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Situation and sustainability of the Spanish Pension System in 2050

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Abstract

Pensions of every kind account for the major income sources of a significant part of the population. The implications of said income sources are many, three of them are of major importance in any society: social effects, granting certain levels of income ensures that socially detrimental situations are kept at bay (crime, neighborhood's decay, radicalization of any sort…); granting income sources to specific segments of the society fosters consumption, contributing in turn, to the overall economic cycle; last but not least, moral effects must be bore in mind too. In Spain, since 2012, contributions are outweighed by expenses, creating a deficit that grows wider year after year due to, mainly, macroeconomic factors and the very design of the Spanish Pension system, despite several modifications, the current system seems to be unfeasible in the long-run. This work aims at, based on previsions and trends of the main macroeconomic variables affecting the pension system computed through a set of econometric models, conduct and provide a forecast of both the expected revenues and expected expenses of the Spanish Pension System in 2050 to assess whether the system will experience a surplus, a deficit or will be perfectly balanced.

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1.Introduction

Pensions of every kind account for the major income sources of a significant part of the population; disabled, retirees, widows in some cases and, in average terms, vulnerable collectives that exhibit lower income levels than the remaining part of the society. The implications of said income sources are many, three of them are of major importance in any society: social effects, granting certain levels of income ensures that part of the population will be able to enjoy decent or at least acceptable living standards that will permeate in society affecting the overall well-being of its citizens and ensuring that socially detrimental situations are kept at bay (crime, neighborhood's decay, radicalization of any sort…); economic effects are substantiable too, granting income sources to specific segments of the society allows them to conduct certain economic activities that otherwise could not, fostering consumption, contributing in turn, to the overall economic cycle; last but not least, moral effects must be bore in mind, people who are not able to fend for themselves, must be taken care of, no matter the reason behind their inability to do by themselves, societies as such have a duty to fulfill towards them, to ensure that they can live with dignity as both citizens and human beings.

Today, economic and especially demographic variations and shifts threat to jeopardize the feasibility of pension systems around the world, burdening even more systems that seem to be at the verge of collapse.

When it comes to pension systems, there exist two main approaches, the Pay as you go system, and the fully founded one. Fully founded ones are designed to increase and foster two of the tree pillars of the pension system, namely the second and third, "work related pension schemes" and "private savings", at the expense of the first one, "basic government pension"; contrarily PAYG system aims to reenforce the first pillar that results in weaking the remaining two. PAYG systems entail, therefore a high degree of intergenerational solidarity, what makes its functioning greatly dependent upon demographic variables.

The Spanish pension system is found under the umbrella of the social security system, that provides other benefits besides pensions; however, 88.62% of social security's resources are devoted to pensions, Seguridad Social. (2021). That is why in this work we will address only this component.

The public pensions system exhibits two different modalities of benefit, basic assistance directed towards citizens below a certain income threshold financed via taxes; and contributory ones, of compulsory nature financed through the contributions of both employers and employees.

Since the system is conceived as a pay-as-you-go one, intergeneration solidarity is key, that is why financing is conducted, mainly, via contributions by both employers and employees, and in an ancillary way via public funds come from the national budget and

in a marginal way, via private savings and employment pensions schemes (5.3% of the total retirement pension Inverco. (2015)).

Within the system we find two well defined and separate kind of pensions: contributory and non-contributory ones. In view of the fact that contributory pensions account for 91.43% of all pensions, Seguridad Social. (2021), we will not address non-contributive pension benefits.

The revenues to meet the expenses incurred by contributive and non-contributive benefits are collected through three main sources, employees' contribution, accounting for 28.104.046.290 Seguridad Social. (2021); employers' contribution accounting for 88.245.727.080€ Seguridad Social. (2021) and national budget, currently the amount provided directly by the state to finance contributory pensions is 24.417.360.000 Seguridad Social. (2021).

The Spanish public pension system has faced and still must face serious demographic and macroeconomic challenges and problems, said problems are expected to exacerbate seriously under a normal scenario that is without aggravating circumstances let alone under a scenario marked by economic crisis and recessions. To face past challenges and to face those yet to come, the system has ben is and will be subject to structural reforms that are to aim at increasing its resiliency and lifespan.

The first notorious reform took place in 1985; the minimum contributory period was enlarged, shifting from 10 years to 15 years; that is the minimum number of years to be eligible for a contributory pension.

The reform resulting from the "Toledo pact" entered into force in 1997 after being entailing an increase in the number of regulatory bases taken into account to determine the amount of the pensions, shifting from 8 to 15 years.

The reform conducted in 2001, allowed early retirement under some circumstances and only if the citizen was over the age of 61.

In 2003 and 2004 two laws were enacted regarding the role and financing of the reserve fund. Said laws stipulated that surpluses in contributions were to be devoted to finance the fund after the end of each exercise

New reforms were carried out in 2006, in which eligibility criteria for contributive pension, notably disability pensions criteria were stiffened.

In 2011 new reforms were agreed, retirement minimum age was set on 67, 2 years beyond that of the last reform, pensions would be determined based on a contributory period of 25 years instead of 15 as previously settled, in order to be eligible for 100% of the pension it was required to have contributed 37 years instead of 35.

During 2013 the most controversial reform took place. The reform modified the way pensions were revalorized detaching them from the CPI. Introduction of the so-called sustainability factor.

The last reform, carried out in 2020 aims to hinder, discourage and reduce the number of early retirements by fiscal penalization. The valorization according to CPI was retook and the sustainability factor that was supposed to enter into force firstly in 2019 was suspended until 2023.

This work aims to tackle and to expose the problems to be faced by the Spanish pension system. Spanish pensions, are arranged within the frame of a so-called fixed benefit scheme; clearly belonging to the Pay as you go system scheme. Contrarily to the fixed contribution scheme that allows for adjustments of pensions based on the economic situation of the country, fixed contribution schemes disassociate the benefit from the country's economic situation.

To properly analyze the problems in the Spanish pension system and to better fathom its feasibility, the expected benefits of the current system as it is today defined will be analyzed under different scenarios, those scenarios will include expected variations of the most relevant variables considered in the system until 2050.

Different works already tried to expose possible outcomes conducting estimations of the evolution of several macroeconomic factors, some of these works namely Gil et al. (2008), Alonso-Meseguer et al. (2005) and Aino Salomäki. (2006) have provided a basic framework from which to lay out and conduct this work; which in contrast to the above-mentioned ones aims exclusively at exposing the impact that of some of the most well-known macroeconomic variables pose upon the Spanish Pension system as well as at providing a forecast of the possible imbalance between revenues and expenses stemming from the system until 2050.

2.Literature Overview

Different works have been conducted trying to provide future projections regarding expenditure directly related to pensions and social security. Some of them have been considered and have provided a good template to conduct this work.

Within the frame of the Spanish pension system Gil et al. (2008) elaborated a static-microsimulation model aiming at providing a projection of the pension expenditure during the period 2004 – 2050. In this paper the main contributions relate to pensioners' heterogeneity, specifically in terms of pension category, of social security regime, type and gender. The whole social security system is addressed in the paper, and it is explicitly linked the projection of retirement pensions to the rest of contributory pensions. Difference in pensions based on gender are also tackled. According to the study, pensions expenditure will reach its summit in 2045, afterwards a downward tendency is expected. Expenditure in pensions is mainly driven by the evolution in retirement pensions, that are expected to rise in terms of both quantity and beneficiaries. Net present values analysis (interest ranging from 3% to 5%) has been conducted under different scenarios that modulated productivity growth, migrations, and labor market participation over 55 years old; migration flows seem to be the variable that has the greatest impact on the projection results.

Still within the frame of the Spanish pension system Alonso-Meseguer et al. (2005) aimed at providing pension expenditure projections under demographic uncertainty. The approach follows stochastic population projections to obtain stochastic pension expenditure projections for the period 2004 – 2050. Conclusions are interesting provided that they reflect clearly and separately revenues and expenditure. It is shown that revenues remain relatively stable related to GDP, there is no sharp or dramatic decline and what is more, after 2015 revenues increases; the problem exposed is expenditure, baby-boomers retirement will mark the most delicate point for the system due to the number of retirees itself but also to the substantial pension they will be entitled to, the expense peak is expected by 2040 -2045. The work underlies the deficit resulting from this imbalance, which will reach up to 10% of GDP by 2050 by the probability of 90%, it takes into account as well, the debt resulting from said imbalance which is expected to reach between 80% and 280% with an 80% probability.

