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Financial crisis and pension reform in Spain: the effect of labour market dynamics

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ABSTRACT

We analyse the effect of post-financial crisis unemployment dynamics on the Spanish pension system's financial health using Aggregate Accounting. We compare the basic scenario where the current labour market dynamics persist with a full employment (best-case) scenario. We find that economic risk is the main driver of unsustainability in the short run. However, in the long run, the main driver of expenditures lies in the ageing demographic structure. Our results suggest that future reforms should increase labour market participation but confirm that recent pension reforms do not attain sustainability in the long run, indicating the need of further pension reforms.

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Labour market; labour force survey; aggregate accounting; sustainability; pay-as-you-go; public pension

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Policy Highlights

- Adverse labour market dynamics outweigh demographic risk until 2040.
- Main driver of pension expenditures lies in the ageing demographic structure.
- Recent pension reforms do not ensure the sustainability of the system.
- Labour market reforms are needed to increase and secure employment.
- Adequacy of retirement income for Spanish retirees should be increased.

1. Introduction

Public pension schemes in most European countries, including Spain, are pay-as-you-go financed, that is, the income from contributions finances the pension expenditures, and have a defined benefit formula. However, increased life expectancy and decreased fertility compromises their fiscal sustainability(OECD 2017). This demographic trend across Europe, and its effect on pay-as-you-go pension financing, has attracted a lot of academic interest over the years. Two decades ago, Boldrin et al. (1999) argued that parametric reforms are insufficient to offset the increasing dependency ratio and decreasing labour force participation, suggesting that structural reforms that address the intergenerational distortions and fiscal sustainability should be considered. Since then, significant literature has explored the welfare effects

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Supplemental data for this article can be accessed here.

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(Angelini, Brugiavini, and Weber 2009) or political feasibility (Galasso and Profeta 2004) of pension reforms which decrease the financial burden of pension liabilities.

Recently, national and international government bodies show that pension expenditures in Spain will increase much faster than the income from contributions (Kingdom of Spain 2014, 2016) and that an actuarial balance should be introduced to make liabilities explicit (Devesa-Carpio and Devesa-Carpio, 2010). For instance, the European Commission's 2015 Ageing Report estimates that the pension expenditures as a percentage of the GDP (*PE/GDP* from now on) will rise to 12.5% by 2045. The recent financial crisis has intensified the public debate on sustainability, adequacy and equity of pay-as-you-go public pension schemes, as seen in Rosado-Cebrián and Alonso-Fernández (2015); Alonso-Fernández et al. (2018) and De Cos, Ramos, and Jimeno (2018), because the economic risk is expanding the effects of the existing demographic risk. Spain has seen their births per woman decrease since 1960 attaining a record low of 1.23 births per woman in 2000 and is among the European countries with the highest life expectancy at birth (Eurostat, 2018a). This trend decreases the ratio of employed to retirees as less individuals enter the system and they do it at later ages. Ageing together with a decrease in economic growth and an increase in unemployment, public debt and market volatility is compromising pension entitlements in Spain as well as other European countries (Guillén et al. 2009).[1]

The impact of ageing on the pay-as-you-go expenditures in Spain has been thoroughly analysed in the last decade (see, e.g. Balmaseda Del Campo, Melguizo-Esteso, and Taguas-Coejo 2006, or Conde-Ruiz and Alonso, 2006). This literature adopts the Aggregate Accounting method, extensively used in the analysis of fiscal sustainability (Boldrin et al. 1999 or Jimeno, Rojas, and Puente 2008). It analyses the *PE/GDP* through three ratios: the dependency ratio links pensioners to working age population; the inactivity ratio, representing the inverse of the activity rate, and the benefit ratio which relates mean pensions to mean wages. These studies conclude that *PE/GDP* will reach unsustainable levels due to ageing. The main driver for this aggravation lies in the strong growth of the old-age dependency ratio as the other ratios remain stable.

