continues Survey of Labour Careers (MCVL) enables two analyses to be carried out from a methodological perspective. On the one hand, and by comparing the results obtained in each of the reference years, it is possible to have a global overview of the evolution of the system in its different components. On the other hand, the data it provides for each year reflects a panel for each pensioner that appears in the sample of that year, as we have records at our disposal about the nature of their relationship with Social Security since 1996.

The three analyses have been implemented using the information of the year 2007 for those we defined as "standard pensioner", that is, the pensioners who draw a single pension and do not draw any mean-tested complement.

To capture the time dimension of the pension evolution, data has been expanded according to the pension formula used by the Spanish Social Security System (brought up to date according to the evolution of the corresponding Consumer Price Index) up to the year in which the pension was recognized, which is the year the pensioner entered the system.

The method to fill-up all the path of benefits for each pensioner in the sample has been followed in each different research. The researches which account for the effects on welfare of the reforms for pensioners in general and for the gender effects of such reforms have been implemented using the same data. While in the first case all the pensioners are analysed together, in the second one they are separated according to gender so that gender differences are observed. The last research is done for widows and widowers. In this case, the technique of expanding the data for each time the components behind (regulatory base) change allows simulating the path of benefits that the pensioners would have had in such circumstances.

The data on Consumer Price Index was available from the year 1986. Additionally, we had information on the year in which each pensioner entered the system. As a consequence, we have finally worked with unbalanced, right-censored panels which cover the period 1986 to 2007. Each pensioner enters the panel the year the corresponding pension is recognized and continues until the end of the period, 2007.

After debugging the data base the total amount of individuals included is 40,842 in the first and second study, out of which 5,620 are women. The last study comprises 29,713 widows and widowers.

6.- The research: a brief

The research developed may be classified in three different works. The first work **"A dynamic analysis of the effect on pensioners' welfare of social security reforms"**, which has been accepted for publication in the Cambridge Journal of Pension Economics and Finance, analyzes the dynamic effects of the different parametric reforms oriented to reach the financial balance of public pension systems on the well-being of retired population.

As explained above, the work is implemented for the pensioners within the Spanish social security framework. In this first research, both a non-parametric and a parametric duration analyses are implemented. The parametric estimates, made by means of the Nelson Aalen cumulative hazard function allows identifying the welfare level that the Spanish social security systems provides to the population it protects at present. With this aim, poverty risk is used as a mean to identify the welfare level of the population; that is to say, the higher the poverty risk at a given point in time (for a given pension-age), the lower the welfare enjoyed by the pensioners protected. The results obtained in this first part of the research allow concluding that the pensioners protected suffer from a higher probability to be poor as pension becomes older. Concretely, the system presents a 3.6 per cent probability of leading retired population to a poverty situation, fifteen years after they have begun to receive their pension.

The parametric estimate is implemented in the second part of the research. To start with, this approach allows looking for the causal relationship between each of the variables which determine the pension and the welfare dynamics of the pensioners

protected. As it is drawn from the research, changes in the regulatory base of individuals, increments in the age at which they decide to retire, increments in their contribution spell and increments in the reassessment diminish the probability of entering poverty, being the reassessment variable the one which most affects this probability. Afterwards, the results obtained are used to estimate the effects that the reform proposed by the Spanish government, at this time, a delay of the effective retirement age and the five years increase in the number of years included to compute the pension benefit, would have on the welfare enjoyed by the beneficiaries of a pension. The effects of these reforms are estimated for both the case in which only one of them is implemented and the case in which the two measures are taken at the same time. Finally, the effects of a delay on the reforms are estimated.

The results drawn in this second part allow concluding that a 2-year extension of the effective retirement age has positive effects on the individual welfare of retired population while an increase in the number of years computed for the pension calculation decreases the welfare, since it would increase (after nine years drawing the pension) the probability to be poor with regard to the present situation by 33 per cent. When both measures are simultaneously taken, the welfare enjoyed decreases (although at a lower rate), increasing (after nine years drawing the pension) the probability to be poor with respect to the current situation by 18 per cent. If the reforms were eventually delayed, the welfare level of the near-future generation of pensioners would not be affected, but this decision would imply the highest welfare losses for the future pensioners who withstood all the reform. The poverty dynamics for these losers would vary (in the most optimistic scenario) from being 2.69 (for the initial period) to 22.65 times higher (for the final period) than the one at the present time.

The second work **"A dynamic analysis of the effect on pensioners' gender differences of social security reforms",** currently under review, develops an econometric duration model to account for the dynamics of gender differences among pensioners and the effect of pension reform, which at this time means an increase of one year in the retirement age, an increase of three years in the contribution spell and the inclusion of five more years of the history of contribution for the computation of the regulatory base, on such gender differences. Gender differences in the labour market have been widely studied and discussed by both research and public policy. There is a linkage between these differences and those observed among retired people. In this research it is presented a methodology to study the dynamics of gender differences for the retirees and to account for the impact on such gender differences of the proposal made by governments to adequate the institutional framework of social security systems to the challenge of an ageing population.

The research, which is implemented for the Spanish social security pension system, defines two new concepts: the Gender Welfare Gap (GWG) and the Gender Policy Effect (GPE). As pointed out above, starting from a welfare definition based on the European Union's standard poverty line, that is the 60 percent of the median equivalised income, the Gender Welfare Gap measures the dynamics of differences

in welfare enjoyed by men and women. This Gender Welfare Gap serves as a base to define the Gender Policy Effect, which represents the difference between the Gender Welfare Gap resulting from the implementation of a specific policy and the corresponding Gender Welfare Gap existing in the pension system at present.

One of the main contributions of the paper is that the model presented could be usefully applied to measure gender differences in other contexts such as other countries with similar pension systems or it could even be developed to make comparisons between different pensions systems.

Additionally, the results obtained allow concluding that, in Spain: i) pensioners suffer a gender welfare gap that increases as pension becomes older; ii) a policy reform consisting of a delay in one year of the age at which the worker effectively enters the system as a pensioner would progressively reduce the current gender differences by around 5 per cent; iii) a policy reform consisting of an inclusion of five more years of the period computed to calculate the initial pension of the pensioners increases the current gender differences from 11 per cent (first period) to 21 per cent (last period) higher levels than at present ; iv) a three year increase in the contribution spell of pensioners is associated to a 5 per cent decrease of the current gender differences; v) the simultaneous application of the three policies leads to an initial decrease of gender differences equal to 3 per cent and 2 per cent for the one and two-year old (respectively) pension holders, and 5 per cent final increase in the gender differences existing at present.

The last work titled "**The effects of social security reforms on the widow's welfare. A dynamic analysis"**, which is currently under review, aims to present the effects that a change in the regulatory base due to an increase in the number of years computed in the pensioners´ formula may have on the welfare of beneficiaries of widow´s pensions in Spain and proposes an alternative based on the current design of pensions in order to maintain the current level of welfare of this population group.

On this occasion, different scenarios related to different changes in the regulatory base are presented. It is assumed to be a 3, 4 and 5 percent reduction of the regulatory base of the pensioners.

The results allow concluding that, in the most pessimistic scenario (a reduction in the regulatory base equal to 5%) the initial poverty risk would rise from the current 41% to 43.25% implying a welfare reduction of 2.25 percentage points with respect to the current welfare level enjoyed by these pensioners. This risk would dynamically increase until 68.1 for those pensioners who own a nineteen-year-old pension, which is 3.6 percentage points higher than at present. In contrast, in the most optimistic scenario (a reduction in the regulatory base equal to 3%), the initial poverty risk would rise to 42.2% and for those pensioners owing a nineteen- year-old pension the risk would be equal to 66.9%, reducing the welfare level of these pensioners between 1.2 and 2.4 percentage points with respect to the welfare they enjoy at present.
Finally, the research concludes showing that an increase in the coefficient applied to the regulatory base from the current 52% to 54.74% (for the most pessimistic

scenario) would maintain the current level of welfare enjoyed by the beneficiaries of this pension.

In sum, the research in the following part analyses the effects that the social security reforms proposed in order to face the challenge of an ageing population may have on the well-being of retired population in terms of both, welfare and gender impact that each policy reform may have on pensioners (men and women) and the beneficiaries of a widow's pension.

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DISSERTATION I

Patricia Peinado Martínez

A DYNAMIC ANALYSIS OF THE EFFECT ON PENSIONERS' WELFARE OF SOCIAL SECURITY REFORMS

ABSTRACT

The aim of this paper is to analyze the dynamic effects of the different parametric reforms oriented to reach the financial balance of public pension systems on the well-being of the retired population. Using the Spanish social security system as study case, it is implemented a duration analysis to look for a causal relationship and then estimate separately the effects of an effective retirement age delay and a replacement rate reduction as well as the combined effect of these two measures. We also estimate the effects of a delay on the reforms. We find that a change in the effective retirement age would have positive effects on the individual welfare of retired population, while a reduction of the replacement rate would diminish it. The combined effect of the two measures would finally translate into a welfare lost of the retired population. The delay on the reforms implies higher welfare loss (to the affected generations) than the analysed reforms.

KEY WORDS: pensions, welfare dynamic analysis, social security, Spain, reform
JEL CODES: H55, I38, J14

1.-Introduction

The aging process we are witnessing in most developed countries poses an important challenge for the future pension systems, especially in those countries with unfunded systems. On the one hand, aging implies a future increase of the expenditure on pension and on the other, a slowing down in the future growth of the labour supply and, consequently, of the future revenues of the system. The final result if the appropriate reforms are not taken will be a financial imbalance difficult to be withstood.

The different European countries have already started, with varied intensities, some reforms oriented to the restraint of the increasing expenditure level on pensions. One of these reforms is the change of the legal retirement age. So far, only Germany, Denmark and the United Kingdom have modified that age. In Germany and Denmark the legal age has been risen from the current 65 to 67 and in the United Kingdom up to 68. Ireland has also made a slight change from 65 to 66.

The second line of reforms is addressed to modify the parameters used to compute the pension with the aim of reducing the replacement rate[1] at given retirement rates. This decrease can be obtained, for example, by computing all the working life in the calculation of pensions or introducing demographic adjustment factors which take into account the increase of life expectancy. Germany, Sweden, and Portugal have already introduced both measures whereas countries such as Austria, France or Finland have only introduced, at the moment, the demographic adjustment factor.
One of the problems of the parametric-like reforms is the calculation of their intensity. The intensity of reforms can be related, on the one hand, to the final objective which they aim at, that is to say, the elimination of financial imbalances of pension systems. But it must also be kept in mind the effects they may have upon the welfare of retired population. Pension systems have been a powerful instrument to eliminate poverty situations among the elderly (Dang et al*.,* 2006; Engelhardt and Grubert, 2004; Nelson, 2004; Sainsbury and Morissens, 2002). In most European countries these systems have offered further benefit, providing this group of population with access to some consumption levels which are well over the standards corresponding to their poverty threshold. Therefore, the different parametric reforms should go along with predictions about the impact they may have on the welfare of the retired population. These predictions would provide the policy-maker with relevant information to select the most suitable combination of reform measures in order to, on the one hand, ensure the financial balance of the future system and, on the other, keep on providing retired people with access to socially acceptable consumption levels.

[1] In the framework of the Open Method of Coordination the UE defines the replacement rate as the level of pension income the first year after retirement as a percentage of individual earnings at the moment of take-up of pensions

Nevertheless, there is not much research studying the effects of pension reforms on the welfare of retired people. Butrica et al. (2006) reveal, taking United States as a case study, that the working life extension would be the most suitable reform, since it would increase the welfare of population at older ages, measured in terms of annual consumption increase. However, Lachance (2008), by using a life-cycle model, states that this welfare improvement could be lower than estimated if we take into account the cost induced by the working life extension, in terms of less leisure. Gonand and Legros (2009), by using a dynamic general equilibrium model, present different simulations with different combinations of parametric reforms, oriented to balance the pension system in France. In the first scenario, the replacement rate is kept constant and the effective retirement age is delayed. The conclusion is that welfare, measured as a variation of poverty rates, would not be affected. In the second scenario, where retirement age is constant and the computed years for pension calculation are raised, which is equivalent to a reduction in the replacement rate, poverty rate among this population group increases considerably. Other researches, (Sutherland et al. 2008; Pfau, 2006) show the effects different indexes of pension updating have on welfare, also measured as a change in the poverty rate of retired population.

The objective of this paper is to go more deeply into the knowledge of these effects taking the Spanish Social Security system as a case study. The need to reform the system is relatively urgent, since the aging process Spanish population will go through in the following years is one of the most intense of the European Union.[2]. So it seems appropriate to try to predict the effects some of the reforms which are being considered at the moment may have on the individual welfare of the future retired citizens. In a more particular way, we are interested in estimating the effects that an increase in the retirement age and an increase in the number of years included for the computation of pension may have on such welfare. These are the two measures recently announced by the Spanish government to correct the future imbalances of the system.