Yet within the frame of the Spanish pension system Doménech et al. (2008) using a totally different approach tries to provide projections of pension expenditure up to 2060. According to the work a key issue is uncertainty and lack of information among citizenship, it is shown how that makes it extremely difficult to take unpopular measures that are deemed adequate from an economic and empirical point of view. In the work, the aggregate or growth accounting approach is used to formulate projections and reach the predictions, the main expenditure driving force is the general ageing of the population, mildly attenuated by meager and decreasing immigration flows. Conclusions states that Spain must conduct modifications in the social security and its financing, deep and far-reaching modifications inspired in those taken by countries like Denmark and Sweden; said modifications will be most likely unpopular, however the research show that not only are they necessary to long-term sustainability but also that through a clear and transparent explanation of the situation and the changes intended, the hostility and opposition and consequently, the difficulty towards the implementation of these measure could shrink significantly.

If we look outside, different works try to tackle the same problem with similar approaches.

Under the frame of the European Union Aino Salomäki. (2006) reviews the projections of the Economic Policy Committee and the European Commission, it takes into account, besides, data from each national authority and tries to provide a more in-depth understanding on the evolution of projected public pension expenditure. It analyses the main demographic and macroeconomic trends across countries, acknowledging that conclusions, trends and situations may vary across countries due to the lack of absolute convergence at economic, political and social level. It states that the sensitivity of the systems to macroeconomic and demographic shocks varies considerably across countries depending on the design of pension systems. It is shown that the projections seem not to be sensitive to higher or lower interest rates as the public pensions are not funded in the vast majority of Member States. The conclusions state that besides the overall ageing of the European citizenship, the growth rate of wages and the growth rate of pensions are growing apart, being the latter the one increasingly more rapidly on a regular basis. It remarks the fact that only 4 countries out of the 25 have linked pension growth rates to wages growth rates. The paper states that in 2050, pension expenditure will be at its peak all over Europe, and that disparities between wages and pensions growth rates could exacerbate even more a situation barely sustainable.

Tackling different OECD countries Bongaarts. (2004) provides forecast of the expected pension expenses between 2004-2050 based on the evolution of macroeconomic and demographic variables (employment, fertility, dependency ratio, pensioner ratio…). Forecasts of all the relevant variables are carried out and used followingly to estimate future pension expenditure trends; according to the study, for the countries analyzed, the expense incurred in 2050 if the pension system remains unchanged will be unsustainable due to the burden that should be incurred on working population to meet this level of expenditure. Several policy proposals are presented, the main ones entail reducing overall ageing by fostering fertility and accepting immigration at greater scale, reduce social security expenditure by rising the age of retirement and reducing pension benefits, and increase labor force participation. As conclusion, the work states that in the long run, countries relying on PAYG systems will be forced to undergo some serious and in-depth measure since otherwise the expense incurred by pension benefits will entail a burden of around 70% of a citizen's gross wage. None of the proposed solutions are oblivious to political consequences and costs, and that could pose extra hindrances.

Extensive work has been conducted regarding partially capitalized pension systems or multipillar ones. Regarding Denmark's pension system, Jørgen. (2016) exposed the main characteristics of the system while enumerating possible threats and future challenges. The paper exposes in detail the functioning of the danish system as well as the reforms that It has undergone. Conclusions states that despite being more resilient to demographic shocks, the system relies to a greater extent than PAYG systems do on financial markets, making it more vulnerable to interest variations. Besides, the complexity of the system makes it understandable only to experts, excluding the main part of the population, it argues that pension benefits as well as benefits stemming from private savings are subject to taxations; since the system varies delays retirement age as life expectation increase, health levels vary greatly across income levels it is argued that the system exhibits a tendency to polarize the population based on income levels, creating disparities among the society.

3.Pension Schemes: Structure

Pension systems differ across economies and societies; this diversity relates to different cultural, economic and demographic matters; a good way to gain insights is to address them from the "three pillars perspective".

According to this approach, all systems share a common structure, their differences lie only upon which pillar or pillars, they stress, and the fashion they are regulated. OECD. (2005).

- First Pillar: Basic or Universal level, managed entirely by the state, aims at ensuring a minimum level of income and a minimum living standard for the citizenship. Basic income stemming from the first pillars do not differentiate between contributors and non-contributors. First pillar benefits rest upon three principles; universal level payment system is based on intergenerational solidarity; it is a proportional one, pensions are closely related and determined by the level and number of contributions each citizen conducts; contributory schemes ensures that contributing citizens will be granted higher pensions than non-contributors while ensuring minimum levels of income for the last ones. It is of compulsory nature; that is, its financing is perceived as a compulsory saving via taxes and other instruments.

- Second Pillar: Employer's contributions and work-related pension schemes, aimed at raising amounts to complement public pensions. Funds raised shall be capitalized and therefore the final amount is always subject to financial markets' behavior. The obligatory nature of these contribution varies across nations, and so does its management.

- Third Pillar: Private savings, private money devoted to financial assets' purchase like retirement plans and other funds. They are entirely voluntary and managed by private sector.

Depending on which of the pillars is fostered, the resulting system is different and so are the implications and its resilience and endurance towards macroeconomic shocks.

There are mainly two paths, either reenforce the role of the state by stressing the first pillar, or boosting private income sources by increasing either second or third pillar or via a combination of both.

First pillar's size increases are likely to reduce both second and third pillar. Extensive work has been conducted regarding public pensions and greater benefits implication on

private saving and the results are conclusive, those variables are inversely related; even though studies on other macroeconomic variables like consumption delivered unclear outcomes and inconclusive results, consumption seems to be positively affected by increases in first pillar's income sources Willmore. (2000).

Increasing the importance of the first pillar leads to the adoption of a Pay-as-you-go system, in which contributions of current workers are used to pay current retirees' pensions, it is a system strongly linked to the principle of intergenerational solidarity, the state will be in charge of, firstly, collect the required resources to finance benefits and pensions, and then, a redistribution will be conducted. In this scenario, the state ensures not only basic universal levels of income but also grant contribution-related benefits that move away from basic income levels Hernández. (2009).

- Defined benefit pension schemes: Pension is determined throughout a process that takes into account a series of known and fixed variables that ultimately lead to a fixed invariable amount. Spain and France are good example of countries with said system. OECD. (2005).

- Defined contribution pension schemes: Also known as national account system, it takes into account variables that vary in time, that is, the economic demographic or political situation in the country can affect differently these variables, that is why retirees won't be able to forecast their future pension with full accuracy until retirement. Swedish pension scheme is a good example. OECD. (2005).

Increasing second and third pillar's income sources by either incentives or by a blatant reduction of first pillar's sources reduces the degree of intergenerational solidarity required in order the system to thrive; it is argued that, and current facts seem to endorse the hypothesis, that systems based on a complementarity of both second and third pillar are less vulnerable to demographic shocks, providing greater resiliency to the system and the economy Hernández. (2009). These systems follow a capitalization. In this scenario the state grants only basic income levels.

- Fully capitalized system: Main retirees' income sources stem from the second and third pillars. Private investment and employers' contributions are to be enlarged via capital markets; benefits should offset the lack of substantial state aid, this particular system is characterized by a reduced role of the state regarding pensions. We can find it in E.E.U.U and across the main part of South America Tapia, W. (2008).

- Partially capitalized system: Also known as mixed system and currently one of the most widely extended. It is based on the coexistence and complementarity of a relatively important first pillar and an equally important second or third one. The state should provide a minimum level of income that can include state pensions and other benefits, employers may provide in turn resources with

which structure a retirement plan, but indeed a key part is made up of private savings. It is worth mentioning that first pillar can be structured as a defined pension scheme or as a defined contribution one, while keeping the remaining pillars unchanged. This system is currently adopted in Germany, the Netherlands, Denmark and the main part of central Europe nations Tapia, W. (2008).

4.The Spanish pension system

4.1 The system at a glance

Spanish pension system is structured, today, as a defined benefit scheme "FEDEA. (2013)". It can be found under the umbrella of the social security system, that provides other benefits besides pensions; however, 88.62% of social security's resources are devoted to pensions, Seguridad Social. (2021), that is why in this work we will address only this component.

The public pensions system exhibits two different modalities of benefit, basic assistance directed towards citizens below a certain income threshold financed via taxes; and contributory ones, of compulsory nature financed thanks to the contributions of both employers and employees.