When assessing pension's fiscal sustainability, realistic assumptions for employment and productivity are needed to successfully capture economic risk. A wealth of literature focuses on labour market reforms, how it relates to institutional settings and how incentive programs can increase productivity, secure employment and decrease labour market exposure to economic shocks (Kluve and Schmidt 2002; Cingano et al. 2010; Pagano and Pica 2012; de Serres and Murtin 2014; Sachs 2015). We focus on transitions between employment, unemployment and labour market's withdrawal following the Global Financial Crisis (GFC) in Spain and its effect on pension financing. The unemployment rate increased from 13.30% in 2007 to 26.30% in 2013, stabilizing to 21% by 2016 (Labour Force Survey (2016), LFS). This trend decreased the income from contributions by 7.1% between 2008 and 2015 while expenditures increased by 36.5%, setting the ratio of income from contributions to pension expenditures to 86.9% in 2015 (Ministry of Employment and Social Security 2016).

The Spanish labour market has been widely studied by exploiting the longitudinal database Working Life Continuous Sample (Muestra Continua de Vidas Laborales). The seminal work of Toharia (1998), started a strand of literature that analyses the driving factors of the Spanish labour market. Few considered the effect of labour market

transitions on the welfare of representative individuals (Jimeno 2003; Rosado-Cebrián, Domínguez-Fabián, and Alonso-Fernández 2015) and none, to the extent of the authors' knowledge, incorporate age-dependent labour market transitions to analyse public pension financing.

We analyse the effect of the levels of unemployment and withdrawal from the labour force after the global financial crisis in Spain on the *PE/GDP* by using the Aggregate Accounting framework. We consider the latest pension reforms introduced in 2011 and 2013 to achieve sustainability. We consider transition probabilities between two contributory states (employment and unemployment) and one non-contributory state (inactivity), as calibrated from the cross-sectional data from the Labour Force Survey (LFS) for the post-crisis period 2008 to 2016. Including these transitions in our endogenous model, the cash flows related to the income and expenditures become more realistic, producing more insightful estimates of the future pension expenditures. This innovative approach is a novelty in pension economics to the best of the authors' knowledge.

While economic risk outweighs demographic risk until 2040, the main driver of expenditures in the long run lies in the dependency ratio. Our results suggest that future reforms should address the weaknesses of the labour market and confirm that the recent pension reforms made in Spain do not attain sustainability in the long run, opening the door for more structural pension reforms.

The remainder of the paper is structured as follows. First, the Spanish pension system and the most recent reforms are briefly described. Then, we explain the Aggregate Accounting methodology, the LFS database and the multinomial logit used to calibrate our multi-state model. The empirical analysis follows and then we conclude.

2. The Spanish pension system

The Spanish public pension scheme is a pay-as-you-go financed, defined benefit scheme. Participants do not have individual accounts which are funded by their own contributions, like in funded pension schemes. However, the pension received depends on their lifelong wages. As of 2017, pensioners expect in average a gross and net replacement rate of 72% and 82%, respectively, which is higher than the European average of 58% and 71% (OECD 2017). High life expectancies and low fertility drive the pension liabilities to unsustainable levels. Various parametric reforms were introduced to reduce liabilities, three of which have had the most impact.[2] Two reforms were implemented to increase the working life of individuals and to promote active ageing. The third reform introduced a *Sustainability Factor* affecting pensions at retirement and a liquidity-based *Pension Revalorization Index* which affects subsequent pension indexation.

One of the novelties introduced in Bill 27/2011 was the *Sustainability Factor (SF)*. Despite initially agreeing to enforce the SF from 2027,[3] the sharp decrease in income from contributions caused by rising unemployment between 2008 and 2014 accelerated its implementation to 2019 (Ministry of Employment and Social Security 2016). The SF links the first pension to the difference between the life expectancy at 67 at retirement and the life expectancy observed in 2019.[4] At least 12 European countries have

implemented similar reforms that link pension payments to life expectancy or similar indicators (OECD 2012).