We estimate these effects assuming that the reforms are implemented at the present time. The financial problems of the system, however, will no take place in the immediate future. The last estimates about the financial imbalance of the social security system consider that the deficit could take place, depending on the assumptions made, at the beginning of the 2030's or in the second half of the 2020's (Herce et *al.*, 2009; de la Fuente and Doménech, 2009; Serrano et *al.*, 2011). The social problems related to the reform of the social security system could delay the reform until the moment the financial imbalances brake out. In this scenario the intensity of the reforms would be higher than if they were implemented at the present time. Herce et *al*. (2009) consider that for the year 2050 the equilibrium average pension would be 41.77 points lower than the current one. De la Fuente and Doménech (2009), in their most optimistic scenario, consider that for the period

[2] In 2050, the old-age dependency ratio for Spain is estimated to reach 59%. In the EU-27, this ratio would be 50%.

2007-2060, the equilibrium average replacement rate should be equal to 49.51%, 30 percentage points lower than the current one. In Serrano et *al*. (2011) it is estimated that the generosity of the system (measured as the taxable average earnings over the average pension) should diminish from the current 0.64 to 0.369 for the year 2050. In the paper we also estimate the welfare effects of these changes.

In order to make some progress in these objectives, we estimate two duration models. The first model is a non-parametric estimate which evaluates the welfare the current Spanish pension system provides to retired population. The second model is a parametric estimate with which we will measure the effects of such mentioned reforms, as well as the effects of their delay, have on the individual welfare of retired population.

The methodology we propose complements, from a dynamic perspective, the information provided by the traditional indicator that is used to measure the generosity of a social security system: replacement rate. This is a static indicator which does not gather information about the future individual welfare of retired citizens. With the duration model we propose, we can research on the evolution of this welfare, for a given replacement rate.
This paper shows some methodological novelties regarding the researches mentioned above, which improve the understanding of the effects of reforms.

A first novelty is it is an empirical research. We used micro data to research on the effects of reforms. The results we obtained, thus, can be used as inputs to design models where there are other variables (different from pensions) which also influence on the retired population welfare. A second novelty is the welfare measurement we made is not static. Our methodology allows observing the evolution of that welfare over time, since the moment the individual enters the system as a pensioner. A third novelty is we consider all variables determining the pension as a whole, which allows us to realize about the causal impact each of them has on the individual welfare of pensioners.

The paper is structured as follows. In the following epigraph we introduce the database we have worked with, as well as the methodology. Afterwards, we present the results of the different estimates carried out and finally, we include a discussion and state the main conclusions obtained.

2.-Data and Methodology

2.1.-Data source

The results shown in the following part have been obtained from the Muestra Continua de Vidas Laborales (MCVL) drawn up each year by the Spanish Ministry of Immigration and Social Security.

This sample, which has been put together each year since 2004, provides information about the working life of 1,170,000 pensioners and employed workers[3]. This statistical source enables two analyses to be carried out from a methodological standpoint. On the one hand, and by comparing the results obtained in each of the reference years, a global overview may be obtained of the evolution of the system in its different components. On the other hand, the data it provides for each year reflects a panel for each pensioner that appears in the sample in that year, as we have records at our disposal about the nature of their relationship with Social Security since 1996.

The analysis has been implemented using the information of the year 2007 for the standard pensioners[4]. To capture the time dimension of the pension evolution, this data has been expanded according to the pension formula used by the Spanish Social Security System up to the year in which the pension was recognized, this is the year in which the pensioner entered the system. As a consequence, we have worked with an unbalanced, right censored panel data which starts in the year 1996 and finishes in the year 2007, but in the survey there are pensioners whose first relation with the system was in 1986. The panel, thus, covers the period 1986-2007. Each pensioner enters the panel the year when the corresponding pension is recognized and continues until the end of the period, 2007. After debugging the data base the total amount of individuals included in the study is 40,842.

2.2.-Welfare definition

We define welfare of a pensioner as that situation where he/she is not poor. As an indicator of poverty situations we use the standard criterion proposed by the European Union, that is to say, 60% of the median equivalised income[5]. Therefore, the social security system ensures a positive individual welfare as long as it provides an income flow (pension) which allows different individuals to keep their standards above the level of the poverty threshold.[6]

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[3] The Spanish social security system comprises the General Social Security Scheme to which salaried workers as a whole are affiliated (71% of the total number of those affiliated), and a Special self-employed Workers' Scheme to which those persons who are self-employed are affiliated (15% of the total number of those affiliated). The rest of the system comprises several minor regimes such as fishing workers or miner workers. In this study, we shall be focusing exclusively on pensioners that form part of the General Social Security Scheme.

[4] The standard pensioner is defined as the pensioner who draws a single pension and does not draw any mean-tested complements during all the period under study.

[5] The poverty threshold is defined as the 60 per cent of the Equivalised Median Income for households comprising one single person between 1995 and 2007 (EUROSTAT, 2009). For the period 1986-1994 the poverty line is defined as the 60 per cent of the Equivalised Mean Income estimated by Prieto and García (2007).

[6] Pensioners, besides the income they receive from the social security system, can have access to other different sources of alternative income. These other sources are not considered in this work, since the study of poverty situations among retired population is not the aim of this paper. Poverty thresholds are used exclusively as an indicator to evaluate the welfare provided by the system. As mentioned in Cellini, McKernan and Ratcliffe (2008), one of the useful

2.3.-The determinants of welfare

In a pay-as-you-go system the income individuals receive is a function of the regulations which govern the right to a pension and of the working life of each individual. In Spanish's Social Security model the pension is the result of applying a Coefficient related to the number of years worked by each pensioner to the personal Regulatory Base.

The Regulatory Base is obtained in accordance with the following expression (1). TAE_i refers to the Taxable Average Earnings of 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:

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

The Coefficient varies between 0.5 and 1 depending on the years the pensioner has contributed to the Social Security System. The minimum value (0.5) is applied to the people with a 15 years record. This coefficient rises until it reaches its maximum for those who have contributed 35 years.

Additionally, with the ultimate goal of maintaining the purchasing power provided by the initial pension, every year pensions are brought up-to-date according to the evolution of the Consumer Price Index (CPI).

Although the legal retirement age is 65, Spanish legislation permits the population to retire from the age of 61. These early retirements are, though, penalized. For each year between 61 and 65, people who opt to retire are penalized with a yearly reduction of 8% above the pension which would correspond to them. The law also permits extending the working age above the legal retirement age for those people who have not been contributing for 35 years when they reach the age of 65. In any case, the limit age for this time extension is 70. As a consequence of this legislation, the effective retirement age varies between 61 and 70 inclusive, though the average effective retirement age in the Spanish system is 64.

Therefore, the total pension received is a function of the "regulatory base", the "contribution spell", the "effective retirement age" and of the "reassessment" associated to the pension each year. These are the variables of our model.

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points of using the official poverty lines, is to measure the economic well-being of the population under study which is precisely our aim in this paper.

2.3.-The model

We implement a duration analysis with which we estimate the welfare of the retired population during the time they are members of the system as pension recipients[7]. We have opted for an analysis of these characteristics so that we can see the changes which take place in such welfare as the pension "gets older"·. For example, a person may not be poor with the income provided by the system for a certain number of years. Yet, this individual may later fall into poverty due to the "aging of his or her pensions". "The pension aging" occurs because pensions are updated depending on the evolution of the CPI, whereas the poverty threshold we used to make reference to the welfare also evolves depending on the changes of productivity. This model, thus, permits us to understand the evolution of the probability of pensioners to fall below the poverty line. In other words, it allows us to observe the evolution of pensioners´ welfare from the very moment they start to receive their pension.

The empirical analysis is implemented in two steps.

For the first of the objectives pointed out in the introduction, that is, in order to have an overview of the welfare provided by the system to retired population, we implement non-parametric estimates of the hazard rate in terms of the Nelson-Aalen[8] cumulative hazard function. The cumulative hazard function measures the total amount of risk that has been accumulated up to time t. The estimator proposed by Nelson and Aalen can be described as in expression (2). Where n_j is the number at risk at time t_j, d_j is the number of failures at time t_j, and the sum is over all distinct failure times less than or equal to t.

$$\hat{H}(t) = \sum_{j|t_j \leq t} \frac{d_j}{n_j} \tag{2}$$

The function is estimated upon the whole universe of individuals, without considering the personal characteristics of each of them.

So as to estimate the effect that different parametric reforms might have on retired population welfare, though, it is necessary to know how the different personal characteristics reflected on the variable which determines the pension influence on this welfare. In order to understand the hazard rate conditioned to the specific pension determinants, we secondly implement a proportional hazard parametric

[7] The database we have worked with provides information only on "living pensions" in the reference year. All the pensioners studied, were alive in 2007.

[8] The analysis could also have been implemented by means of the Kaplan-Meier Survivor function since it is asymptotically equivalent to Nelson-Aalen's approach. However to compute the cumulative hazard Nelson-Aalen is preferable in terms of efficiency. See Klein and Moeschberger (2003) for further reading.

maximum likelihood estimate[9]. The estimate is done in discrete time and it is assumed a complementary log-logistic functional shape[10] of the hazard, as proposed by Jenkins (2009). The attractive feature of this distribution is that the hazard function is non-monotonic, as happens with other distributions such as exponential, Weibull or Gompertz, commonly used in the literature.

Assuming a Gaussian error component, estimates are controlled by the presence of individual unobserved heterogeneity, which could arise from the absence of some other important information regarding the pensioner such as personal characteristics which has not been gathered by pension's determinants. This control is particularly important since it prevents estimates from being biased (Lancaster, 1990). The time-varying covariates included are external in the sense of Kalbfleish and Prentice (1980) since the complete path of pensioner's pension components are determined for the whole period analyzed regardless of whether the pensioner has entered or not poverty. Such covariates enable us to answer how differences in pension components alter the probabilities of entering poverty. This hazard function can be written as in expression (3).

$$h[t;X(t)] = 1 - \exp[-\exp(z(t))]$$
$$z(t) = D(t) + \beta' X(t) + u \tag{3}$$

Where $h[t;X(t)]$ is the hazard function, $D(t)$ represents the theoretical baseline hazard function[11] as the logarithm of time, $X(t)$ is a matrix which includes the covariates plus an intercept and u is the error term with zero mean[12]. In table 1 we provide details on all variables.

[9] This methodology is also proposed by Cellini, McKernan and Ratcliffe (2008)

[10] The results obtained in the non-parametric estimates prove the existence of a non-monotonically increasing and then decreasing hazard rate.

[11] We have named it as theoretical in order to distinguish it from the "baseline case" as we have defined below. In this work we will refer to "baseline" as the reference case and by the term "theoretical baseline" we will recognize the function $D(t)$, this is the value of the hazard when all the covariates are equal to zero.

[12] One way of interpreting the error term is that it summarises the impact of "omitted variables" on the hazard rate. For alternative interpretations in terms of errors of measurement in recorded regressors or survival times see Lancaster (1990).

Table 1: Covariates' Description

Variable	Type	Description
Regulatory Base	Time-Invariant	Value of the Regulatory Base.
Effective Retirement Age	Time-Invariant	Age at which the pensioner starts drawing the pension.
Contribution Spell	Time-Invariant	Number of years of contribution to the Social Security.
Reassessment	Time-Varying	Actualization of the Regulatory Base according to CPI.

Finally, from the results obtained in the parametric estimates, we can calculate the effect that several policy reforms[13] would generate on the individual welfare of the retired population. In order to advance in this aim, we will differentiate five different scenarios. The first of the scenarios, which we will call baseline, will serve as a reference to measure the effect that each reform measure might have on the pensioners´ individual welfare. In the second scenario, we will call Case I, we evaluate the impact of a 2 years´ increase in the effective retirement age upon this welfare. In the third scenario, (Case II) we assess the impact of a 4% decrease on the regulatory base[14]. In the fourth scenario, we will call Case III, we show the combined effect of the two measures before: an increase in the effective retirement age and a decrease of the regulatory base. Finally, in Case IV, we show the welfare effects that would take place if the reforms were delayed. We have estimated the welfare effect for the future generations of two alternative reductions (40 and 50 per cent) of the average pension[15].

We will measure the change of the individual welfare (resulting from the different studied reforms) as the increase or decrease that the selected variable generates with regard to the individual welfare existing in the baseline case. In econometric terms, this change is measured as the percentage variation on the cumulative hazard

[13] All the estimations carried out can be understood as predictions as long as the characteristics of the current retired population studied are preserved in time. As a consequence, the analysis implemented is useful to bring closer the effects that the different reform strategies currently under debate might have on the welfare of the population under study though they would lose their consistency if there were a structural change of such population group.

[14] This decrease would be the approximate result that could be reached if the number of years computed in the calculation of the regulatory base were increased from 15 as currently to 20 (as the Spanish government has proposed). The change in the regulatory base is identified with a change in the average pension given that the median pensioner has contributed more than 35 years and, consequently the coefficient applied to his/her regulatory base is equal to 1.