Pension determination in Spain was supposed to include, the so-called "sustainability factor", a set of measures that modify the parameters and variables used to compute pensions based on the economic and demographic situation the country find itself in 2023, that would reshape the current scheme into one of defined contribution; currently, this factor is suspended. The system underwent modifications of the variables used to determine pensions as well as the criteria to be eligible for one, in other words, continuous modifications and reforms are conducted in the system in order to adapt pensions and other benefits to the current demographic and economic scenario.

Since the system is conceived as a pay-as-you-go one FEDEA. (2013), intergeneration solidarity is key, that is why financing is conducted, mainly, via contributions by both employers (variable amount depending on the nature of the activity and the sector centered around 30% of worker's gross wage) and employees (variable depending on the number of extra hours and centered around 6.4% of the gross salary Seguridad Social. (2019); in an ancillary way via public funds come from the national budget and in a marginal way, via private savings and employment pensions schemes (1.5% of the total retirement pension expense Inverco. (2015)).

Within the system we find two well defined and separate kind of pensions contributory and non-contributory ones Seguridad Social. (2021).

Non-contributory pensions are granted to all those citizens over the age of 65 years not having contributed as many years or as much as required to be eligible for a pension and perceiving income levels below 5.639,40 € yearly; the age requirement varies when the citizen is afflicted with a disability level of 65% or beyond, under this circumstance, the solicitor must be under the age of 75 and over the age of 18 years old. Other requirements such as residence and nationality must be met as well. Disability can include mental health issues.

The maximum pension of the kind available for an individual living alone is 5.639 € yearly.

Non-contributory pensions are fully financed by the state via national budget. They accounted for roughly 1% of the Spanish GDP in 2019, Seguridad Social. (2019).

4.2 Contributory benefits

Contributory pensions require that the solicitor or the citizen originating the pension be or have been an active contributor towards social security during a period of time that may vary depending on the benefit solicited. There are different benefits within the category.

Contributory retirement pensions are granted to citizens having contributed up to a minimum level and being over a certain age. To be eligible for retirement pension, the solicitor must be over the age of 65 years as general rule, yet there are casuistries that allow for an early retirement. Pensions cannot exceed or fall short of certain limits. The amount of said benefit is determined according to the defined benefit and a contributory scheme, that takes into account the labor record of the solicitor. Contributory pensions are computed as follow Seguridad Social. (2021):

1. Contributory Base: The social security contributions conducted up to 24 years (288 months) previous to retirement are added together. These contributions vary depending on the gross yearly salary.

2. Regulatory Base: The resulting feature is divided by the total number of years taken into account multiplied by 14, which is an estimation of the total amount of salaries (12 ordinary payments + 2 extra each year). Today, the denominator is 336 yet it is likely to increase in the future. The result is the regulatory Base.

3. According to the total number of years contributing the percentage of the regulatory base eligible varies, the more years contributed the larger the percentage is up to 36 years contributed which grants a 100% of the regulatory base. See table 1.

4. Solicitors are allowed to retire before or after the minimum age of 65 years, depending on whether they are voluntarily asking for retirement or it is the firm that encourage or force them to do so, fiscal reductions and rewards are applied in such scenarios. See table 2 and table 3.

Contributory retirement pensions are, on average substantially greater than non-contributory ones, being the maximum 37.904,86 € yearly and they accounted for 12.6% of SS expenses in 2019, Seguridad Social. (2019).

Widow's pension, are contributory pensions that will be granted to the spouse of a deceased citizen should the criteria is met. If the deceased citizen was beneficiary of a contributory pension or a disability one or if the citizen has contributed 500 days within the last 5 years of life, the spouse will be eligible for said pension Seguridad Social. (2021).

Total disability Pension: benefits of the sort are granted to citizens that have suffered accidents, injuries or have undergone medical surgeries or procedures that somehow limit their labor capacity making them unable to conduct any labor task. There are degrees of disability, partial professional disability, forcing a reduction of the solicitor's activity by a 33%; total professional disability, implying that the solicitor can conduct some activities but not its main one or the one in which is currently employed; total disability for all job and activity; great disability, when the solicitor requires of other people's help to carry out with its daily live. According to the general regime, the citizen will receive a single payment for a partial professional disability, accounting for 24 last regulatory bases; for total professional disability, the monthly pension will account for 55% of the last regulatory base; for total disability for all job and activity, the monthly pension will account for 100% of the last regulatory base Seguridad Social. (2021).

Orphanage pension, benefit granted to the deceased citizen's offspring under certain circumstances. The beneficiary must be below the age of 21, if the beneficiary exhibits high levels of disability this criterion is disregarded; should the solicitor has no income sources or income sources below the minimum interprofessional salary they age criterion would be set below 25 years old. To originate a pension of the sort, the deceased citizen must have contributed at least 500 days during the previous 5 years in case of being an active member of the social security, in case of not being an active member, contribution period will take into account 15 years before passing Seguridad Social. (2021).

4.3 Financing sources

Social security financing:

- Revenues:
    - Employees' contribution:
      Contributions of both employers and employees are defined and stipulated in different regimes of the social security, each regime may stipulate the intervals or the percentage with which contributors must contribute to the system, regimes are diverse to properly address the different nature of the activities and sectors as well as the different kind of contracts. We will proceed to explain the general regime.
      Employees will devote a certain percentage of their contributory base; as general rule, full-time and part-time employees will devote 4.7% of their

regulatory base to social security financing, in addition, 1.55% of it will be devoted to social security as unemployment contingency.
Contributory bases are defined within intervals that takes into account only the gross base salary of the worker. These intervals vary depending on the nature of the activity and the sector it belongs even within the general regime. Currently, social contributions from employees account for 28.104.046.290€, Seguridad Social. (2021). See table 4, table 5 and table 6.

- Employers' contribution:
  According to the general regime, employers are bound to contribute with a certain percentage of employees' contributory base, as a general rule 23.60% for social security and 5.5% as unemployment contingency.

  Given the importance of self-employed in Spain, a regime stipulates their unique features and specifics. According to said regime, they will contribute with a 28.3% of the employee's contributory base. Currently, social contributions from employers account for 88.245.727.080€, Seguridad Social. (2021).
  See table 7.

- National Budget:
  Progressive and direct contributions of the state of permanent nature that reflected and detailed in the general national budged. Furthermore, the state is in charge of non-contributory pensions, they are entirely financed through special funds channeled directly from the national budget, yet the management and administration of said pensions lies upon the Autonomous communities. Currently the amount provided directly by the state is 31.177.469.000€, from which 7.003.864.540€ are to be destined to non-contributory pensions, Seguridad Social. (2021).

4.4 Systems reforms

The Spanish public pension system has faced and still must face serious demographic and macroeconomic challenges and problems, said problems are expected to exacerbate seriously under a normal scenario, without aggravating circumstances let alone under a scenario marked by economic crisis. To face past challenges and to face those yet to come, the system has been, is and will be subject to structural reforms that aim at increasing its resiliency and lifespan.

The first notorious reform took place in 1985 Palier, 2010, p.189; the minimum contributory period was enlarged, shifting from 10 years to 15 years. The number of contributory bases (years) taken into account varied as well, from 2 to 8 years previous to retirement were considered to determine the quantity of the pension.

The reform resulting from the "Toledo pact" entered into force in 1997. The new reform increased the number of regulatory bases taken into account to determine the amount of the pensions, shifting from 8 to 15 years, fixed pensions to a revalorization according to the evolution of the CPI and eliminated the thresholds that once could hinder contributions below the maximum. Besides, a reserve fund was created as to offer some financial relief in case of the social security finding itself in a plight. The very same Toledo pact stipulated that revisions must be conducted after 5 years Hernández et al. (2017).

The reform conducted in 2001 allowed early retirement under some circumstances and only if the citizen was over the age of 61; the reform aimed at ensuring and encouraging retirement beyond the age of 67 via fiscal incentives Hernández et al. (2017).

In 2003 and 2004 two laws were enacted regarding the role and financing of the reserve fund. Said laws stipulated that surpluses in contributions were to be devoted to finance the fund after the end of each exercise that is after having satisfied all Social security's expenses Hernández et al. (2017).

As result of the revision of the pacts in 2003, new reforms were carried out in 2006, said modifications encompassed the alterations of the contributory bases taken into account, from that reform on, the computation would be conducted based on the effective contributed days up to 15 effective years. Partial retirement was allowed at the age of 61 only if the solicitor could prove 30 years of contribution. Eligibility disability pension criteria were stiffened Hernández et al. (2017).