The second novelty is the *Pension Revalorization Index (PRI)*, which affects the indexation on pensions. This index links the income from contributions, pension expenditures and CPI. Subsequent applications of the *PRI* are deemed to reduce the pension adequacy substantially. Devesa-Carpio et al. (2015) argue that the purchasing power of an individual retiring in 2014 and surviving 21 years is expected to decrease between 2% and 28.6% in the baseline economic scenario. The Ministry of Employment and Social Security quantified the impact of the *FS* and *PRI* in their 2014 report: the implementation of the *PRI* can save up to 33,000 € million compared to a scenario without reform. This would guarantee the pension scheme's sustainability by adjusting the average pension paid. However, the pension scheme would still face a deficit after recovering economically due to population ageing.

The *FS* and *PRI* increases the sustainability of the system at the expense of the pension adequacy (de La Fuente and Doménech (2013), Rosado-Cebrián and Domínguez, (2014)) since the indexation on pensions would be lower than the consumer price index (CPI). This affects especially individuals living longer than average (Devesa-Carpio et al. 2015). The decrease in adequacy goes against some recommendations to have pensions which are "*not only sustainable, but also adequate and sufficient*" (European Commission 2012). To address this, the government agreed in 2015 to increase the pension entitlements to mothers by the number of children. For instance, a mother's pension at retirement increases by 5% if she had two children, 10% for three children and 15% for four children or more.

Overall, the recent reforms are still insufficient to ensure the long-term sustainability of the Spanish pension system. The papers above mentioned analysed the effect of the reforms put in place in 2011 and 2013 and focused mainly on the demographic risk. These studies do not consider explicitly the economic risk caused by the recent increase in unemployment rates. We propose a methodology that incorporates reversible labour market transitions and provides a framework to study the impact of unemployment in the pension scheme.

3. Methodology

This section describes the Aggregate Accounting framework used to analyse the pension system, the database, and the estimation methodology for the transition probabilities between employment, unemployment and inactivity. We consider reversible employment state transitions, allowing us to analyse the effect of the post-crisis labour market dynamics in Spain and its impact on future pension expenditures.

3.1. Aggregate accounting method

The Aggregate Accounting framework is one of the most widely used methods by public administrations and statistical bodies to analyse the financial soundness of Social Security (Jimeno, Rojas, and Puente 2008). It relies on demographic scenarios for fertility, life expectancy and migration flows, and macroeconomic scenarios

influencing the labour market such as the employment rate. Assumptions on the mean pension and wages' increase are also made to calculate the GDP and pension expenditures.

Similarly, Doménech and Melguizo (2008) argue that sound projections can be obtained in a simple way while considering a great degree of heterogeneity within and between cohorts, as stated in Table 1. The table summarizes the main characteristics of the most common pension sustainability frameworks. One of their shortcomings is that analysis of actuarial equity is less straightforward.

Several authors have analysed the sustainability of the Spanish pre-reform pension scheme with this framework. Balmaseda Del Campo, Melguizo-Esteso, and Taguas-Coejo (2006) considered the Spanish National Statistical Institute (SNSI) demographic projections for the period 2007–2059 and concluded that the scheme is not sustainable. More recently, Moral-Arce, Patxot, and Souto (2008) extended the analysis considering heterogeneous wage profiles from the SNSI's Working Life Continuous Sample database. However, these studies assume that the employment rate is equal across ages and do not incorporate labour transitions.

We calculate the *PE/GDP* as the product of three factors. The first factor reflects the demographic structure and is represented by the ratio between the retired and working age population. Contrary to the old-age dependency ratio, it only considers retirees who receive pension payments.[5] The second factor considers the labour market and is represented by the ratio between the working age and employed population. The last factor, commonly known as an economic factor, represents the ratio between mean pensions and mean wages. Mathematically, the pension expenditures at time t, denoted by PE_t, scaled to the GDP_t, at time t, are expressed as follows:

$$\frac{PE_t}{GDP_t} = \frac{RP_t}{WP_t} = \frac{\bar{P}}{\bar{W}} = \underbrace{\frac{RP_t}{WAP_t}}_{\text{Dependency Ratio}} \cdot \underbrace{\frac{WAP_t}{WP_t}}_{\substack{\text{Inverse} \\ \text{employment} \\ \text{rate}}} \underbrace{\frac{\bar{P}}{\bar{W}}}_{\substack{\text{Economic} \\ \text{Factor}}} \tag{1}$$

Table 1. MODELLING FRAMEWORKS FOR PENSION SYSTEM'S SOLVENCY ANALYSIS.