[15] These reductions establish the rank within the average pension could finally stand, according to the results presented by Herce et al (2009); de la Fuente and Doménech(2009) and Serrano et al. (2011).

function generated by the variation in the selected variable. The estimates of the cumulative hazard function have been computed as 1 minus the corresponding estimates of the Survivor function where the survivor function estimates $\hat{S}[t;X(t)]$ have been implemented according to the expression (4) as proposed by Jenkins (2009).

$$\hat{S}[t;X(t)] = \exp\sum_{s=1}^{t}\ln\left[\hat{h}[t;X(t)]\right] \tag{4}$$

As this percentage variation depends on the effect of the reforms on the hazard we will also present the value of the associated hazards ratios. Since we are working in a time-varying framework (some covariates change each time period) the hazard ratios concerning such type of covariates change each time the time-varying covariate changes. For this reason and in order to make interpretation easier, the reported results show the average hazard ratio for the whole period analyzed; this is the average over the hazard ratios of the period as in expression (5). Where hr_j refers to the hazard ratio corresponding to covariate, j, $\hat{h}_j[t;X(t)]$ refers to the hazard estimates value corresponding to the covariate, $\hat{h}_b[t;X(t)]$ represents the baseline hazard[16] estimates and T is the total number of periods studied.

$$\hat{hr}_j = \frac{\sum_{t=0}^{T}\frac{\hat{h}_j[t;X(t))]}{\hat{h}_b[t;X(t)]}}{T} \tag{5}$$

Changes in welfare, though, will be measured from the information provided by the cumulative hazard function.

[16] Although the hazard value is usually referred to as "baseline" when all the covariates are equal to zero, in this case, in which reassessment varies each time period according to the CPI, it is more useful to make the comparisons using the case of the median pensioner as baseline, and thus, it will be used in the rest of the study. The median pensioner is characterized by a monthly regulatory base equal to 964.655 euros, has been contributing for 40 years and has been effectively retired when she/he was 64 years old.

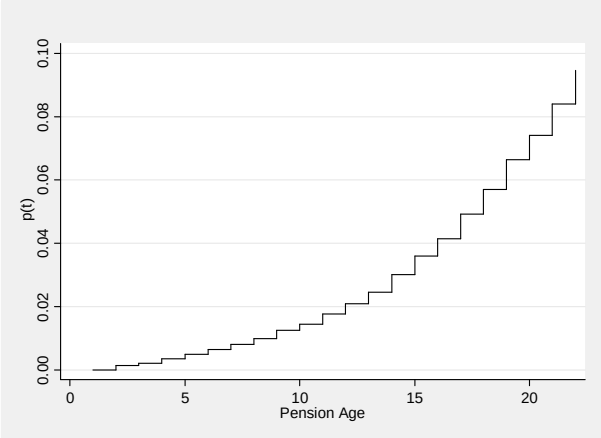
3.- Results

3.1.- Non-Parametric model

In figure 1 we show the Nelson-Aalen cumulative hazard function estimates for the current system. Initially, that is, the year individuals enter the system as pensioners, the likelihood associated to the system of leaving people in poverty situations is lower than 1% (0.0035). From that moment on, as the function reflects it, the likelihood increases as times goes by, though it keeps on presenting low values. Thus, the likelihood takes value 0. 01 in the eighth year. After 22 years, this likelihood rises up to 9.46% (0,0946). After 15 years, the estimated average time to draw the pension for the median pensioner (see note 17 for the characteristics of this pensioner), this likelihood reaches a 3.6% value (0,036).

In the light of these results, it seems logical to conclude that the Spanish retirement pension system ensures a level of life above the poverty threshold for most pensioners during all those years they have received that pension.

Figure 1: Nelson-Aalen Cumulative Hazard Estimates



3.2.-Parametric model

The results from the parametric estimates are reported in table 2. The first column reports the estimates of the coefficients and the second column the hazard ratios with respect to the baseline hazard. At the bottom of table 2 we provide the values for the

standard deviation of the heterogeneity variance (Std_u) and the ratio of the heterogeneity variance to one plus the heterogeneity variance (rho). As it can be derived, the likelihood ratio test suggests statistically significant frailty.

As it can be observed from the estimates of the coefficients, the positive sign of the slope of the baseline hazard reveals the existence of positive duration dependence; this is, the likelihood to enter a poverty situation grows as times goes by. Regarding the covariates included in the model, all of them reduce the hazard (all of them affect negatively in the probability that the pensioner falls below the poverty line). As a consequence, an increase in the "regulatory base" would induce a decrease of the hazard and, inversely, a decrease in the "regulatory base" would generate an increase of the hazard. Similarly, an increase in the "retirement effective age" of the pensioner would reduce the hazard. An increase in the number of years the pensioner has been contributing to the system ("contribution spell") would also reduce the hazard faced. "Reassessment" variable, which contains the pension updating, works in the same direction.

Coefficients, though, only provide partial information on the magnitude with which each covariate affects the probability of entering poverty, that is, the measurement of the effect that each covariate has on hazard estimates. The measurement of the effect on the hazard of the different covariates must be done in terms of hazard ratios; that is, in terms of the increase or decrease caused by a variation of the covariate on the baseline hazard. The baseline hazard estimates are reported in the second column first row of table 2. The hazard ratios related to each variable are also reported in the second column of the table 2. A covariate which does not change the baseline hazard at all would present a value equal to 1. This value would be higher than 1 for those covariates which increase the hazard and lower than 1 for those which decrease it. As it can be observed, and as it was inferred from the sign of coefficients, all variables show a hazard ratio lower than 1. A 1 per cent increase in the "regulatory base" generates a 17 per cent diminution of the hazard, as the value 0.83 reveals. When the pensioner retires being one year older, the hazard decreases a 6 per cent, as it is revealed by the hazard value for the variable "retirement effective age". One more year of contribution to the social security ("contribution spell" variable) reduces the hazard a 3 per cent. Finally, a 1 per cent increase in the reassessment applied each year induces a diminution of the hazard equal to 87 per cent.

Table 2: Results from parametric estimates

Covariate	Coefficients *(β)*	Hazard Ratios
	Slope	
Baseline Hazard	4.01986*	7.16 e^{-06}
	(0.14547)	
Regulatory Base	-0.00263* (0.0002)	0.8316
Retirement Effective Age	-0.06177* (0.01353)	0.9425
Contribution Spell	-0.03149* (0.02939)	0.9703
Reassessment	-0.02564* (0.00096)	0.1263
Constant	-3.56469* (0.99393)	-
Std_u	0.22334	-
Rho	0.02943	-

(*) Significant at 1%

3.3.-Policy Reforms

Figure 2 shows the predicted cumulative baseline hazard. From the baseline case we must conclude that the probability to be poor is very close to zero for the whole period. However, as figure 2 shows, this likelihood gradually increases from year zero to year nine, and, after the year 10, it stabilizes at 0.015 per cent value.

Figure 2: Baseline

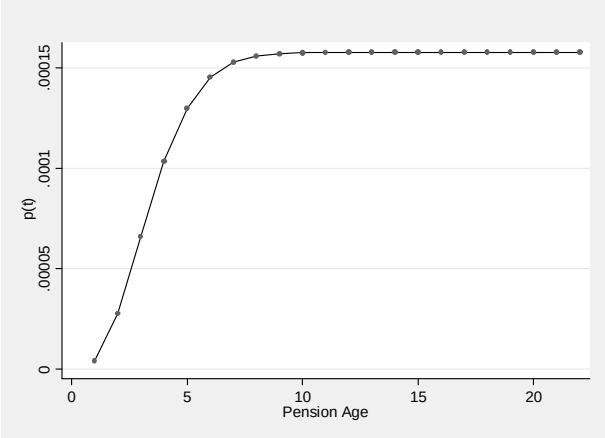


Table 3 reports the hazard ratios estimates for the different policy reforms. The corresponding cumulative hazard functions are represented in figures 3 to 5.

Table 3: Effects of the Policy Reforms on the Hazard Rate.

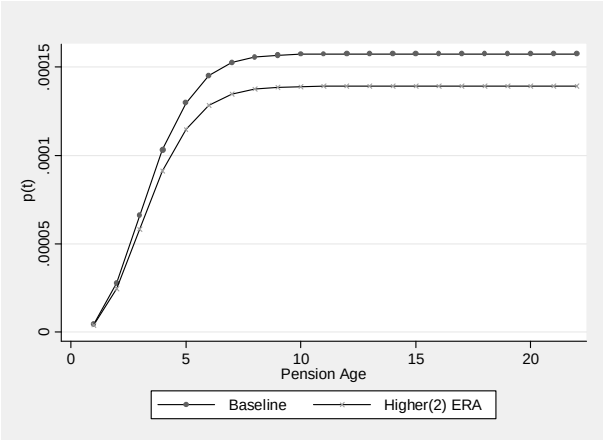
	BASELINE (Hazard Rate)	CASE I (+2 ERA)	CASE II (-4% RB)	CASE III (Cases I and II)	CASE IV (Delay)
Hazard Ratio	$7.16\ e^{-06}$	0.8883	2.3422	2.0795	$4.29\ e^{05*}$ $1.92\ e^{07**}$

Note: The hazard ratio is defined as the ratio between the corresponding hazard rate and the baseline hazard rate. The hazard ratios in the table have been computed as the mean of the corresponding hazard ratios of the whole period.
*This value corresponds to a 40% reduction; ** This value corresponds to a 50% reduction

3.3.1.-Case I: Effective Retirement Age delay

A two-year increase on the "retirement effective age" at which the pensioner starts drawing a pension benefit decreases the hazard ratio about 12 per cent [17], as it can be seen in table 3. As Figure 3 shows, this reduction in the hazard ratio generates a reduction of the cumulative hazard function equal to 12 per cent. The rise in the welfare (measured as the difference between the two functions) keeps on increasing up to the tenth year and then, as it happens to the baseline case, it remains constant. In conclusion, a policy reform concerning a two-year delay of the "effective retirement age" would induce a 12 per cent increase of the welfare.

Figure 3: Case I



3.3.2.- Case II: Regulatory Base reduction

As table 4 shows, a 4 per cent reduction of the "regulatory base" generates an increase of the hazard equal to 134[18] per cent (as the hazard ratio value 2.34 reveals). Figure 4 shows what this effect implies in terms of the cumulative hazard function.

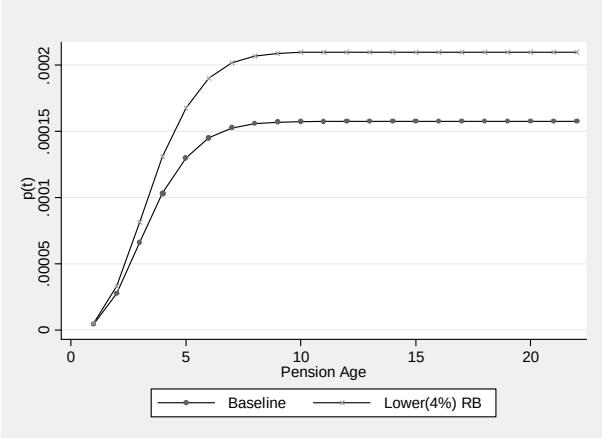
At the beginning of the period, when the pension has been newly recognized, the difference of the cumulative hazard function with respect to the baseline case is

[17] Note that this is double the effect of one-year increase discussed in the previous section.

[18] The value is not four times the increase discussed in the previous section since it is a combined effect, which comes from the change in reassessment provoked by the change in the regulatory base.

almost imperceptible. As time passes, this difference increases up to year nine when it becomes stable at 33 per cent value. In other words, the system would increase in 33 per cent (9 years after receiving the pension) the likelihood to be poor with regard to the present situation. In terms of welfare, after nine years drawing a pension, the welfare would be reduced 33 per cent with respect to the baseline case's welfare and this welfare reduction would prevail until the end of the period.

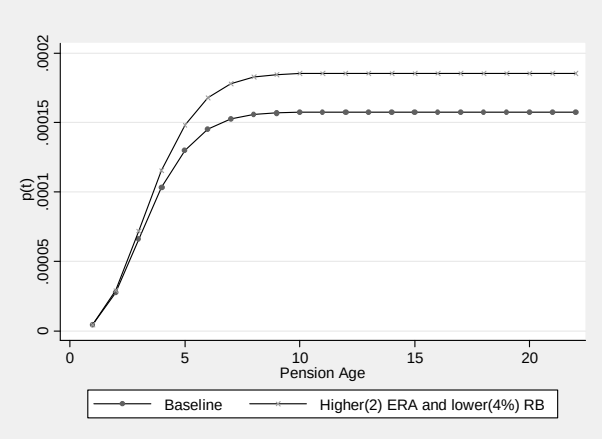
Figure 4: Case II



3.3.3.- Case III: Effective Retirement Age delay and Regulatory Base reduction

A policy reform consisting of a simultaneous two-year increase in the "effective retirement age" and 4 per cent reduction in the "regulatory base" raises the hazard ratio up to 2.08 (see table 4). As figure 5 shows, this 108 per cent increase in the hazard is materialized in an initial 1 per cent increase in the cumulative hazard the first year the pension is drawn which increases up to 9 per cent the third year and finally, up to 18 per cent for the ninth year. After the year ten, the difference stabilizes at 18 per cent value.