In 2011 new reforms were agreed, said reforms entered into force in 2013. Again, retirement minimum age was set on 67, 2 years beyond that of the last reform, pensions would be determined based on a contributory period of 25 years not 15 as previously settled, in order to be eligible for 100% of the pension it was required to have contributed 37 not 35. Before long, in 2013 a new law, complemented this reform, aiming at increasing citizenship's proneness towards working beyond the minimum retirement age by increasing fiscal incentives, last but not least, early retirement requirements were stiffened and the age in which solicitors could apply for it increased Hernández et al. (2017).

During 2013 the most controversial reform took place. The reform modified the way pensions were revalorized, while the revalorization could not be below 0.25% nor over 0.50% over CPI's increase, they were no longer subject to the CPI, revalorization was conducted based on a formula linking revenues and expenses of the social security system. Furthermore, a new variable was used to compute pensions, the so-called sustainability factor was supposed to enter into force in 2019, it would relate the initial pension with the life expectancy over the age of 67, the factor would be subject to supervision and should it be necessary, modified every 5 years. This reform de facto

turned the Spanish pension system from a defined benefit scheme into a defined contribution one Hernández et al. (2017).

The last reform, carried out in 2020 aimed to hinder, discourage and reduce the number of early retirements by fiscal penalizations, 2% will be subtracted directly to the regulatory base if the solicitor contributed at least 38.5 years, the reduction decreases as the number of years contributed increased, reaching the minimum reduction, 1.625%, when contributing 44.5 years for each trimester until the solicitor reaches 67 years old. Said reform retook the valorization according to CPI and suspended the sustainability factor that was supposed to enter into force firstly in 2019, and after a bilateral agreement between conservative parties in 2023 Hernández et al. (2017).

5.Data and Sources

To properly conduct this work, 30 different variables have been selected and assessed, all of them numerical and continuous.

Dependent variables:

Expenses: Expenses incurred in the social security system. Ranged from 1995 to 2021, expressed in € thousands; extracted from the Spanish Social security website.

Revenues: Revenues of the social security system. Ranged from 1995 to 2021, expressed in € thousands; extracted from the Spanish Social security website.

Independent variables:

Number of pensioners: Citizens entitled to a pension. Ranged from 1995 to 2020, expressed in individual units; extracted from the Spanish Social security website.

Average pension: Average pension to which citizens are entitled. Ranged from 1995 to 2020, expressed in units of euros; extracted from the Spanish Social security website.

Average effective retirement age: Average age at which citizens decide to retire. Ranged from 2005 to 2020, expressed in years; extracted from the Spanish Social security website.

Life expectancy: Average period citizens are expected to live. Ranged from 1995 to 2019, expressed in years; extracted from the National Institute of Statistics (INE).

NAWRU: Non-accelerating wage rate of unemployment, measure of structural unemployment. Ranged from 1995 to 2021, expressed in percentage units; extracted from the European commission's database.

Number of contributors: Number of citizens devoting part of their gross wage to social security. Ranged from 1999 to 2020, expressed in individual units; extracted from the Spanish Social security website.

Number of firms: Number of firms existing in Spain. Ranged from 1999 to 2020, expressed in years; extracted from the National Institute of Statistics (INE).

Average wage: Mean of official perceived wages in Spain. Ranged from 2000 to 2019, expressed in units of euro; extracted from the OECD's database.

Auxiliar Independent variables:

Health public expenditure: Public resources devoted to health services. Ranged from 2002 to 2019, expressed in € thousands; extracted from the Spanish Health Ministry's webpage.

Net average income per capita: Yearly income perceived on average by citizens, measure of structural unemployment. Ranged from 2008 to 2019, expressed in units of euro; extracted from the National Institute of Statistics (INE).

Total population: Number people officially living in Spain. Ranged from 1996to 2020, expressed in individual units; extracted from the National Institute of Statistics (INE).

Dependency ratio: Age-population ratio of those individuals not in the labor force and those in the labor force. Ranged from 1995 to 2020, expressed percentage units; extracted from the National Institute of Statistics (INE).

Mortality ratio: Ratio of yearly deceased individuals and the whole of the population. Ranged from 1995 to 2020, expressed percentage units; extracted from the National Institute of Statistics (INE).

Average income per consumption unit: Household income devoted to each unit of consumption. Ranged from 2008 to 2019, expressed in units of euro; extracted from the National Institute of Statistics (INE).

Replacement rate: Percentage of a worker's pre-retirement income that is paid out by a pension program upon retirement. Ranged from 2008 to 2018, expressed percentage units; extracted from the National Institute of Statistics (INE).

GDP growth: Yearly variation in GDP size. Ranged from 1995 to 2019, expressed in percentage units; extracted from the World Bank's database.

Expected working life: Average years individuals will devote to official work. Ranged from 2000 to 2019, expressed in years; extracted from the Eurostat's data base.

Average contribution: Average contribution conducted by individuals. Ranged from 2000 to 2019, expressed in units of euro; extracted from the Spanish Labor and work ministry's web page.

Demand expectations: Survey encompassing both consumers and producers' expectations regarding the economic situation. Ranged from 1999 to 2020, expressed in score units; extracted from the Spanish National Bank (Banco de España).

Foreign direct investment: Amount of foreign capital devoted to investment in Spain. Ranged from 2005 to 2020, expressed in units of U.S dollar; extracted from the OECD's database.

Activity rate: Proportion of the population, both employed and unemployed, that constitutes the labor force supply of the labor market. Ranged from 2002 to 2020, expressed percentage units; extracted from the National Institute of Statistics (INE).

Average population age: Mean of the age of individuals. Ranged from 1999 to 2020, expressed in years; extracted from the National Institute of Statistics (INE).

Fertility rate: Average number of children that would be born to a woman over her lifetime. Ranged from 1999 to 2020, expressed in child per women; extracted from the National Institute of Statistics (INE).

Productivity per hour: Amount of GDP produced in an hour of work. Ranged from 1999 to 2020, expressed in units of U.S dollars; extracted from the OECD's database.

Proportion of full-time workers: Relationship between full-time workers over the total employed individuals. Ranged from 2002 to 2020, expressed in percentage units; extracted from the National Institute of Statistics (INE).

Proportion of tertiary educated individuals: Proportion of individuals with college education or equivalent with respect the total individuals. Ranged from 1999 to 2019, expressed in percentage units; extracted from the OECD's database.

Early school leaving: People aged 18 to 24 who leave education and training without attaining upper secondary qualification or equivalent. Ranged from 2004 to 2019, expressed in percentage units; extracted from the National Institute of Statistics (INE).

Competitive index: Measure (100 max, 0 min) of competitivity. Ranged from 2007 to 2019, expressed in score units; extracted from the World Bank's database.

Logistics index: Measure (5 ma, 0 min) of infrastructure development. Ranged from 2007 to 18 expressed in score units; extracted from the World Bank's database.

Households' consumption: Mean of official perceived wages in Spain. Ranged from 1999 to 2019, expressed in $ billions; extracted from the World Bank's database.

6.Analysis methodology

In order to conduct the quantitative analysis, two main econometric models have been used: ARIMA models and Linear Regression ones.

Independent variables, “Expenses” and “Revenues” have been analyzed in order to foresee their value in 2050 and to be able to forecast future imbalances. To accurately forecast said values, 8 important macroeconomic variables have been considered, which in turn, are analyzed through a set of 22 auxiliar variables that aim to provide a greater value of precision to the forecasts.

Linear regression models have been used to forecast the 2050 value of the 22 auxiliar variables (Z). Based on the forecasts, ARIMA models have been used to conduct the forecasts of the 8 macroeconomic variables (X) in 2050, which in turn, have been utilized to provide forecast through ARIMA processes of the main two variables (Y) “Expenses” and “Revenues” which have been expressed as intervals of possible future values.

Computation and statistical modelling have been conducted with Stata and Rstudio software.

Linear regression attempts to model the relationship between two or more variables by fitting a linear equation to observed data. One variable is considered to be an explanatory variable (Y), and the others are considered to be a dependent variable (X). Dependent variables are therefore explained as a function of independent variables:

$$\hat{y} = \beta_0 + \beta_1 * x_1 + \cdots + \beta_n * x_n + \varepsilon$$

Linear models are simple, easy to use predictors and estimation tools yet they exhibit several shortcomings (limitation to linear relationships or sensitivity to outliers).