Framework	Data needed	Advantages	Shortcomings
Aggregated Accounting	Demographic, labour market and economic variables	Projections are based on few variables	Actuarial equity not straightforward to derive
General equilibrium	Demographic, macroeconomic and institutional variables	Endogenous variables	Complex data manipulation and high sensitivity to hypothesis made on the dynamics
Individual life cycle	Administrative data	Disaggregated analysis of individual's working life profiles	Complexity
Indirect	Income from contributions and pension expenditure	The equilibrium between income and expenditures can be quantified accurately	Not possible to determine the representative individual's characteristics

Source: The authors, based on European Commission – ECOFIN (2007).

where RP_t, WP_t and WAP_t represent the retired, working and working-age population, respectively, and $\bar{P}$ and $\bar{W}$ represent retiree's average pension and labour productivity, respectively.

Our focus is to study the effect of labour transitions on the *PE/GDP*. This increases the tractability and interpretability of our results and highlights the impact of our labour market assumptions. We enhance the classical aggregate accounting framework by considering a multi-state model with three states: employment, unemployment and inactivity. Our transition probabilities impact the three factors:

- The employed population is based on those who remain employed, but also on those who were either inactive or unemployed and transition to employment and those who exit employment during a given period.
- Transitions from contributory periods, employment and unemployment, to non-contributory periods, inactivity, affect accrued rights. Hence, future average pensions will vary.
- Similarly, the number of retirees is impacted as solely those who contribute for a minimum period are eligible to receive a pension.

3.2. Database from the Labour Force Survey

The database from the Labour Force Survey (LFS) provides an estimate of the total employed, unemployed and inactive individuals and the transitions between these three states on a trimestral basis. Statistics are based on a representative sample drawn of households linked to a permanent address in Spain. Collective homes such as hospitals, residential care facilities or barracks, and holiday houses are not considered as households. However, individuals living in collective homes are considered in the sample whenever they belong to a family based externally. The LFS database provides cross-sectional transitions for either age categories (all gender, nationality and educational attainment confounded), gender, nationality or educational attainment.[6] This survey has been done by the SNSI since 1964 and considers 65.000 households per trimester. In practice, only around 60.000 households are effectively interviewed which accounts for 180.000 individuals. Definitions of employment, unemployment and inactivity align with the International Labour Organisation (ILO) guidelines:

(1) **Economically active**: individuals aged 16 years old or over who supply labour or are actively seeking employment during the interviewing week. It includes employed and unemployed.
   (a) **Employed**: individuals who supply labour (full, partial or casual) or are self-employed. It includes individuals who were in sick or annual leave during the interviewing week.
   (b) **Unemployed**: unemployed individuals seeking employment or made themselves explicitly available to be employed. They are divided between unemployed seeking first employment and those who were employed in the past.

(2) **Economically inactive**: individuals 16 years old or over who do not fall under the "employed" and "unemployed" definitions provided above during the interviewing week. It comprises homemakers, students, retirees and pre-retirees. It includes as well those who are not able to work and receive a public or private disability pension.

3.3. Multi-state model description and estimation

Marston, Feldstein, and Hymans (1976) stated in their seminal work that researchers should "*not only consider flows into and out of unemployment but into and out of the labour force as well*". Various studies consider not only unemployment but inactivity or out-of-the-labour force since these two states are empirically driven by different behavioural factors (Jones and Riddell 1999). We incorporate inactivity to serve two distinct purposes: to acknowledge inactivity is driven by a distinct risk compared to employment, and because inactive individuals do not accrue pension rights.