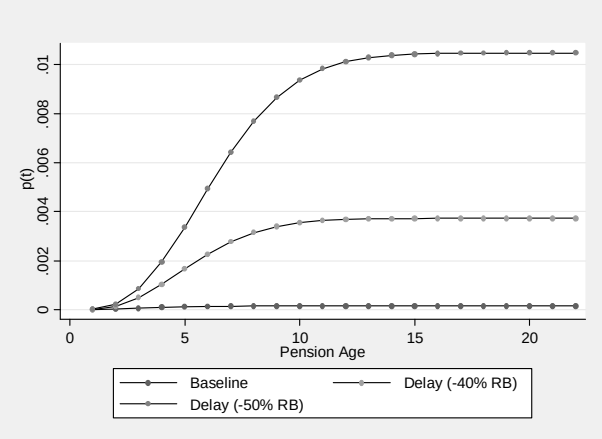
Figure 5: Case III



3.3.4.- Case IV: Delay on the reforms

If the reforms required to balance the system were not implemented at the present time, the near-future generations of pensioners would not withstood any welfare lost. However, for the generations of the pensioners who enter the system once financial imbalance appears the welfare lost would be higher than the welfare lost shown in the previous cases. This delay raises the hazard ratio up to values between $4.29e^{05}$ and $1.92e^{07}$ (see table 4). As figure 6 shows a 40% reduction of the average pension multiplies the cumulative hazard (in the first year) by 3.69 times. This difference increases during the whole live of the pension as time passes. In the last period the cumulative hazard is equal to 23.65 times the baseline one. For a 50% reduction, these values are, respectively, equal to 5.29 and 66.49 times. In terms of welfare, the welfare of the pensioners affected by the delay of the reforms would be between 2.69 and 65.49 times lower than the welfare they enjoy at the present time.

Figure 6: Case IV



In conclusion, a policy reform consisting of increasing the "effective retirement age" in two years and reducing the "regulatory base" a 4 per cent would cause, after nine years drawing a pension, an 18 per cent increase of the probability of being poor. In other words, after drawing a pension for nine years, the welfare would be reduced an 18 per cent as a consequence of the policy combination implemented, and this welfare reduction would be maintained until the end of the pensioner's life[19]. From the result obtained, we can conclude that an extension of the effective retirement age would be the most suitable reform to be implemented in order to harmonize the financial imbalance with the maintenance of the welfare of retired population. This conclusion is similar to the one drawn by Butrica et al. (2006) and Gonand and Legros (2009). A reform exclusively focused on the increase of years computed for the pension calculation, that is to say, a decrease in the replacement rate, would bring about the most harmful effects in terms of welfare of retired population. This result is also similar to the one presented by Gonand and Legros (2009).

The measures put forward by the Spanish administration (a 2-year increase in the retirement age and an increase of 10 computed years for the pension calculation) have a final negative effect on the individual welfare of retired population. This is due to the fact that the negative effect on the welfare generated by the reduction in the replacement rate is higher than the positive effect associated to the increase of the effective retirement age.

[19] In Spain the average time a pension is drawn between 15 and 18 years. Since the period analyzed estimates the effect for 22 years, we could conclude that the effect will prevail until the end of the pensioner's life.

A delay on the reforms will induce more intense reductions in the average pension and, consequently, for the affected generations of pensioners raises the probability to be poor relatively to both, the baseline and the different estimated scenarios of reform.

4.- Discussion

In order to correctly interpret the results obtained it must be pointed out the limits of our analysis. Our starting point is that the Spanish pension system, in a relatively short future, will face a problem of financial imbalance if the necessary policy reform measures are not taken. The estimation approach followed in this paper, which differs from the simulation approaches more commonly used in the literature, allows to reach our final goal, this is to estimate the intensity of the effects that the parametric-like reforms proposed by the Spanish government would have on the welfare of the future cohorts of retired people and no-reform in the present time.

The results obtained rest under the assumption that all the adjustment needed to reestablish the financial balance of the system is withstood by the retired population. This is the central idea over which the proposal of the government rests and, in general, over which the related existing literature rests. An alternative reform could displace part of the welfare cost to the active population by means of an increase of their contribution rate to the system. In this case, the effect of the reforms on the welfare of the retired population would be lower since part of the welfare lost would be withstood by the contributors. A reform scenario of these characteristics should also include, apart from the estimates of the effects on the welfare of the retired population, the estimates of the effects on the welfare of this active population.

The model proposed in the paper has not been designed to simulate the conditions that would warrantee the financial equilibrium of the system. We accept that the reforms proposed by the government are sufficient to warrantee such equilibrium. If finally these strategies prove not to be sufficient and an additional reform would be needed, the welfare lost of the population would be assumingly higher than the one predicted in the analysis. The scenario in which the reforms are delayed over time shows the potential welfare lost if more restrictive reforms were needed.
Finally, it is convenient to remark that the welfare lost estimated does not necessarily mean that the poverty rates among the retired population increase. The analysis implemented in this paper uses the poverty line as a mean to identify welfare; this is as a threshold to measure the effects of the reforms. As a matter of fact, in Spain, according to the Spanish Survey of Household Finances (EFF) 2005, the pension benefit represents the 64 per cent of the total income of the retired people. Additionally, 80.6 per cent of the pensioners own a household. The household represent 73 per cent of the real assets (57 per cent of the total assets) for this population group[20]. As this data proves, a research aimed to analyze the implications

[20] The average pension in the year 2005 for the retirees of the general scheme was equal to 12,157 Euros, while the average income was 19.7074.7 Euros, according to EFF. The

of the reforms on the poverty situation of the elderly people should also consider, apart from the retirement income provided by the system, other factors such as the additional sources of wealth enjoyed by the population group studied.

5.- Conclusions

The aim of this paper is to analyze the effects of the different parametric reforms, oriented to reach the financial balance of public pension systems, on the individual retired population welfare. The study has been carried out by implementing two duration analyses. These analyses allow to study the evolution of this welfare over time and, consequently, to measure the dynamic effect of the different parametric reforms. Taking the Spanish pension system and the reforms announced by the Spanish government as a case study, the results obtained allow us to conclude: i) currently, the system has a 3.6 per cent probability of leading retired population to a poverty situation, fifteen years after they begin to receive their pension; ii) a 2-year extension of the effective retirement age has positive effects on the individual welfare of retired population; iii) an increase in the number of years computed for the pension calculation decreases the welfare, since it would increase (after nine years drawing the pension) the probability to be poor with regard to the present situation a 33 per cent; iv) a combination of these two measures also decreases the welfare (although at a lower rate), increasing (after nine years drawing the pension) the probability to be poor with respect to the current situation an 18 per cent; v) a delay on the reforms do not affect the welfare of the near-future generation of pensioners, but would imply the highest welfare looses for the future pensioners who withstood all the reform. The poverty dynamics for these losers would vary (in the most optimistic scenario) from being between 2.69 (for the initial period) to 22.65 times higher (for the final period) than the one at the present time.

computation of this value has been done for the households comprising one non-working and retired individual older than 64. For the calculus of the value the five STATA 9 format datasets provided in the EFF have been separately used and the results obtained have been imputed as proposed in the user guide published.

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DISSERTATION II

Patricia Peinado Martínez

A DYNAMIC ANALYSIS OF THE EFFECT ON PENSIONERS' GENDER DIFFERENCES OF SOCIAL SECURITY REFORMS

ABSTRACT

Gender differences in the labor market have been widely studied and discussed by both research and public policy. One of the contributions of feminist economics has been the establishment of a linkage between these differences and the ones observed among retired people. In this paper it is presented a methodology to study the dynamics of gender differences for the retirees and to account for the impact on such gender differences of the proposal made by governments to adequate the institutional framework of social security systems to the challenge of an ageing population.

KEY WORDS: gender welfare gap, gender policy effect, gender dynamics, social security, pension reform
JEL CODES: H-55; I-38; J-16

1.- Introduction

Pension systems have again been the focus of attention in the last years, especially in countries where pay-as-you-go systems are dominant. These systems have to deal with the problem of an ageing society and, as a consequence, with the future imbalance arising from such circumstances. In order to cope with this problem, the policy makers of the different countries have started a series of reforms of the pension systems they govern. Countries such as Denmark, Germany or United Kingdom have opted for delaying the retirement age at which the pensioners are entitled to the pension while in other countries like Portugal or Sweden it has been decided to increase the number of years included for the computation of the benefit or even to apply adjustment factors that take into account the increasing life expectancy of the individuals covered as in the case of Austria, Finland or France.

The reforms have been designed to prevent the future imbalance and do not take into account the consequences on welfare for the future retired people[1]. Among these consequences especial consideration should be made to the welfare differences between men and women[2].

Labor market different characteristics are the cause of gender differences during the individuals' life as pensioners (Johnson 1999; Johnson, Sambamoorthi and Crystal 1999; Bardasi and Jenkins 2010). Particularly, the low wages earned by women and their relatively short job tenures appear to be the responsible for the relative low pension wealth for women. These differences are driven by the way in which the different pension systems have been designed such as the traditional defined benefit (DB), the multi-pillar systems that include defined contribution plans (DC), and the unfunded pay-as-you-go systems-which are contributory, based on labor market experiences. Workers contribute during their working life (pay-roll taxes) and receive benefits that depend on wage history, years of work, or more directly on their contributions. These social security systems based on employment, then, pose a problem for women who are less likely to have worked and contributed for many years, and who earned lower wages when working (James, Cox and Wong 2003). As a consequence, the development of policies that, ceteris paribus, improve women's labor market role during their working life turns out to be the way to achieve gender equality in pensions (Johnson, Sambamoorthy and Crystal 1999; James, Cox and Wong 2003).

Alternatively, pension systems could be redesigned so that the working careers of men and women taken into account for the computation of pension benefits lead to a different pattern of gender differences. For instance, a longer contribution spell is considered relatively favourable for women (Bonnet, Buffeteau and Godefroy 2006), whereas the fact of including more years when computing the benefit tends to be worse for women (Leitner 2001; Bonnet, Buffeteau and Godefroy 2006).

[1] For analysis of these consequences see (Butrica, Smith and Steuerle 2006, Lachance 2008, Gonand and Legros 2009, Peinado and Serrano 2011)
[2] For a review on the research see Jefferson,T.(2009)

Additionally, women's relatively earlier pension age is sometimes identified as a source of gender inequality in terms of pension income (Bonnet, Buffeteau and Godefroy 2006).

The existing differences between men and women's pension benefits entails pension reforms to have different effects for each gender. To the best of my knowledge, the only researches that have studied the effect of the pension system's reforms on the gender differences are James, Cox and Wong (2003), Bonnet, Buffeteau and Godefroy (2006). The first work, which analyzes the effects of the multipillar pension reforms for Chile, Argentina and Mexico, concludes that the targeting of public pillars towards the low earners and from regulations over payouts from the private pillar, have redistributed and improved gender ratios. As a consequence, they conclude, women have gained more than men from the reforms. The second article, made for France, bases the analysis in private-sector pensions. The research concludes that pension reforms in France are tending to slow the narrowing of the pension gender gap. They observe that the reform's most negative effects are linked to the increase in the number of years used to calculate the reference wage and the fact that some women are bringing forward their retirement age when fewer financial penalties are incurred.

The present paper analyzes the dynamic-effects that some of the reforms under debate may have on the gender differences using Spain as a case study. In contrast to the research on the subject, which has been made by implementing simulation techniques, here, an empirical research is presented. More concretely, in this paper traditional duration analysis is developed to account for the gender differences that currently exist and to quantify the effect that the different reforms proposed by the government would have on such gender differences. There are several novelties regarding the technique implemented. First, gender differences are measured in terms of welfare. Second, regarding the dynamic dimension of the problem, the evolution of the gender differences of pensioners is analyzed since the moment they are entitled to a pension benefit. Third, the effect of policy reforms is defined in terms of gender differences and quantified for each policy reform and for the alternative in which the reform is fully implemented.

As said before, the methodology used in this paper is designed to estimate the effects of the policy. As a consequence, conclusions from the research are linked to the population behind (micro-data) and would be valid for future generations of pensioners to the extent that population in the study exhibit the same characteristics that those future pensioners generations. In Spain the gender gap has not substantially changed for the different generations. According to the data provided by the Spanish Ministry of Immigration and Social Security (2010), the average retirement pension for women in Spain is equal to 616.47 euros while for men it is equal to 1,038.70; that is, women's benefit represents 59.4 percent of men's average benefit. These values, for the group of pensioners who entered the system in the year 2010, are respectively 839.29 and 1,362.57 euros, representing the average benefit received by women the 61.6 per cent of that received by men. Additionally, the

group of women pensioners who abandoned the system in the same period were drawing an average retirement pension equal to 587.50 while, in the case of men it was equal to 960.45 euros, which means that women's benefit represented the 61.2 percent of the benefit received by men.

According to the last data available in the Survey of Wage Structure provided by the National Statistics Institute (INE 2006), the yearly average earnings for women are equal to 1,160.4 euros while the corresponding ones for men are equal to 1,575.1; in other words, women's earnings represent 74 percent of men's. The same data for the generations of workers that will enter the pension system the next years (40 and more year-old workers) is equal to 1,252.5 in the case of women and 1,870.4 in the case of men. As a consequence, for the workers who will be retiring in the next years, women's average earnings represent 67 percent of men's average earnings.
These data shows that, at present, the gender gap is observed both for pensioners and workers. Consequently, in a context as the one pointed out by the literature, in which the working patterns are transferred to pension benefits, gender differences will also be observed for the future generations of pensioners.