The Autoregressive Integrated Moving Average (ARIMA) model operate with time series or even panel data series and aims at considering autoregressive features and factors the data could exhibit to provide accurate estimators. It combines the differenced autoregressive model with the moving average one. It is expressed as:

$$y't = I + \alpha_1 y'_{t-1} + \cdots + \alpha_p y'_{t-p} + \beta_0 + \beta_n * x_n + e_t + \theta_1 e_{t-1} + \cdots + \theta_q e_{t-q}$$

Where y'_{t-1} represents the past values (one period ago) of y, the dependent variable; and $\theta_1 e_{t-1}$ represents the past error (one period ago) of the regression.

ARIMA (p,d,q) models entail 3 paramount factors, the AR (autoregressive) part which shows up to which period “p” (lag) the time series is regressed on its own past data; the MA (moving average) part which indicates up to which period “q” (lag) the error is a linear combination of past respective errors; and the degree of integration I which shows the order of the differenced values “d” that has been used to replace the data values in order to obtain stationary data, which is the requirement of the ARIMA model approach.

7.Results

E1: Expenses | Nº Retirees

pensionbenefits	Coef.	St.Err.	t-value	p-value	[95% Conf	Interval]	Sig
retirees	36.975	4.08	9.06	0	28.979	44.97	***
Constant	-82603178	21243482	-3.89	0	-1.242e+08	-40966719	***

Mean dependent var	100917820.225	SD dependent var	31683496.550
Number of obs	26	Chi-square	82.142
Prob > chi2	0.000	Akaike crit. (AIC)	924.215

*** p<.01, ** p<.05, * p<.1

E1: Expenses | Average Pension

pensionbenefits	Coef.	St.Err.	t-value	p-value	[95% Conf	Interval]	Sig
averagepension	163570.91	16375.322	9.99	0	131475.86	195665.95	***
Constant	-8976730.4	9308852.8	-0.96	.335	-27221747	9268285.9	
L	.857	.16	5.36	0	.543	1.17	***

Mean dependent var	100917820.225	SD dependent var	31683496.550
Number of obs	26	Chi-square	99.957
Prob > chi2	0.000	Akaike crit. (AIC)	877.290

*** p<.01, ** p<.05, * p<.1

E1: Expenses | Effective Retirement Age

D.pensionbenefits	Coef.	St.Err.	t-value	p-value	[95% Conf	Interval]	Sig
D	11814660	1969465.3	6.00	0	7954579.2	15674741	***
Constant	5964105.4	1363740.4	4.37	0	3291223.3	8636987.4	***
L	.64	.142	4.52	0	.362	.918	***
L	.732	.158	4.62	0	.422	1.043	***

Mean dependent var	5806343.841	SD dependent var	2812681.891
Number of obs	15	Chi-square	123.111
Prob > chi2	0.000	Akaike crit. (AIC)	477.962

*** p<.01, ** p<.05, * p<.1

E1: Expenses | Life Expectancy

pensionbenefits	Coef.	St.Err.	t-value	p-value	[95% Conf	Interval]	Sig
lifeexpectancy	16171866	875346.74	18.47	0	14456218	17887514	***
Constant	-1.212e+09	70856794	-17.10	0	-1.350e+09	-1.073e+09	***

Mean dependent var	98248019.906	SD dependent var	29199748.078
Number of obs	25	Chi-square	341.319
Prob > chi2	0.000	Akaike crit. (AIC)	865.158

*** p<.01, ** p<.05, * p<.1

E2: Revenues | Nº contributors, Avg Wage

Revenues	Coef.	St.Err.	t-value	p-value	[95% Conf	Interval]	Sig
contributors	10.777	1.307	8.25	0	8.216	13.338	***
averagewage	10561.063	2085.178	5.06	0	6474.189	14647.937	***
Constant	-3.819e+08	60893040	-6.27	0	-5.012e+08	-2.625e+08	***

Mean dependent var	95910136.427	SD dependent var	16874716.374
Number of obs	20	Chi-square	94.962
Prob > chi2	0.000	Akaike crit. (AIC)	692.850

*** p<.01, ** p<.05, * p<.1

E2: Revenues | NAWRU

Revenues	Coef.	St.Err.	t-value	p-value	[95% Conf	Interval]	Sig
nawru	-4645365	1390163	-3.34	.001	-7370034.4	-1920695.7	***
Constant	1.616e+08	30176364	5.36	0	1.025e+08	2.208e+08	***
L	1.694	.151	11.20	0	1.398	1.991	***
L2	-.712	.151	-4.70	0	-1.008	-.415	***

Mean dependent var	89078465.798	SD dependent var	25631741.580
Number of obs	27	Chi-square	4879.146
Prob > chi2	0.001	Akaike crit. (AIC)	894.731

*** p<.01, ** p<.05, * p<.1

E2: Revenues | Nº contributors

Revenues	Coef.	St.Err.	t-value	p-value	[95% Conf	Interval]	Sig
contributors	6.713	1.681	3.99	0	3.419	10.007	***
Constant	-23968828	36477806	-0.66	.511	-95464013	47526357	
L	.978	.012	81.76	0	.955	1.002	***

Mean dependent var	95168621.403	SD dependent var	19135335.665
Number of obs	22	Chi-square	7415.327
Prob > chi2	0.000	Akaike crit. (AIC)	736.323

*** p<.01, ** p<.05, * p<.1

E2: Revenues | Nº firms

Revenues	Coef.	St.Err.	t-value	p-value	[95% Conf	Interval]	Sig
numberoffirms	61.742	10.266	6.01	0	41.622	81.862	***
Constant	-96289640	32381316	-2.97	.003	-1.598e+08	-32823427	***
L	.821	.237	3.47	.001	.357	1.285	***

Mean dependent var	95168621.403	SD dependent var	19135335.665
Number of obs	22	Chi-square	248.810
Prob > chi2	0.000	Akaike crit. (AIC)	723.307

*** p<.01, ** p<.05, * p<.1

E2: Revenues | Avg Wage

Revenues	Coef.	St.Err.	t-value	p-value	[95% Conf	Interval]	Sig
averagewage	10471.133	2898.562	3.61	0	4790.055	16152.21	***
Constant	-1.918e+08	81385360	-2.36	.018	-3.513e+08	-32243069	**

Mean dependent var	95910136.427	SD dependent var	16874716.374
Number of obs	20	Chi-square	13.050
Prob > chi2	0.000	Akaike crit. (AIC)	720.801

*** p<.01, ** p<.05, * p<.1

The different variables combinations stem from the need of avoiding collinearity problems, and, in addition, provides an interesting path to obtain a range of expected future values for the two main variables assessed.

Additional models and estimations of the independent variables used in the before stated analysis can be found in the annex.

8.Forecasts

The analysis previously conducted shed some light upon the future expected values of both expenses and revenues of the Spanish Pension System; as explained an interval have been constructed in order to encompass different possible scenarios and thus different values for both variables.

Equation 1: Expenses incurred by the Spanish Pension System in 2050:

- Expenses: [84514669, 796231489] thousand euros; predictions' mean: 354,747,105 thousand euros.

Independent variables (X) 2050 forecast:

- Life expectancy: [80.1, 80.5] years old; predictions' mean: 80.3 years old.
- Number of pensioners: 15,586,918 individuals.
- Average retirement age: 66.88 years old.
- Average pension: [1716,1943] euros per month; predictions' mean: 1,830 euros monthly.

Equation 2: Revenues of the Spanish Pension System in 2050:

- Revenues: [32286715, 456786702] thousand euros; predictions' mean: 167,597,808 thousand euros.

Independent variables (X) 2050 forecast:

- NAWRU: [11.5, 14.35] percent (%); predictions' mean: 12.95%.
- Number of contributors: [19315788, 43723826] individuals; predictions' mean: 21,769,300 individuals.
- Average wage: [1341, 25256] euros yearly; predictions' mean: 9,148 euros yearly.
- Number of firms: [2082478, 2213714] firms; predictions' mean: 2,148,095 firms.