We consider a three-state Markov[7] process based on the data described in Section 3.2. We estimate a multinomial logit model in line with recent research in labour market dynamics (see e.g. Kingdon and Knight 2006; Haan 2010). Individuals can transit to and from, as well as sojourn at, any of the considered states: employment, unemployment and inactivity, at any period. There are nine transition probabilities for every age group. Finally, we assume only one transition during[8] the period of estimation, meaning that a transition from employment to unemployment and back to employment within one trimester is equivalent to sojourning in the employment state.

To highlight the labour market transitions, the number of employed individuals ${}_{E}N_{t}^{x}$ aged x at a time t can be described as follows:

$$
\begin{aligned}
{}_{E}N_{t}^{x} &= {}_{E}N_{t-1}^{x-1}P_{EE}^{x} + {}_{U}N_{t-1}^{x-1}P_{UE}^{x} + {}_{I}N_{t-1}^{x-1}P_{IE}^{x} \qquad (2)\\
&\underset{P_{EE}^{x}=1-P_{EU}^{x}-P_{EI}^{x}}{=} {}_{E}N_{t-1}^{x-1} + \underbrace{{}_{U}N_{t-1}^{x-1}P_{UE}^{x} + {}_{I}N_{t-1}^{x-1}P_{IE}^{x}}_{Entries} - \underbrace{{}_{E}N_{t-1}^{x-1}P_{EU}^{x} + {}_{E}N_{t-1}^{x-1}P_{EI}^{x}}_{Exits},
\end{aligned}
$$

where ${}_{j}N_{t-1}^{x-1}$ represents the population in state j aged $x-1$ at $t-1$ and P_{ij}^{x} represents the probability of transition between state i and j for an individual aged x at the time t, and this for $i,j \in \{E,U,I\}$ where E represents employment, U unemployment and I inactivity. Equation (2) shows that employed individuals correspond to those who sojourn and transit to employment. A similar expression applies to unemployed individuals ${}_{U}N_{t}^{x}$ and inactive individuals ${}_{I}N_{t}^{x}$. Considering reversible transitions between contributory and non-contributory states contributes to a more detailed analysis of public pension financing. Indeed, the total employed, unemployed and inactive population is no longer simplified to a constant proportion of the current working age population. This highlights the effect of our modelling framework on Equation (1) discussed in Section 3.1.

4. Empirical analysis

We present the assumptions used to perform an empirical analysis of the *PE/GDP*. We forecast the pension expenditures and retired population from 2016 to 2060 based on

the methodology presented in Section 3. Labour transitions are assumed to persist during the forecasting period and are equal to those presented in Appendix A.1 based on the period 2008 to 2016.

4.1. Working and retired population

- Employed and inactive population until 2016 correspond to historical values from the LFS database. Unemployed individuals that receive an unemployment benefit are labelled as "unemployed", as they contribute to the Social Security and accrue pension rights, whereas the remainder is considered "inactive". The split between "contributory" and "non-contributory unemployed" is made according to data from the National Employment Service Body (NESB). Appendix A.1 summarizes the estimated trimestral probabilities of transition between employment, unemployment and inactivity.
- Employed, unemployed and inactive population from 2016 to 2060 are calculated as presented in Section 3.3.
- Individuals enter the labour force at age 16 and leave the labour force at 67.[9] New entries are based on the official population forecasts from the SNIS from 2016 to 2060. The split between employed, unemployed and inactive entries is based on the distribution in 2016. For instance, the total unemployed individuals aged 16 in 2020 corresponds to the SNIS forecast of individuals aged 16 times the proportion of unemployed individuals aged 16 in 2016, which is equal to 4.17%.
- Survival probabilities are based on the SNIS' 2016 life table.
- Immigration is not considered.[10]
- Retired population and their corresponding pensions are taken from the Statistical Reports from the Ministry of Employment and Social Security.[11]
- The future retired population corresponds to those who have contributed for a minimum period in line with Bill 27/2011. Labour transitions before retirement affect the career length. Once retired they are no longer affected by the labour transitions but only by the survival probabilities.