Under these circumstances, it is of particular relevance to provide policy makers with useful information so that they identified to which extent the current pension system could be used to deal with existing gender differences. At the same time, given that reform measures in the political agenda are aimed to combat the future imbalance of the system and do not take into account the gender dimension of the problem, it also turns out to be of particular importance to quantify the effects of these reforms on gender differences.

The last reform proposal announced by the Spanish government consists of three main points concerning the way the pensions are computed: i) a diminution of the initial pension by means of an increase from 15 to 20 of the number of years included for the calculation of the benefit (this is a diminution of the replacement rate of pensioners); ii) a delay of the retirement age at which pensioners are effectively being retired (at present in one more year) and; iii) an increase in the current contribution spell of pensioners in three more years.

The aim of this research is to define a technique which allows analyzing from a dynamic standpoint, first, the way in which a pension system may deal with the problem of gender differences by means of the instruments available under the current legislation and secondly, to quantify the effects that the policy reforms under debate may have on the existing gender differences.

In order to advance in this aim the econometric model is shown in section II. Section III explains the data source. The results are presented in section IV. Finally, section V contains the main conclusions of the paper.

2.- Econometric model

A pension system will warrantee a positive welfare to the pensioner it protects as long as the pension provided by such system remains over the minimum living standard of the society in which the pensioner lives. One way to identify that minimum living standard is by means of the poverty threshold of the country under study, which is the minimum income necessary to acquire the budget of goods and services that are considered sufficient to satisfy the minimum needs of an individual living in a specific society or country. Let *j* denote the gender group of interest and PL_t the poverty line of the country under study. Then, the welfare loss suffered by a retired individual *i* of gender *j* in period *t* wl_{it}^{j} is defined as a binary dummy variable which takes value zero for those pensioners enjoying a positive welfare (whose pension is higher or equal to the poverty line) and one for those who have experienced a welfare loss (whose pension is below the poverty line).

$$wl_{it}^{j} = \begin{cases} 0 & p_{it}^{j} \geq PL_t \\ 1 & p_{it}^{j} < PL_t \end{cases} \qquad (1)$$

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

Using the standard notation in survival analysis (see for example Lancaster (1990) or Wooldridge (2002)), let $T \geq 0$ denote the duration, that is to say, the length of time a pensioner enjoys a positive welfare, then the cumulative distribution function of the duration *T* conditional on vector $Z_j(t)$ of (possibly time-varying) covariates is defined as

$$F_j(t|Z_j(t)) = P_j(T \leq t|Z_j(t)) \qquad (2)$$
$$t \geq 0$$

With the associated density function $f_j(t|Z_j(t))$

$$f_j\left(t|Z_j(t)\right) = \frac{\partial F_j(t|Z_j(t))}{\partial t} \qquad (3)$$
$$t \geq 0$$

The survival function $S_j(t|Z_j(t))$ is defined as the conditional probability of enjoying a positive welfare at time *t* given that until that time there has not been a loss of welfare, so

$$S_j(t|Z_j(t)) = 1 - P_j(T \le t|Z_j(t)) = P_j(T > t|Z_j(t)) \qquad t \ge 0 \tag{4}$$

The hazard function, $h_j(t|Z_j(t))$ is defined as the conditional probability of suffering a loss of welfare from a positive welfare situation in the time interval *[t, t+h)* given the length of time spent in the situation of positive welfare, that is

$$h_j(t|Z_j(t)) = P_j(t \le T < t+h|T \ge t, Z_j(t)) = \frac{f_j(t|Z_j(t))}{S_j(t|Z_j(t))} \tag{5}$$

Duration dependence is said to exist if $\partial h_j(.)/\partial t \neq 0$ for any *t*. If $\partial h_j(.)/\partial t > 0$, duration dependence is positive. In this case, the longer a pensioner has enjoyed a positive welfare, the more likely is to fall to a welfare lost situation. If $\partial h_j(.)/\partial t < 0$, duration dependence is negative. In this case, the longer a pensioner has enjoyed a positive welfare, the less likely she or he is to fall into a situation of welfare loss.

For the estimates to be implemented it has been assumed a log-logistic[3] functional form for the hazard function. One of the attractive features of this distribution with respect to the estimates originally proposed by Cox (1972), in which no assumption is made about the form of the hazard, is that it allows estimating the baseline hazard function which is of direct interest here. The other attractive feature of this distribution is that the impact of the distributional assumptions on the estimates are minimized since it is a flexible parametric functional form (non-monotonic), contrary to other distributions such as the exponential, Weibull or Gompertz, commonly used in the literature. Following Jenkins (2009), this hazard function $h_j\left(t|Z_j(t)\right)$ can be written as

$$\begin{aligned} h_j\left(t|Z_j(t)\right) &= 1 - \exp\left[-\exp\left(G_j(t)\right)\right] \\ G_j(t) &= D_j(t) + \beta_j' Z_j(t) + u_j \end{aligned} \tag{6}$$

[3] The results obtained in the non-parametric estimates prove the existence of a non-monotonically increasing and then decreasing hazard rate.

where $D_j(t)$ represents the baseline hazard function as the logarithm of time, $Z_j(t)$ is a matrix which includes all the covariates (possibly time-varying[4]) plus an intercept and u_j is the error term with zero mean[5].

Let $j=m$ denote the gender group formed by all the male pensioners and $j=w$ the gender group formed by all female pensioners (women). Then the Gender Welfare Gap (GWG) is defined as the gender difference of the value of the survival function, that is, the gender difference registered in each period t of the conditional probability of enjoying a positive welfare given that until that moment a welfare loss had not been experienced, so

$$GWG(t|Z_w(t), Z_m(t)) = -\left(S_w\left(t|Z_w(t)\right) - S_m\left(t|Z_m(t)\right)\right) \tag{7}$$

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

From expressions 4 and 7 the GWG can also be described in terms of the cumulative distribution function of the duration, so

$$\begin{aligned} GWG\left(t|Z_w(t), Z_m(t)\right) &= -\left(S_w\left(t|Z_w(t)\right) - S_m\left(t|Z_m(t)\right)\right) = \\ &= -\left(P_m\left(t|Z_m(t)\right) - P_w\left(t|Z_w(t)\right)\right) \end{aligned} \tag{8}$$

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

Finally let $GWG^c\left(t|Z_w(t), Z_m(t)\right)$ denote the value of the GWG at the present time (current GWG) and $GWG^k\left(t|Z_w(t), Z_m(t)\right)$ the value of the gap when a policy reform k is implemented, then the Gender Policy Effect (GPE) of policy reform k is defined as

(9)

[4] The time-varying covariate included is external in the sense of Kalbfleish and Prentice (1980) since the complete path features in $Z_j(t)$ are determined for the whole period analyzed regardless of whether the pensioner has entered or not a welfare loss situation.

[5] Following Lancaster (1990), and to prevent estimates from being biased (to alleviate the problem of omitted variables), it is assumed a Gaussian error component to control the presence of individual unobserved heterogeneity, which could arise from the absence of some other important information regarding the pensioner such as personal characteristics, which has not been gathered in $Z_j(t)$.

$$GPE^k\left(t\middle|Z_w(t),Z_m(t)\right)=GWG^k\left((t\middle|Z_w(t),Z_m(t))\right)$$
$$-GWG^c\left((t\middle|Z_w(t),Z_m(t))\right)$$

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

This is the increase or decrease in the GWG caused by the policy reform under study with respect to the currently existing value of the GWG.

3.- Data

The analysis in this paper is implemented for the case of Spanish social security system.
In a pay-as-you-go system such as the Spanish one, the income individuals receive is a function of the regulations which govern the right to a pension and of the working life of each individual. More concretely, in Spain, the pension that individuals receive is the result of applying a coefficient related to the number of years contributed by each pensioner to the personal *regulatory base.*

The regulatory base is obtained in accordance to expression (10). TAE_i refers to the Taxable Average Earnings of 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:

$$RB=\frac{\sum_{i=1}^{24}TAE_i+\sum_{i=25}^{180}TAE_i\frac{CPI_{25}}{CPI_i}}{210} \tag{10}$$

The coefficient varies between 0.5 and 1 depending on the years the pensioner has contributed to the social security system (*contribution spell*). The minimum value (0.5) is applied to the people with a 15-year record. This coefficient rises until it reaches its maximum for those who have contributed for 35 years. Additionally, with the ultimate goal of maintaining the purchasing power provided by the initial pension, every year pensions are brought up-to-date according to the evolution of the Consumer Price Index (CPI). This actualization is known as the *reassessment* of the pension.

The legal retirement age in Spain is 65. However, the legislation permits the population to retire from the age of 61. For each year between 61 and 65, though, people who opt to retire are penalized with a yearly reduction of 8% above the pension which would correspond to them. The law also permits extending the working age above the legal retirement age for those people who have not been contributing for 35 years when they reach the age of 65. In any case, the limit age for

this time extension is 70. As a consequence of this legislation, the effective retirement age varies between 61 and 70 inclusive, though the average effective retirement age in the Spanish system is 64.

Therefore, the determinants of the durability of pensioners' welfare, and as a consequence, the explanatory variables included in the model, are the "regulatory base", the "contribution spell", the "effective retirement age", and the "reassessment" of the pension. A summary of the variables is provided in table 1.

Table 1: Covariates' Description

Variable	Type	Description
Regulatory Base	Time-Invariant	Value of the Regulatory Base.
Effective Retirement Age	Time-Invariant	Age at which the pensioner starts drawing the pension.
Contribution Spell	Time-Invariant	Number of years of contribution to the Social Security.
Reassessment	Time-Varying	Actualization of the Regulatory Base according to CPI.

The poverty line used is the standard in the European Union; this is 60 per cent of the median equivalized income[6] for the country under study, in this case, Spain.

The three policy reforms recently announced by the Spanish government to correct the future imbalances of the system are: i) to increase in 1 year the retirement age of workers ii) to include five more years of the working life of the pensioner in the computation of the regulatory base of the individual; iii) to make individuals contribute for a longer period so that the average contribution spell increases in three years with respect to the one existing at present. The measurement of the effects of these reforms is approached as follows. From the estimates implemented, the value of the functions for the average pensioners (woman and man respectively) is estimated. From these baselines, the effects of the different reforms are computed. The first policy reform analyzed (Policy Reform I) presents the estimates for a one-year delay of the effective retirement age at which pensioners start receiving their pension[7]. The case Policy Reform II presents the analysis for a 4 per cent reduction

[6] The poverty threshold is defined as 60 per cent of the Equivalized Median Income for households comprising one single person between 1995 and 2007 (EUROSTAT 2009). For the period 1986-1994 the poverty line is defined as 60 per cent of the Equivalized Mean Income estimated by Prieto and García (2007).

[7] This reform does not imply a longer contribution spell during the pensioner´s working life. The effect of the contribution spell is separately estimated.

of the regulatory base of pensioners[8]. Policy Reform III explains the effect of a three-year longer contribution of pensioners. Finally, "Total Reform" covers the combined effect of these three reformist measures.

The data source is the Continuous Survey of Working Lives (2007) drawn up each year by the Spanish Ministry of Immigration and Social Security. This sample, which has been put together each year since 2004, provides information about the working life of 1,170,000 pensioners and employed workers[9]. The analysis has been implemented by using the information of the year 2007 for standard pensioners[10]. From this data the whole path of pension benefits has been reconstructed for each pensioner in the data according to the pension formula used by the Spanish social security system (bringing them up to date by applying the corresponding indexes of consumer prices) up to the year in which the pension was recognized, which is the year the pensioner entered the system. This computation corresponds exactly to the one implemented by the administration and allows extending the panel until the generations which entered the system in the year 1986[11]. As a consequence, the work has been implemented with an unbalanced, right-censored panel data which starts in 1986 and finishes in 2007. Each pensioner enters the panel the year in which the corresponding pension is recognized and is recorded until 2007. After debugging the data base the total amount of individuals included in the study is 40,842 from which 35,222 are men and 5,620 women.

[8] This decrease would be the approximate result that could be reached if the number of years computed in the calculation of the regulatory base were increased from 15 as currently to 20, (as the Spanish government has proposed). The estimates are made over the average pension, which for the average pensioner coincides with the regulatory base since the coefficient applied is equal to unity, so estimates can be approached by means of a change in the regulatory base as is the case of this research.

[9] The Spanish social security system comprises the General Social Security Scheme to which salaried workers as a whole are affiliated (71% of the total number of those affiliated), and a Special self-employed Workers' Scheme to which those persons who are self-employed are affiliated (15% of the total number of those affiliated). The rest of the system comprises several minor regimes such as fishing workers or miner workers. This study is focused exclusively on pensioners that form part of the General Social Security Scheme.

[10] The standard pensioner is defined as the pensioner who draws a single pension and does not receive any means-tested complement for the whole period analyzed.