The analysis allows us to use the mean of both expected expenses and revenues so as to forecast the state of Spanish Pension System's balance; according to the computations; in 2050, the system will experience a deficit of 187,149,297 thousand euros. The quantitative study shows that the unbalances that initially took place in 2012 will grow wider and that expenses will substantially outweigh revenues if all macroeconomic variables follow the current tendency and if no changes or modifications in the current system are conducted. In 2021 the deficit is estimated to be of 42,197,429 thousand euros; in 2050 the deficit will be almost four times and a half greater, a 443.5% greater as a matter of fact.

9.Conclusions

Pensions of every kind account for the major income sources of a significant part of the population. The implications of said income sources are many, three of them are of major importance in any society: social effects, granting certain levels of income ensures that socially detrimental situations are kept at bay (crime, neighborhood's decay, radicalization of any sort…); granting income sources to specific segments of the society fosters consumption, contributing in turn, to the overall economic cycle; last but not least, moral effects must be bore in mind too. In Spain, since 2012, contributions are outweighed by expenses, creating a deficit that grows wider year after year due to, mainly, macroeconomic factors and the very design of the Spanish Pension system, despite several modifications, the current system seems to be unfeasible in the long-run. In this work the main macroeconomic variables affecting or having major influence on the system have been analyzed and their expected value forecasted, based on these previsions and trends computed through linear regression models and ARIMA models, a plausible and accurate forecast of both the expected revenues and expenses of the Spanish Pension System in 2050 have been provided. The results seem conclusive, in 2050 the deficit will have grown 440% compared to that of today if all factors behave as predicted and no further changes or modifications on the pension system are conducted. Indeed, the values obtained are compelling and totally discouraging for those clinging to the system as it is designed today. To reach a well-balanced system two paths are possible and feasible, it is required to either increase revenues or decrease the overall expense of the system, of course the perfect solution would entail a middle point in which expenses decrease and revenues increase.

Reduce expenses is a must, yet we have to bear in mind the moral and distributional effects that said objective would entail.

According to the results obtained, the three key variables to be dealt with when tackling the system's expenses are: Average pension benefit, average retirement age and the total number of pensioners. Since it is not possible to remove active contributors from the system i.e it is totally unfeasible to deprive someone of his future pension after having actively contributed to the system, no suggestions will be made on that front. It would be wise, however, to reduce the benefits to which contributors are entitled, as well as stiffening the criteria in order for a contributor to be fully entitled to a pension. It is advisable not to reduce all pensions or stiffening all criteria homogenously since by so doing, lower income deciles would be bearing as much burden as upper income ones. The cut and stiffening should be progressively conducted and based on the contribution, by the same token, increasing the minimum age at which retirement is available, which is paramount to attain the sufficient reduction in the expense level, should not be homogenous either, workers in jobs or sectors that entail a certain level of physical effort, which are normally subject to lower salaries, should not experience any forced increase in their working life. Fiscal measures and incentives must be designed in order

to retain as many individuals in the workforce and to enlengthen their working life as much as possible, always according to a cost-benefit analysis, since said incentive would most certainly entail an expense in turn.

According to the results obtained the most efficient way to boost revenues would be to reduce unemployment while increasing both average wage and number of firms. Indeed, combining increases in wages and unemployment reduction would be only attainable through a general productivity increase, which, given the current situation ant trends, seems unlikely; forcibly rising wages could trigger an increase in unemployment therefore proving to be counterproductive since unemployment is, according to the results, more relevant from the point of view of revenue sources than wage levels are. Reductions in unemployment rate however would alleviate the situation of the whole social security not only the contributory pension system since less unemployment benefits would be required and more active contributors would be lifting the amount of revenues up, unemployment reduction is therefore paramount due to its double role. The number of firms operating has a positive effect on the amount of revenues, and again, increasing the number of firms would exhibit a double role, it would help keeping unemployment at bay or even reducing it and would contribute as an entity to the system. The optimal strategy would help firms proliferate, appear and settle in Spain, fiscal and other incentive could be used following always a cost-benefit analysis, an interesting strategy would be tackling the current level of administrative bureaucracy in order to ease and facilitate procedures and legal requirements for business and enterprises formation as much as possible. The core strategy should be attracting and facilitate the creations of new enterprises that would employ a greater amount of the labor force, that would shift from being a burden to the system to a pillar upon which to rest. If this strategy is combined with the appropriate management of economic policies to channel and encourage investment toward productive sectors and activities the effects would most certainly be greater and more notorious.

Combining a measured, fair and reflected reduction in the number of benefits bestowed, with an efficient administrative and fiscal reform endorsed by minor specific policies it is possible to reach a balanced pension system in Spain by 2050.

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11.Annex

Table1:

Año 2020

Años cotizados	% Base Reguladora	Años cotizados	% Base Reguladora
15 años	50%	26 años	77,2%
16 años	52,5%	27 años	79,5%
17 años	55%	28 años	81,8%
18 años	57,6%	29 años	84,1%
19 años	60,1%	30 años	86,4%
20 años	62,6%	31 años	88,6%
21 años	65,1%	32 años	90,9%
22 años	67,6%	33 años	93,2%
23 años	70,2%	34 años	95,5%
24 años	72,7%	35 años	97,8%
25 años	75%	36 años	100%

Año 2027

Años cotizados	% Base Reguladora	Años cotizados	% Base Reguladora
15 años	50%	26 años	75,1%
16 años	52,3%	27 años	77,4%
17 años	54,6%	28 años	79,6%
18 años	56,8%	29 años	81,9%
19 años	59,1%	30 años	84,2%
20 años	61,4%	31 años	86,5%
21 años	63,7%	32 años	88,8%
22 años	66%	33 años	91%
23 años	68,2%	34 años	93,3%
24 años	70,5%	35 años	95,6%
25 años	72,8%	36 años	97,8%
		37 años	100%

Source: Instituto BBVA de pensiones. (2020, October 16). Cálculo de la pensión: bases de cotización, base reguladora, ajuste por años de cotización. Directly extracted.

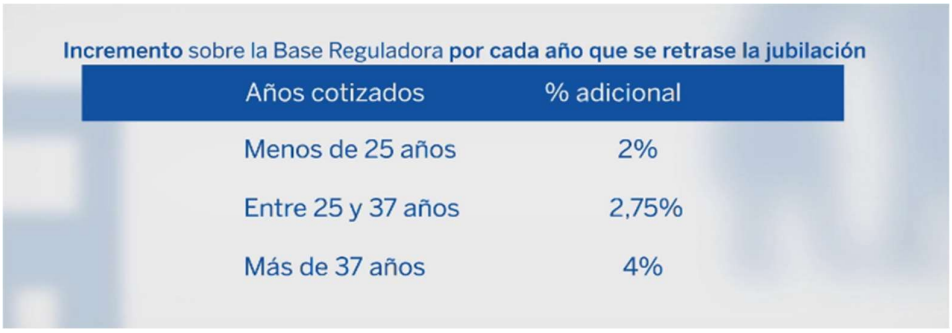
Table 2:

Reducción sobre la Base Reguladora **por cada trimestre que se anticipe la jubilación**

Años cotizados	por despido	voluntaria
Menos de 38 años y 6 meses	1,88%	2,00%
Entre 38 años y 6 meses, y 41 años y 6 meses	1,75%	1,88%
Entre 41 años y 6 meses, y 44 años y 6 meses	1,63%	1,75%
Más de 44 años y 6 meses	1,50%	1,63%

Source: Instituto BBVA de pensiones. (2020, October 16). Cálculo de la pensión: bases de cotización, base reguladora, ajuste por años de cotización. Directly extracted.

Table 3:



Incremento sobre la Base Reguladora **por cada año que se retrase la jubilación**

Años cotizados	% adicional
Menos de 25 años	2%
Entre 25 y 37 años	2,75%
Más de 37 años	4%

Source: Instituto BBVA de pensiones. (2020, October 16). Cálculo de la pensión: bases de cotización, base reguladora, ajuste por años de cotización. Directly extracted.

Table 4, Full-time workers:

Grupo de Cotización	Categorías Profesionales	Bases mínimas euros/mes	Bases máximas euros /mes
1	Ingenieros y Licenciados.Personal de alta dirección no incluido en el artículo 1.3.c) del Estatuto de los Trabajadores	1.466,40	4.070,10
2	Ingenieros Técnicos, Peritos y Ayudantes Titulados	1.215,90	4.070,10
3	Jefes Administrativos y de Taller	1.057,80	4.070,10
4	Ayudantes no Titulados	1.050,00	4.070,10
5	Oficiales Administrativos	1.050,00	4.070,10
6	Subalternos	1.050,00	4.070,10
7	Auxiliares Administrativos	1.050,00	4.070,10
		Bases mínimas euros/día	Bases máximas euros /día
8	Oficiales de primera y segunda	35,00	135,67
9	Oficiales de tercera y Especialistas	35,00	135,67
10	Peones	35,00	135,67
11	Trabajadores menores de dieciocho años, cualquiera que sea su categoría profesional	35,00	135,67

Source: Seguridad Social. (2019). Bases y tipos de cotización 2019. Directly extracted.