[11] This extension of the data allows exploding the information to the maximum available and, as a consequence, provides a gain in terms of efficiency.

4.- Results

Table 2 presents the estimates hazard ratios[12] corresponding to the different welfare determinants (pension components)[13]. The hazard ratios account for the effect of the covariates with respect to the baseline hazard (value of the hazard when all covariates are equal to zero). A covariate which does not change the baseline hazard at all would present a value equal to 1. This value would be higher than 1 for those covariates which have a positive effect on the hazard and lower than 1 for those which have a negative effect.

The positive value of the slope of the baseline hazard estimates informs about the existence of positive duration dependence for both men and women. These positive duration dependences reveal that the method used to bring pensions up to date according to the CPI does not prevent the pensioner from suffering a loss of welfare as pension ages[14], regardless of the gender. On the other hand, the different magnitude of the baseline hazard, significantly smaller for men, informs about the existence of a baseline Gender Welfare Gap (GWG). This difference leaves women in a disadvantage position with respect to men; thus, the ageing process of the pension leads to a higher welfare loss for women than for men (132.6 vs. 3.53).

[12] The time-varying framework implies that some covariates change each time period and as a consequence the hazard ratios concerning such type of covariates change each time the time-varying covariate changes. For this reason and in order to make interpretation easier, 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 (11). Where $\hat{hr}_j^q\left(t\middle|Z_j(t)\right)$ refers to the hazard ratio corresponding to covariate, *q*, $\hat{h}_j^q\left(t\middle|Z_j(t)\right)$ refers to the hazard estimates value corresponding to the covariate, $\hat{h}_j^b\left(t\middle|Z_j(t)\right)$ represents the baseline hazard estimates and *T* is the total number of periods studied.

$$\hat{hr}_j^q\left(t\middle|Z_j(t)\right)=\frac{\sum_{t=0}^{T}\frac{\hat{h}_j^q\left(t\middle|Z_j(t)\right)}{\hat{h}_j^b\left(t\middle|Z_j(t)\right)}}{T} \tag{11}$$

[13] Table 2 also presents the estimates of the coefficients and the corresponding deviation standard for each variable. The interpretation of the results is made in terms of hazard ratios.

[14] This is in line with the one obtained in Peinado and Serrano (2011).

Table 2: Results from estimates

Covariate	Women	Men
Baseline Hazard	**132.6 e^{-06}**	**3.53 e^{-06}**
Slope (Pension Age coefficient)	-2.073*	-5.5134*
	(0.1849)	(0.2215)
Constant	1.3126	-4.5496*
	(1.6018)	(1.3995)
Regulatory Base	**0.8846**	**0.7779**
	-0.002*	-0.0028*
	(0.0003)	(0.0003)
Effective Retirement Age	**0.9512**	**0.9201**
	-0.0499*	-0.0944*
	(0.0228)	(0.0183)
Contribution Spell	**0.9697**	**0.9827**
	-0.0307*	-0.0198*
	(0.0052)	(0.0043)
Reassessment	**0.1889**	**0.1098**
	-0.0157*	-0.0317*
	(0.0015)	(0.0013)
Std_u	0.2167	0.2243
Rho	0.0278	0.0297

(*) Significant at 5%
Number in parenthesis are standard deviations
Numbers in bold are the hazard ratios

Regarding the effects of each of the covariates on the baseline hazard, a one per cent increase of the Regulatory Base (RB) generates a 12 per cent reduction of the hazard to women and a 22 per cent reduction of the hazard to men as revealed by the respective values 0.88 and 0.78 (recall that the effect is measured with respect to baseline hazard so it is compared to unity). Thus, increasing the regulatory base a one per cent leads to a welfare gain for men higher than the welfare gain experienced by women.

A delay in one year of the Effective Retirement Age (ERA) at which the pensioner is retired, leads to a 5 per cent decrease of the hazard for women and an 8 per cent decrease of the hazard for men. This means that, under the current law, delaying the age at which the pensioner is retired affects the enjoyed welfare positively. However, the magnitude of the change is relatively more important for men than for women.

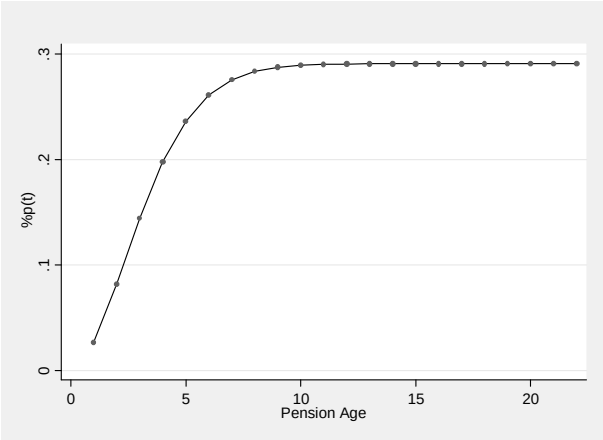
Regarding the Contribution Spell (CS), that is, the number of years the pensioner has been contributing to the system as a worker, one more year of contribution generates a 3 per cent welfare gain for women and a 2 per cent welfare gain for men as revealed by the corresponding coefficients (0.97 and 0.98). Again, the effect is different depending on the pensioner´s gender but, in this case, the fact of contributing one more year betters off the welfare evolution of women relatively more than the welfare evolution of men.

The reassessment variable, which is a time-varying covariate, is the variable that most affects the hazard rate for both genders. A one per cent increase in the reassessment generates an 81 per cent reduction of the hazard to women and an 89 per cent reduction of the hazard to men. This welfare gain, though, is 8 percentage points higher for men than for women, which strengthens the relative advantage of men with respect to women.

4.1.- The Current Gender Welfare Gap

The current Gender Welfare Gap (GWG^c) is presented in Figure 1. This GWG^c informs about the dynamics of the current gender differences that exist in the Spanish social security system, that is, the GWG which exists at present. Notice that the effect is presented in percentages. At the beginning of the period, when the worker leaves the labour market and starts drawing a pension as a pensioner, the GWG^c is positive and almost zero (0.026). As time passes, this GWG^c suffers a rapid increase up to year 10 in which it reaches value 0.29. Afterwards, the speed of the increase trend slows down to reach value 0.291 in the year 19 and subsequent years. From this result it is concluded, on the one hand, that there is a positive Gender Welfare Gap (against women) and, on the other hand that the existing GWG increases as pensions become older.

Figure 1: Current Gender Welfare Gap (GWG^c)

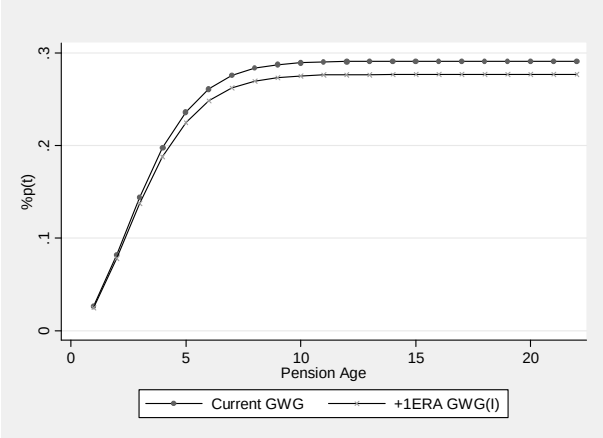


4.2.- Policy reforms

4.2.1.- Policy Reform I: One year delay of the Effective Retirement Age

When the Effective Retirement Age (ERA) is increased in one year (see Figure 2), the GWG evolves below the current GWG. When the pension is first drawn (zero year old pension) the GWG is positive and even closer to zero (0.025) than in the case of the current GWG. The GWG after this policy reform shows the same increasing tendency as the current GWG although, in this case, when the pension is 10 years old, the value of the GWG is 0.275. As shown in figure 6, this value of the GWG after the implementation of the policy generates a final decrease of the GWG equal to 0.014 points with respect to the one existing at present, that is to say, the value of the Gender Policy Effect (GPE^I) in this case is 0.014 (notice that according to Figure 6 value 0 is the current situation and the other lines indicate the evolution of the differences in GWG due to each policy reform). This 0.014 implies a 5 percent reduction of the current GWG. Consequently, delaying one year the Effective Retirement Age generates 5 per cent reduction of the gender differences that exist at present.

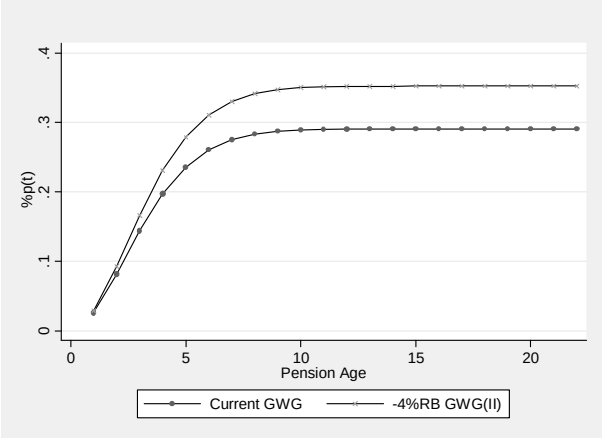
Figure 2: Policy Reform I. GWG^c vs. GWG^I



4.2.2.- Policy Reform II: Four per cent decrease of the Regulatory Base

A four per cent decrease of the Regulatory Base of the pensioners entails an increase of the GWG, which evolves above the current GWG for the whole life of the pension as it can be seen in Figure 3. For zero-year-old pensions, the GWG is equal to 0.029 and increases up to 0.35248 for the year 17 onwards. The evolution of the difference between the gaps shown in Figure 6 proves that a 4 percent reduction in the Regulatory Base causes a continuous increase of the GWG (an increasing GPE^{II}), which reaches the maximum value (0.062) for the 12 and more year-old-pensions. This value implies 21 per cent increase of the current GWG, which means that gender differences would be 21 percent higher than at the present time.

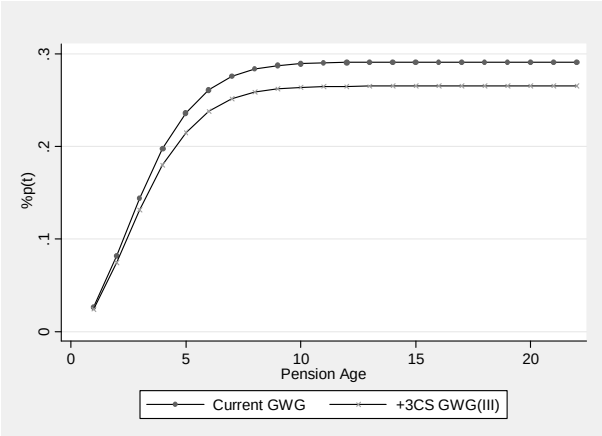
Figure 3: Policy Reform II. GWG^{c} vs. GWG^{II}



4.2.3.- Policy Reform III: Three years increase in the Contribution Spell

As figure 4 reveals, if pensioners are made to contribute for 3 more years, the GWG would evolve below the current GWG with values between 0.024 (for the one-year old pensions) to 0.2650 (for the pensions older than 13). This evolution means that the GWG will diminish from 0.0023 points for the first period the pension is recognized to 0.026 points for the pensions older than 18. This GPE^{III} implies around 9 percent reduction (for the whole period) of the currently existing differences between men and women.

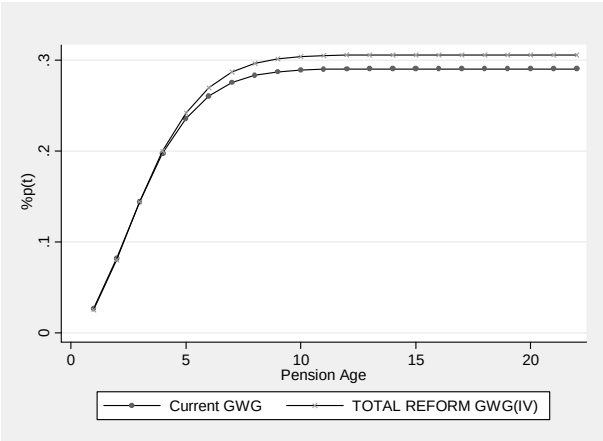
Figure 4: Policy Reform III. GWG^{c} vs. GWG^{III}



4.2.4.- Policy Reform IV: Total Reform (One year delay of the Effective Retirement Age, Four per cent decrease in the Regulatory Base and Three years increase in the Contribution Spell)

When the three reforms are implemented at the same time, this is when the Effective Retirement Age is delayed in 1 year, the Regulatory Base is reduced 4 per cent and the Contribution Spell is increased in 3 years simultaneously, the GWG decreases with respect to the current GWG for the first two years of the pension but when pension is three and more years old the GWG increases with respect to that existing at present (see figure 5). In this case the value of the GWG at the very moment the pension is recognized (year zero) is equal to 0.025 whereas it reaches value 0.306 for the year 16 onwards. From figure 6 it is concluded that a Total Reform generates a decrease of the existing GWG (increasing GPE^{IV}) in 0.001 points for the two-year-old pensions and then an increase in 0.015 points for the 10-year and older pension drawers. This evolution implies an initial reduction of the gender differences equal to 3 percent for the first year, a 2 percent decrease of the differences for the second year, and a final increase of around 5 percent for the 9-year and older pension holders.

Figure 5: Total Reform GWG^c vs. GWG^{IV}

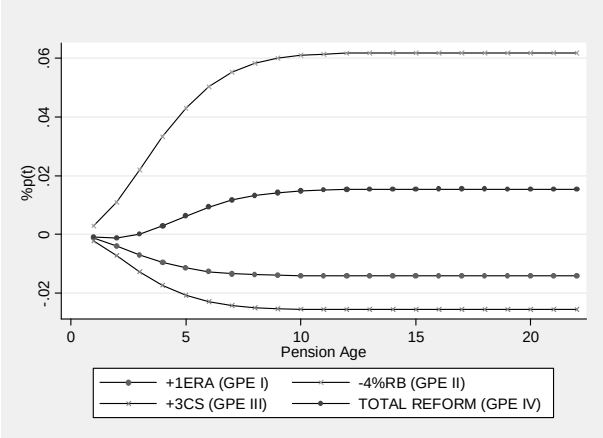


4.3.- Policy Reforms' Comparison

The analysis implemented leads to an important question for the policy maker: which policy would be the most accurate to treat or to avoid gender discrimination? The answer can be approached in the light of the Gender Policy Effects (GPE) presented

in figure 6. As explained above, the GPE of policy reform *k* is defined as the increment generated by such reform on the GWG. When no policy reform is implemented, the GWG would be the one at the present time, that is, the current GWG (level 0 in the figure). However, when any of the policy reforms is implemented, the GWG, as it has been seen, evolves above and below the current GWG. In the case of Policy Reform I (+1ERA) gender differences diminish for the whole life of the pension. This is in line with the argument in Bonnet, Buffeteau and Godefroy (2006) who encountered that the lower retirement age for women is one of the causes of gender differences against women and, as a consequence, retiring one year latter should, as it is here encountered, reduce gender differences. Additionally, the dynamics show that this reduction in gender differences is produced faster at the beginning and more slowly at the end. This diminution accounts for about 5 percent decrease of the current GWG. Policy reform II (+4%RB) brings about the highest increase in gender differences. This conclusion is also reached by Leitner (2001) and Bonnet, Buffeteau and Godefroy (2006). The dynamics of the GPE shows that gender differences increase rapidly at the beginning of the life of the pension and slow down for the 10 and more year-old pensions. This evolution generates an increase in gender differences from 11 percent (for the first period) to 21 percent (for the last period). A three years increase in the Contribution Spell of pensioners (Policy Reform III) generates a decrease of gender differences for the whole period. This evidence matches with the argument for the case of France in Bonnet, Buffeteau and Godefroy (2006), who found out that a higher contribution spell is relatively favourable to woman. The results in this paper allow quantifying the magnitude of diminution, which in this case represents around a 9 percent diminution of gender differences for the whole life of the pension. Finally, implementing the three policy measures simultaneously reduces gender differences for the two first years of the pension and then, generates an increase in gender differences equal to 1 per cent for the four-year-old pension holders, 2 percent for the three-year-old pensions and around 5 percent for those who are drawing an eight or more year-old pension. As a consequence, the implementation of the total reform (GPE^{IV}) is associated to an overall increase in the currently existing gender differences although, smaller in magnitude than the one induced by the reduction of the regulatory base (GPE^{II}) of individuals.

Figure 6: Gender Policy Effects (GPE)



In conclusion, policies consisting of a delay in one year of the age at which the worker effectively enters the system as a pensioner or an increase in three years in the contribution spell of such pensioner are the reformist measures that reduce the existing gender differences whereas a policy consisting only of a reduction of the regulatory base of pensioners increases the current Gender Welfare Gap. The simultaneous application of the three policies leads to an initial decrease and a final increase in the currently existing gender differences among Spanish pensioners due to the fact that the negative Gender Policy Effect caused by the change in the regulatory base is not compensated by the positive Gender Policy Effects generated by the two other policy measures, that is, by the one-year increase in the age at which the pensioner effectively retires and the increase in three years of the contribution spell of pensioners.

5.- Conclusions

The econometric duration model used in this paper to account for the dynamics of gender differences among pensioners and the effect of pension reform proposals on such gender differences could be usefully applied to measure gender differences in other contexts such as other countries with similar pensions systems or even developed to make comparisons between different pensions systems.

This paper concludes that in the case of Spain, i) pensioners suffer a Gender Welfare Gap that increases as pension becomes older; ii) a policy reform consisting of a delay in one year of the age at which the worker effectively enters the system as a

pensioner would progressively reduce the current gender differences around 5 percent; iii) a policy reform consisting of an inclusion of five more years of the period computed to calculate the initial pension of the pensioners increases the current gender differences from 11 percent (first period) to 21 percent (last period) higher levels than at present ; iv) a three year increase in the contribution spell of pensioners is associated to a 5 percent decrease of the current gender differences; v) the simultaneous application of the three policies leads to an initial decrease of gender differences equal to 3 percent and 2 percent for the one and two-year old (respectively) pension holders, and 5 percent final increase in the gender differences existing at present.

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DISSERTATION III

Patricia Peinado Martínez

THE EFFECTS OF SOCIAL SECURITY REFORMS ON THE WIDOW'S WELFARE: A DYNAMIC ANALYSIS

ABSTRACT

The pension system reform, induce by the estimate effects of ageing population on the financial imbalance of the system, has direct effects in the welfare or retired population. In this paper it is shown, using duration analysis, the dynamic effects that a change in the regulatory base, due to an increase in the number of years computed in the pensioner's formula, may have on the welfare of beneficiaries of Spanish widow's pensions.

KEY WORDS: dynamic welfare, widow's pension, social security, policy reforms
JEL CODES: H55, I38, J14

1.- Introduction

The pension system reform, induced by the estimated effects of an ageing population on the financial imbalance of the system, has again been a priority in the political agenda in Spain. The problem is not new given that the need for such a reform had been known for long.

However, these measures would also lead to (negative) effects on the welfare of retired population since the income-leisure relationship the future retirees will enjoy will get worse with respect to the current situation.

The ageing process of the population, on the other hand, also affects the other potential income sources to which the retired population is entitled: the financial and real assets that may have been accumulated during their working life. In theory, the deccumulation of assets, in an ageing context, will reduce the price of such assets as a consequence of the relative change produced in the size of asset buyers (the young ones) and the sellers (the retired population). It is not easy to determine the impact that the ageing process may have on the price of financial assets because of capital exportation. The impact on real assets, and especially, on households' prices faces up a lower estimation problem. Takáts (2010) estimates the negative impact for a sample of 22 developed economies and Spain is said to be one of the countries where the effects are going to be more adverse. Taken into account that in Spain the household is the most important asset families own (Bank of Spain, 2007), the future retirees may encounter, if they decide to deccumulate in order to compensate the loss of income caused by the pension system reform, lower incomes that the ones estimated at present.

The effects that the ageing process of population may have on the welfare of future generations of pensioners have not been, so far, a matter of reflection or research among experts. The interest has been taken solely in the effects of ageing on public finances and, as a corollary, in determining the most appropriate reforming measures to contain the predictable increase in the public expenditure which may be expected as a result of the increasing life expectancy.

The hypothesis behind this kind of research is that the advised reforms do not have any remarkable negative impact on the welfare of retired population, but, on the contrary, are needed to guarantee the future viability of pension systems. This hypothesis, which regarding the Social Security General Regime may be right (see first dissertation), is no longer true in the case of widow's pensions.

The features of a widow's/widower´s pension recipient are very similar in the vast majority of developed countries (Choi, 2006; Sandell and Iams, 1997; Karamcheva and Munell, 2007). In the case of Spain, the most detailed analysis about this benefit can be seen in Ahn & Felgueroso (2007). The features referred to are, basically, the two following.

The first one is related to a problem of gender. According to the Spanish Continuous Survey of Working Life (Muestra Continua de Vidas Laborales, 2007) 95.5% of widow´s pensions paid by the Spanish social security system are received by women[1]. This truth is the logical corollary of the social (and family) pattern that dominated in the past decades, characterized by a weak (and irregular) incorporation of women into the workforce. In 2009 only 35.6% of retirement pensions were drawn by women, being the quantities equivalent to 59% of men's pensions.

The second one refers to poverty risk. The Spanish Survey of Life Conditions (Encuesta de Condiciones de Vida, ECV 2007) reveals that poverty rate among Spanish men who receive a pension benefit is equal to 29% while this rate reaches 33% in the case of women. In Ahn & Felgueroso (2007), where a detailed analysis of poverty risk is done exclusively for widowed people, the risk for those men who live alone is fixed in 28.4%, a percentage which is practically identical to the one obtained in the ECV (2007). However, in the case of widows who live alone, poverty risk rises up to 36.2%, 8 points higher than that corresponding to men. Poverty risk, when men do not live alone, is practically equal for men and women (9.4% and 9.3% respectively). Differences in poverty risk, are partly the combined result, on the one hand, of the minor presence (and of the lower average quantity of the pension) of women as recipients of the retirement pension and, on the other hand, of their stronger presence in widow´s pensions, whose average in 2009 was equal to 64.7% of the average retirement pension of the system[2].

Widow´s pensions account for 26.58% of the total amount of pensions granted by social security, which in absolute terms was equivalent to 2,273,470 pensions in the year 2009. The pension system reform and, especially, the changes in the method used to compute the regulatory base, will have direct and indirect effects on the widow´s pensions given that they stem from a retirement pension.

There is a natural concern for the effects that such a reform may have on this benefit since, unless the reform is accompanied by a reform of widow´s pension, it would lead to an increase in the poverty risk among the future recipients of this benefit, the vast majority of whom are women. Given this, the objective of the present article is to estimate the effects that the reform could have on the welfare of the recipients of this benefit using the poverty rate as welfare index.

The methodology used is a duration dynamic analysis in which simulation and estimation techniques are combined in order to quantify the effects of the reform. In McLaughlin (1998) a dynamic analysis for the study of aged women is also implemented although it is not a duration analysis. With the methodology proposed here it can be observed the pensioners' welfare evolution from the moment they start

[1] In the Financial and Economic Report of the social security budgets for the year 2010 this rate was reduced to 93% for the year 2009.

[2]The average retirement pension for a man in 2009 was 1001,47 Euros and for a woman 593,49 Euros. In the case of widow´s and widower´s pensions, the quantity of the average pension was respectively 431 and 568 Euros (Financial and Economic Report, 2010)

drawing the pension in such a way that it can be studied the effect of the aging process of the pension on their welfare, an aging process which is the result of the passing of time.

The article is organized as follows. Next section contains the methodology and data used. Afterwards the results are presented and, finally, conclusions are drawn.

2.-Data and Methodology

2.1.-The pension formula

The widow's pension drawn by pensioner *i* in year *t* as shown in expression (1).The effective pension is the result of applying a coefficient[3] equal to η_t to the *Regulatory Base*[4]. The *Reassessment* variable contains the amount of the pension arising as a result of the indexing of the pension to variations in the Consumer Price Index (CPI)[5].

$$WidowPension_{it} = \eta_t \,\mathrm{Re}\, gulatoryBase_i + \mathrm{Re}\, assessment_{it} \qquad (1)$$

The widow's pension received at the moment *t* by the individual *i* is therefore the result of adding the amount of annual $Reassessment_{it}$ to the effective pension[6].

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[3] Notice that the coefficient applied η_t depends on the year *t* but not on the specific pensioner *i*. This notation has been chosen for simplicity. The coefficient also varies depending on the pensioner but, as it will be explained below, in this research we are just interested in the case regarding the standard widow's pensioner.

[4] The *Regulatory Base* is obtained in accordance with the following expression (2). TAE_i refers to the Taxable Average Earnings of 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:

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

[5] The variable "reassessment" contains two types of updating according to the CPI. On the one hand, it contains the updating corresponding to the pension from the moment the retiree started drawing the pension until the moment in which the widow´s pension is entitled. On the other hand, it contains the updating which results from the annual evolution of the CPI from the year in which the widowed pensioner started drawing the pension until the period analyzed.

[6] The widow´s pension, as well as the rest of pensions within the system, is complemented with other benefits of a means-tested nature (basically the minimum complements), which are not taken into account in this work. These complements are discretional. Every year, the government defines the minimum poverty threshold of the system according to the personal and household characteristics regarding the pensioner. It is beyond the scope of this paper to know the effect of these complements, so they have not been included in the estimates. In any case the inclusion of these complements would not alter the estimated results given that the minimum evolves below the poverty threshold and thus, does not eradicate poverty among these pensioners.