Table 5, Part-time workers:

CONTRATO DE TRABAJO A TIEMPO PARCIAL	
GRUPO COTIZACIÓN	**BASE MÍNIMA/HORA**
1	8,83
2	7,32
3	6,37
4 a 11	6,33

Source: Seguridad Social. (2019). Bases y tipos de cotización 2019. Directly extracted.

Table 5, Percentages:

TIPOS DE COTIZACIÓN (%)			
CONTINGENCIAS	EMPRESA	TRABAJADORES	TOTAL
Comunes	23,60	4,70	28,30
Horas Extraordinarias Fuerza Mayor	12,00	2,00	14,00
Resto Horas Extraordinarias	23,60	4,70	28,30

DESEMPLEO	EMPRESA	TRABAJADORES	TOTAL
Tipo General	5,50	1,55	7,05
Contrato duración determinada Tiempo Completo	6,70	1,60	8,30
Contrato duración determinada Tiempo Parcial	6,70	1,60	8,30

	EMPRESA	TRABAJADORES	TOTAL
FOGASA	0,20		0,20

	EMPRESA	TRABAJADORES	TOTAL
FORMACIÓN PROFESIONAL	0,60	0,10	0,70

Source: Seguridad Social. (2019). Bases y tipos de cotización 2019. Directly extracted.

Table 7, Self-employed:

Base Mínima euros/mes	**944,40 €/mes**
Base Máxima euros/mes	4.070,10 €/mes
Base de Cotización menores de 47 años ó con 47 años.	Trabajadores que **a partir del 01/01/2021**, este día inclusive, sean menores de 47 años podrán elegir entre los límites de las bases mínima y máxima. Igual elección podrán efectuar los trabajadores que en esa fecha tengan una edad de 47 años y su base de cotización en el mes de diciembre de 2020 haya sido igual o superior a 2.052,00 euros/mes o causen alta en este Régimen Especial con posterioridad a esta fecha. Trabajadores que a partir de 01/01/2021, este día inclusive, tengan 47 años de edad, si su base de cotización fuera inferior a 2.052,00 euros/mes no podrán elegir una base de cuantía superior a 2.077,80 euros/mes, salvo que hubieran ejercitado su opción en tal sentido antes del 30 de junio de 2019, produciendo efectos a partir del 1 de julio del mismo año. En el caso del cónyuge supérstite del titular del negocio que, como consecuencia del fallecimiento de éste, haya tenido que ponerse al frente del mismo y darse de alta en este Régimen Especial con 47 años de edad, en cuyo caso no existirá dicha limitación. Trabajadores que tengan 47 años, si su base de cotización fuera menor de 2.052,00 euros/mes y no ejercitase opción alguna las bases de cotización estará comprendida entre las cuantías de 944,40 euros/mes y 2.077,80 euros/mes.
Base de Cotización 48 ó más años de edad.	Trabajadores que a partir de 01/01/2021, este día inclusive, tengan cumplida la edad de 48 o más años, la base de cotización estará comprendida entre las cuantías de 1.018,50 y 2.077,80 euros/mes. En el caso del cónyuge supérstite del titular del negocio que, como consecuencia del fallecimiento de éste, haya tenido que ponerse al frente del mismo y darse de alta en este régimen especial con 45 o más años de edad, la elección de bases estará comprendida entre las cuantías de 944,40 y 2.077,80 euros/mes. Si la última base de cotización acreditada hubiera sido superior a 2.052,00 euros/ mes, se habrá de cotizar por una base comprendida entre 944,40 euros/mes y el importe de aquella, con el tope de la base máxima de cotización.
Base de Cotización 48 ó 49 años de edad.	Trabajadores que a 01/01/2011, tenían 48 o 49 años de edad si la última base de cotización acreditada hubiera sido superior a 2.052,00 euros/mes podrán optar por una base de cotización comprendida entre 944,40 euros/mes y el importe de aquélla, con el tope de la base máxima de cotización.
Base de Cotización 48 ó más años de edad con 5 ó más años cotizados antes de los 50 años.	Si la última base de cotización hubiera sido inferior o igual a 2.052,00 euros/mes, habrán de cotizar por una base comprendida entre 944,40 y 2.077,80 euros/mes. Si la última base de cotización acreditada hubiera sido superior a 2.052,00 euros/mes, se habrá de cotizar por una base comprendida entre 944,40 euros/mes, y el importe de aquélla, con el tope de la base máxima de cotización.
Tipo Contingencias Comunes	28,30 por ciento
Tipo Contingencias Profesionales	1,30 por ciento
Tipo Cese de Actividad	0,90 por ciento
Tipo Formación Profesional	0,10 por ciento

Source: Seguridad Social. (2019). Bases y tipos de cotización 2019. Directly extracted.

All ARIMA models are of own creation and have been specifically designed and conducted for this work.

Equation 1: Pension System's Expenses.

E1.1: Retirees | Total Population, Dependency ratio, Mortality rate

retirees	Coef.	St.Err.	t-value	p-value	[95% Conf	Interval]	Sig
dependencyratio	21160.48	190143.44	0.11	.911	-351513.82	393834.78	
mortalityrate	90688.063	206036.78	0.44	.66	-313136.61	494512.73	
population	.254	.222	1.15	.252	-.181	.69	
Constant	-8127316.5	1349822.5	-6.02	0	-10772920	-5481712.9	***
L	1.74	.376	4.63	0	1.003	2.477	***
L2	-.91	.144	-6.34	0	-1.192	-.629	***
L	-1	0	-7674.30	0	-1	-.999	***

Mean dependent var	4985575.333	SD dependent var	712517.461
Number of obs	24	Chi-square	195481239.522
Prob > chi2	0.000	Akaike crit. (AIC)	656.701

*** p<.01, ** p<.05, * p<.1*

E1.2: Avg Pension | GDP Growth rate, Expected working life

averagepension	Coef.	St.Err.	t-value	p-value	[95% Conf	Interval]	Sig
growthrate	-.547	.511	-1.07	.285	-1.548	.454	
expectedworkinglife	120.535	3.872	31.13	0	112.946	128.124	***
Constant	-3250.852	127.008	-25.60	0	-3499.782	-3001.922	***
L	1.538	.103	14.95	0	1.337	1.74	***
L2	-.869	.087	-9.95	0	-1.041	-.698	***

Mean dependent var	744.788	SD dependent var	167.211
Number of obs	20	Chi-square	1765.622
Prob > chi2	0.000	Akaike crit. (AIC)	147.797

*** p<.01, ** p<.05, * p<.1*

E1.2: Avg Pension | GDP Growth rate, Expected contribution

averagepension	Coef.	St.Err.	t-value	p-value	[95% Conf	Interval]	Sig
growthrate	-6.514	12.111	-0.54	.591	-30.252	17.223	
averagecontributio~e	.522	.19	2.75	.006	.15	.894	***
Constant	-70.733	297.615	-0.24	.812	-654.048	512.583	

Mean dependent var	731.527	SD dependent var	160.627
Number of obs	19	Chi-square	160.431
Prob > chi2	0.000	Akaike crit. (AIC)	234.425

*** p<.01, ** p<.05, * p<.1*

E1.3: Effective retirement age | Avg income per consumption unit, Replacement rate

averageretirementage	Coef.	St.Err.	t-value	p-value	[95% Conf	Interval]	Sig
averageincomeperco~t	0	0	-0.10	.923	0	0	
replacementrate	3.096	.349	8.88	0	2.413	3.78	***
Constant	62.436	1.025	60.92	0	60.427	64.445	***

Mean dependent var	64.031	SD dependent var	0.232
Number of obs	11	Chi-square	91.243
Prob > chi2	0.000	Akaike crit. (AIC)	-13.274

*** p<.01, ** p<.05, * p<.1

E1.4: Life expectancy | Public health expenditure

lifeexpectancy	Coef.	St.Err.	t-value	p-value	[95% Conf	Interval]	Sig
healthexpenditure	0	0	1.42	.157	0	0	
Constant	80.531	.422	190.93	0	79.705	81.358	***
L	1.98	.008	259.13	0	1.965	1.995	***
L2	-1	0	-2068.67	0	-1.001	-.999	***
L	-1.949	.022	-87.85	0	-1.993	-1.906	***
L2	1	0	4083.32	0	.999	1	***

Mean dependent var	81.826	SD dependent var	1.257
Number of obs	18	Chi-square	523506172.294
Prob > chi2	0.157	Akaike crit. (AIC)	10.492

*** p<.01, ** p<.05, * p<.1

E1.4: Life expectancy | Net average income per capita

lifeexpectancy	Coef.	St.Err.	t-value	p-value	[95% Conf	Interval]	Sig
netaverageincomepe~n	0	0	0.86	.387	0	.001	
Constant	80.171	2.519	31.82	0	75.233	85.109	***
L	1.929	.07	27.44	0	1.791	2.067	***
L2	-.965	.041	-23.49	0	-1.045	-.884	***
L	-1	0	-236092.88	0	-1	-1	***

Mean dependent var	82.577	SD dependent var	0.676
Number of obs	12	Chi-square	4516796910078.719
Prob > chi2	0.387	Akaike crit. (AIC)	14.971

*** p<.01, ** p<.05, * p<.1

Equation 2: Pension System's Revenuess.

E2.1: NAWRU | Consumers Expectations, Foreign direct investment

nawru	Coef.	St.Err.	t-value	p-value	[95% Conf	Interval]	Sig
consumersexpectati~s	-.006	.004	-1.67	.096	-.013	.001	*
fdi	0	0	-3.53	0	0	0	***
Constant	15.458	.199	77.60	0	15.068	15.849	***
L	1.89	.018	106.05	0	1.855	1.925	***
L2	-1	0	-4661.81	0	-1	-.999	***
L	-1.938	.033	-59.15	0	-2.002	-1.874	***
L2	1	.001	1059.67	0	.998	1.002	***

Mean dependent var	15.531	SD dependent var	1.465
Number of obs	16	Chi-square	162367289.337
Prob > chi2	0.002	Akaike crit. (AIC)	17.578

*** p<.01, ** p<.05, * p<.1

E2.1: NAWRU | Producers Expectations, Foreign direct investment

nawru	Coef.	St.Err.	t-value	p-value	[95% Conf	Interval]	Sig
producersexpectati ~s	-.005	.009	-0.55	.582	-.023	.013	
fdi	0	0	-2.49	.013	0	0	**
Constant	15.633	.259	60.45	0	15.126	16.14	***
L	1.855	.032	58.48	0	1.793	1.917	***
L2	-.987	.012	-81.23	0	-1.011	-.963	***
L	-1	0	-314470.89	0	-1	-1	***

Mean dependent var	15.531	SD dependent var	1.465
Number of obs	16	Chi-square	171491554490.442
Prob > chi2	0.039	Akaike crit. (AIC)	19.379

*** p<.01, ** p<.05, * p<.1*

E2.2: Nº Contributors | Total Population

contributors	Coef.	St.Err.	t-value	p-value	[95% Conf	Interval]	Sig
population	.337	.078	4.33	0	.184	.489	***
Constant	2268287.2	3438402.4	0.66	.509	-4470857.6	9007432	

Mean dependent var	17351724.545	SD dependent var	1312960.884
Number of obs	22	Chi-square	18.789
Prob > chi2	0.000	Akaike crit. (AIC)	676.292

*** p<.01, ** p<.05, * p<.1*

E2.2: Nº Contributors | Activity rate, Fertility rate, Avg Age

contributors	Coef.	St.Err.	t-value	p-value	[95% Conf	Interval]	Sig
activityrate	92276.69	129670.41	0.71	.477	-161872.64	346426.02	
fertilityrate	-3201967.6	3172721.4	-1.01	.313	-9420387.3	3016452.2	
averageage	13449.576	159176.06	0.08	.933	-298529.78	325428.93	
Constant	15787655	7750800.6	2.04	.042	596364.94	30978945	**
L	1.717	.027	63.52	0	1.664	1.77	***
L2	-.997	.002	-475.00	0	-1.001	-.993	***
L	-1.947	.02	-97.94	0	-1.986	-1.908	***
L2	1	.001	1577.65	0	.999	1.001	***

Mean dependent var	17626099.556	SD dependent var	1020302.406
Number of obs	18	Chi-square	4484827999.148
Prob > chi2	0.001	Akaike crit. (AIC)	515.522

*** p<.01, ** p<.05, * p<.1*

E2.3: Nº firms | Competitiveness index, Logistics index

numberoffirms	Coef.	St.Err.	t-value	p-value	[95% Conf	Interval]	Sig
scorecompetitiven ess	29969.663	10769.603	2.78	.005	8861.629	51077.697	***
scoorelogistics	-502777.52	163958.97	-3.07	.002	-824131.19	-181423.85	***
Constant	2980205.4	986954.51	3.02	.003	1045810.1	4914600.7	***

Mean dependent var	3263792.833	SD dependent var	90956.713
Number of obs	12	Chi-square	17.389
Prob > chi2	0.000	Akaike crit. (AIC)	301.899

*** p<.01, ** p<.05, * p<.1*

E2.3: Nº firms | Competitiveness index, Households Consumption

numberoffirms	Coef.	St.Err.	t-value	p-value	[95% Conf	Interval]	Sig

scorecompetitiveness	25919.678	5509.479	4.70	0	15121.297	36718.059	***
householdsconsumpt~n	761.32	181.579	4.19	0	405.432	1117.207	***
Constant	801545.94	401818.27	1.99	.046	13996.607	1589095.3	**

Mean dependent var	3271439.308	SD dependent var	91344.338
Number of obs	13	Chi-square	49.764
Prob > chi2	0.000	Akaike crit. (AIC)	324.170

*** p<.01, ** p<.05, * p<.1

E2.4: Avg wage | GDP growth rate, Productivity per hour, Full-time workers

averagepension	Coef.	St.Err.	t-value	p-value	[95% Conf	Interval]	Sig
growthrate	-.608	.287	-2.12	.034	-1.171	-.046	**
offulltimeworkers	-1.777	.948	-1.87	.061	-3.636	.081	*
prodperc	-.426	.031	-13.75	0	-.487	-.365	***
Constant	987.486	260.984	3.78	0	475.966	1499.005	***
L	1.973	.014	145.46	0	1.946	1.999	***
L2	-.977	.014	-69.39	0	-1.005	-.949	***

Mean dependent var	774.047	SD dependent var	148.876
Number of obs	18	Chi-square	191892.751
Prob > chi2	0.000	Akaike crit. (AIC)	137.897

*** p<.01, ** p<.05, * p<.1

E2.4: Avg wage | GDP growth rate, Population with third level education

averagepension	Coef.	St.Err.	t-value	p-value	[95% Conf	Interval]	Sig
growthrate	-2.964	1.086	-2.73	.006	-5.093	-.835	***
ofpopwithtertiarye~n	33.425	2.614	12.78	0	28.301	38.549	***
Constant	-277.307	80.214	-3.46	.001	-434.523	-120.09	***
L	1.719	.18	9.54	0	1.366	2.073	***
L2	-.892	.094	-9.52	0	-1.075	-.708	***
L	-1	0	-266857.60	0	-1	-1	***

Mean dependent var	730.580	SD dependent var	175.501
Number of obs	21	Chi-square	143317580529.891
Prob > chi2	0.000	Akaike crit. (AIC)	173.999

*** p<.01, ** p<.05, * p<.1

E2.4: Avg wage | GDP growth rate, Productivity per hour, Early school leaving

averagepension	Coef.	St.Err.	t-value	p-value	[95% Conf	Interval]	Sig
growthrate	-8.661	2.479	-3.49	0	-13.521	-3.802	***
ofearlyabandonemen~o	-22.418	2.035	-11.01	0	-26.408	-18.429	***
prodperc	-.016	.47	-0.03	.973	-.937	.905	
Constant	1382.845	45.062	30.69	0	1294.525	1471.165	***
L	1	0	94715.88	0	1	1	***

Mean dependent var	804.428	SD dependent var	127.392
Number of obs	16	Chi-square	12519161964.757
Prob > chi2	0.000	Akaike crit. (AIC)	153.464

*** p<.01, ** p<.05, * p<.1