2.2.- Data source

The results shown in the following part have been obtained from the Spanish Continuous Survey of Working Life (Muestra Continua de Vidas Laborales (MCVL)) carried out each year by the Spanish Ministry of Immigration and Social Security.
This sample, which has been gathered each year since 2004, provides information about the working life of 1,170,000 pensioners and employed workers[7]. The analysis has been implemented using the information of the year 2007 for the standard widow's pensions[8]. From this data the whole path of pension benefits has been reconstructed for each pensioner in the data according to the pension formula[9] used by the Spanish Social Security System up to the year in which the pension was recognized, this is the year in which the pensioner entered the system. As a consequence, the work has been implemented with an unbalanced, right censored panel data which starts in the year 1986 and finishes in the year 2007. This panel, as explain below, is redefined for each policy analyzed according to the characteristics of the specific regulation. Each pensioner enters the panel the year when the corresponding pension is recognized and continues until the end of the period, which is the year 2007. After debugging the data base the total amount of individuals included in the study is 29,713.

2.3.- Poverty and welfare definition

Poverty line allows identifying the welfare of the beneficiary of the widow's or widower´s pension as that situation where he/she is not poor[10]. The standard threshold proposed by the European Union is used as an indicator of poverty situations. This threshold represents 60% of the median equivalised income[11].
Then, it will be said that the holder of a widow´s or widower´s pension will enjoy a positive welfare as long as the social security system provides an income flow

[7] The Spanish social security system comprises the General Social Security Scheme to which salaried workers as a whole are affiliated (71% of the total number of those affiliated), and a Special self-employed Workers' Scheme to which self-employed people are affiliated (15% of the total number of those affiliated). The rest of the system comprises several minor regimes such as fishing workers or mine workers. This study is focused exclusively on pensioners that are part of the General Social Security Scheme.
[8] The standard holder of a widow's or widower´s pension is defined as the pensioner who draws a single pension. This pension has a regulatory base to which the general coefficient approved by the law is applied. Such coefficient is 0.45 to 0.52 according to the year of application.
[9] The reassessment corresponding to the period of time from which the retiree starts receiving the pension to the moment the widow starts drawing it has been assumed to be fifty per cent of the effective pension as revealed by the estimates implemented to the data.
[10] This is in line with the argument of Cellini, McKernan and Ratcliffe (2008).
[11] Poverty threshold is defined as 60 per cent of the Equivalised Median Income for households comprising one single person between 1995 and 2007 (EUROSTAT, 2009). For the period 1986-1994 the poverty line is defined as the 60 per cent of the Equivalised Mean Income estimated by Prieto and García (2007).

(pension) which allows him/her to keep his/her living standard above the level of poverty threshold.

These pensioners, besides the income they receive from the social security system, may have access to other different sources of alternative income, especially the money they have saved during their working life. These other sources are not considered in this work, since the study of poverty situations among widowed population is not the aim of this paper. *Poverty thresholds are used exclusively as an index to evaluate the welfare provided by the system*[12].

In the following, it will be referred to "welfare" and "probability *not* to be poor" as synonyms.

2.4.- Methodology

The methodology used in this work combines simulation and estimation techniques in order to quantify the effect of the policy reforms under study on the welfare of the beneficiaries of a widow's pension.

First of all, since each policy reform gives rise to a different path of pension benefits, the counterfactual paths are simulated according to the corresponding regulation under study. These different paths are then separately used in the estimates presented below. As a consequence, each path (actual and counterfactual) will give rise to different estimates and, the analysis of these estimates will be the base to, finally, evaluate the effect of the different policy reforms.

The estimates of the welfare of the beneficiaries of a widow's or widower´s pension are implemented by means of a duration analysis. Duration analysis allows observing the changes which take place in such welfare as the pension "gets older". That is, as the purchasing power of the pensioner diminishes as time passes by because of the method used to bring pensions up to date. As an example, a widow or widower may not be poor with the income provided by the system for a certain number of years. Yet, this individual may later incur a poverty situation due to the "aging of his or her widow's pension". "The pension aging" occurs because pensions are updated depending on the evolution of the CPI, whereas the poverty threshold used to make reference to the welfare also evolves depending on the changes of productivity. This analysis, thus, allows understanding the evolution of the probability of these pensioners to incur poverty situations. In other words, it allows observing the evolution of pensioners´ welfare from the very moment they start to receive their pension until the end of the period.

The technique consists of a non-parametric duration analysis, which is implemented by means of the Kaplan Meier Survivor Function (1958). This function allows

[12] According to Ahn & Felgueroso (2007) the widow' pension, for a lonely living woman, represents around 65% of her income.

observing the evolution of welfare measured in terms of the probability to be poor associated with the person receiving a widow's or widower´s pension.

The probability for a pensioner to be poor (poverty risk) in period *t* is given by one minus the value of the Survivor function[13] in such moment *t,* where the survivor function is described as in expression 3:

$$\hat{S}(a_m) = \prod_{r=1}^{m} \left[\frac{(N_r - E_r)}{N_r} \right] \qquad m = 1,...,M \tag{3}$$

where $\hat{S}(a_m)$ is the estimates of the probability not to be poor in the moment *m*, N_r is the number of individuals who remain in the sample in the moment *r* (because they have not been censored or because they have not entered a poverty situation) and E_r is the number of people who precisely in the moment *r* fall below the poverty line. With *M* being the maximum number of periods analyzed, 22 in this work.

The policy effect (PE_{im}) is measured by means of the welfare gain or loss induced by such policy. As shown in expression 4, these welfare losses and gains are quantified as the difference between the respective estimated functions of the probability to be poor for the specific time period so that we can observe the dynamics welfare with respect to the initial welfare level registered for the present time. Where the initial welfare level is identified with the probability not to be poor when no policy has been implemented $\left(\hat{S}_0(a_m)\right)$

$$PE_{im} = \left(1 - \hat{S}_i(a_m)\right) - \left(1 - \hat{S}_0(a_m)\right) \qquad m = 1,...,M \quad i = 1,2,3 \tag{4}$$

The estimates implemented are presented in three steps. The first step (Present), which is presented with the second step, shows the value of the function for the holder of the widow´s pension in the present time. The second step (Changes in the regulatory base) quantifies the effect that an increase in the number of years computed in the pension formula may have on the welfare of those pensioners who are beneficiaries of a widow´s pension. This change in the regulatory base[14] would bring about a reduction of the pension that would depend on the exact number of

[13] For further reading see Lancaster (1990).

[13] The changes in the regulatory base are identified with changes in the average pension given that the median pensioner has contributed more than 35 years and, as a consequence, is entitled to the whole regulatory base.

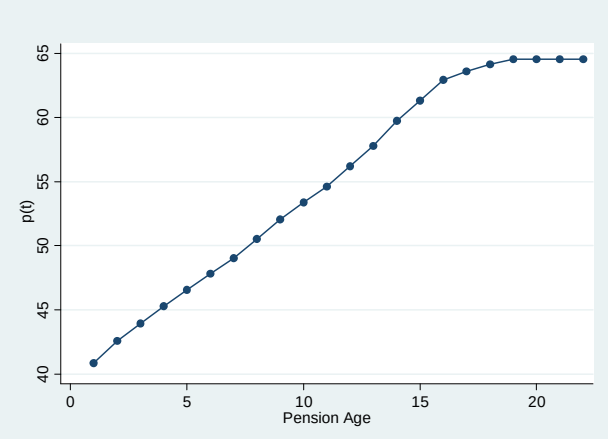
years computed. We present the results for diminutions of 3%, 4% and 5%[15]. The last step (Changes in the widow's pension coefficients) estimates the value that the coefficients of widow´s pensions should present, compatible with the feasible reductions in the regulatory base, in order to maintain the effective pension level that guaranties the welfare level currently enjoyed by the recipients of this benefit.

3.- Results

3.1.-The changes in the regulatory base

Figure 1 shows the estimates of the evolution of the probability of being poor faced by the current Spanish widows´ pension holders. As can be observed, the year in which the pension is recognized the probability of being poor is about 41 per cent. This probability continues rising as time passes by. As the estimates of the function reveals, 50.5 per cent of the beneficiaries of a widow's pensions fall below the poverty line after 8 years since they started receiving the pension. In other words, the evolution of the function reveals that 50.5 per cent of the people who have just entered the system will stand below the poverty line after 8 years drawing the pension.

Figure 1. Present: Estimates of the evolution of the probability to be poor of Spanish widow's pension holders according to pension age (52% coefficient).



[14] In De Pedraza, Muñoz de Bustillo and Rivas (2009)it is estimated that an increase in five years in the regulatory base is equivalent to a decrease in the average pension around 5%.

For example, a woman who becomes a widow in the year 2004 and starts drawing the pension in such a year 2004 is expected to fall below the poverty line before the year 2013 with a probability equal to 50.5 per cent. This poverty risk rises up to 63 per cent for the 16 year-old pension holders and to 64.5 per cent for those who have been drawing that pension for 19 or more years. Thus, the welfare enjoyed by the pensioner decreases over time as a consequence of the ageing process of the pension she/he draws[16].

Figure 2 shows the effects that would bring about, in the welfare of pensioners, a reduction in the regulatory base caused by an increase in the number of years computed in the pension formula.

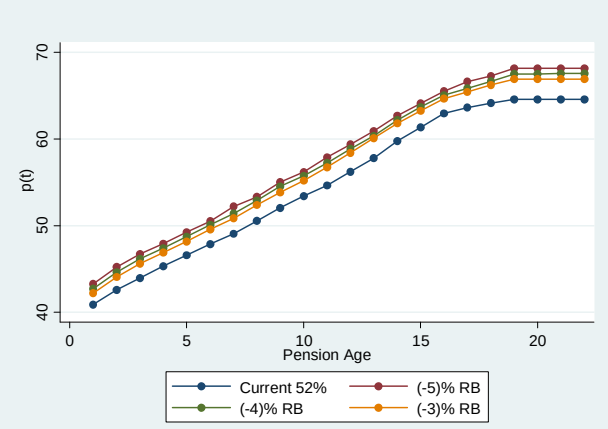
A reduction of 3 per cent of the regulatory base may cause (in the first year) an increase of the poverty risk up to 42.2 per cent; this is 1.2 points higher than the current situation. In the following years the poverty risk increases until the nineteenth year, in which it stabilizes at 66.9 per cent value, this is 2.4 percentage points higher than the current situation. In terms of welfare, the welfare enjoyed by the pensioner decreases as a consequence of the 3 per cent reduction in the regulatory base between 1.2 and 2.4 percentage points with respect to the welfare enjoyed at present.

A 4 per cent reduction of the regulatory base may cause the initial poverty risk increases up to 42.7 per cent. In the nineteenth year the risk is stabilised in a value equal to 67.5 per cent, this is 3 points higher than in the present. As a consequence, the welfare of the widowed pensioner is reduced in 1.7 (when she/he starts drawing the pension) to 3 percentage points (by the end of the period).

Finally, if a reduction of 5 per cent takes place, at the beginning of the period the poverty risk will increase up to 43.25 per cent, which implies a welfare reduction equal to 2.25 percentage points with respect to the current situation. In the nineteenth year the poverty risk will stabilise in a value equal to 68.1; this is, the final welfare will be reduced in 3.6 percentage points with respect to the present time.

[15] Including the minimum complements do not alter the results given that these complements do not help the beneficiaries to rise above the poverty threshold.

Figure 2. Estimates of the evolution of the probability to be poor of Spanish widow's pension holders according to pension age for 3%, 4% and 5% diminution of the regulatory base.



3.2.-The changes in the widow´s pension coefficients

Table 1 shows the value of coefficients needed to maintain the current welfare level if the reform is eventually implemented and have the estimated effects. For a reduction in the regulatory base equal to 3 per cent the new coefficient will be equal to 53.61 per cent; this is 1.61 points higher than at present. If the reduction is equal to 4 per cent, the new coefficient will be equal to 54.17 per cent. For a reduction equal to 5 per cent the coefficient that will maintain the current welfare level of the widowed pensioners is 54.74 per cent, which implies an increase in the current coefficient of 2.74 percentage points.

Table 1. Value of the widow´s pension coefficients compatible with the reduction in the regulatory base to maintain the current level of welfare

Regulatory Base Reduction	3%	4%	5%
Widow´s Pension Coefficient	53.61%	54.17%	54.74%

4.- Conclusions

This paper aims to present the effects that a change in the regulatory base due to an increase in the number of years computed in the pensioner´s formula may have on the welfare of beneficiaries of widow´s pensions. We present different

scenarios related to different changes in the regulatory base. In the most pessimistic scenario (a reduction in the regulatory base equal to 5%) the initial poverty risk would rise from the current 41% to 43.25% implying a welfare reduction of 2.25 percentage points with respect to the current welfare level enjoyed by these pensioners. This risk would dynamically increase until 68.1 for those pensioners who own a nineteen-year-old pension, which is 3.6 percentage points higher than at present. In the most optimist scenario (a reduction in the regulatory base equal to 3%) the initial poverty risk would rise to 42.2% and for those pensioners owing a nineteen- year-old pension the risk would be equal to 66.9%, reducing the welfare level of these pensioners between 1.2 and 2.4 percentage points with respect to the welfare they enjoy at present.

It is also shown that an increase in the coefficient applied to the regulatory base from the current 52% to 54.74% (for the most pessimistic scenario) would maintain the current level of welfare enjoyed by the beneficiaries of this pension.

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