4.2. Contribution bases

- Age-dependent annual contribution bases for the employed and unemployed are based on the mean annual earnings from the Wage Structure Survey from the SNSI in 2013. They are brought to 2016 euros with the Wage Increase Index for the employed and Consumer Price Index for the contributory unemployed. Figure 1 illustrates the age-dependent hump-shaped contribution base for the employed and unemployed. Inactive individuals do not contribute, and their contribution base is equal to zero. The contribution bases are modified to lie between the minimum and maximum contribution base. Indeed, individual's wages[12] may be higher than the contribution base. If this is the case, the wages for pension calculation purposes are capped to the contribution base. Contribution bases before 2016 for the employed (resp. unemployed) are based on the contribution bases in 2016 adjusted by the historical Wage Increase Index (resp. Consumer Price Index) from the SNIS. The minimum and maximum evolve with the forecasted wages and CPI increase from the European Commission.[13]

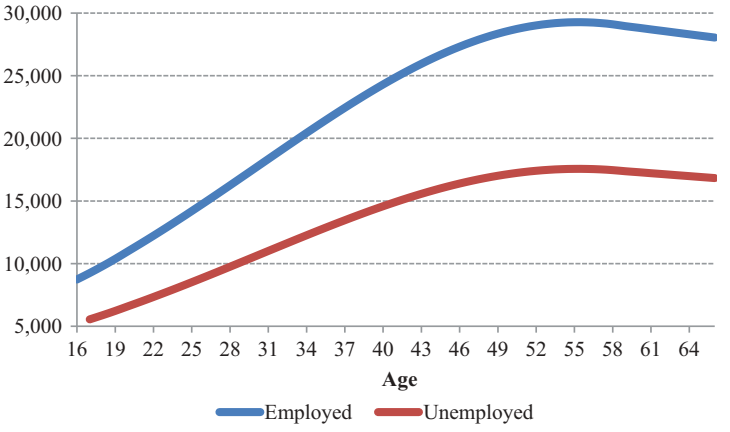

Figure 1. Annual age-dependent contribution base in 2016.
Source: The authors based on the wage structure survey from snsi

4.3. Defined benefit pension calculation

- The pension for a retiring individual aged 67, according to Bill 27/2011, corresponds to a proportion of the pensionable wage. The proportion is equal to the contribution years over a full working career. We consider only the general pension scheme due to the high coverage (Laborales de la Seguridad Social, 2017).[14]
- The pensionable wage depends on the contribution bases during the last 25 years of the working career. Contributions, excepting the last two contributing years, are indexed to the retirement year with the CPI. The sum of these indexed contributions is divided by 29.67 according to Bill 27/2011.
- The resulting amount is multiplied by the *SF* discussed in Section 2 and is calculated by the Ministry of Employment and Social Security.
- Indexation of pensions is set to the *PRI's* minimum revalorization level 0.25% as suggested by Ministry of Employment and Social Security (2016); and Devesa-Carpio *et al.*, 2014 among others.
- The pensions are modified to lie between the minimum and maximum pension set by the Ministry of Employment and Social Security.

4.4. The impact of unemployment and inactivity on the GDP and pension expenditures

We show the results of our empirical analysis for Spain that includes a multi-state reversible labour model. We study the percentage of *PE/GDP* between 2016 and 2060 and incorporate the latest pension reforms introduced in 2011 and 2013.

We analyse two scenarios. The *Baseline Scenario* uses the estimated transition probabilities to employment, unemployment and inactivity from Appendix A.1. The *Full Employment Scenario* assumes full employment to assess a "best" scenario where no unemployment and inactivity periods are considered. Table 2 and Figure 2 illustrate the forecasted *PE/GDP* for the 2016–2060 period for the two scenarios. The percentage increases in both scenarios

Table 2. PUBLIC PENSION EXPENDITURE PROJECTION (2016–2060).

	Pension Expenditures/GDP	Pension Expenditures/GDP
Year	Baseline	Full Employment
2016	14.67%	14.67%
2030	27.76%	14.02%
2040	33.52%	21.96%
2050	35.31%	29.65%
2060	29.12%	27.75%

Source: The authors.

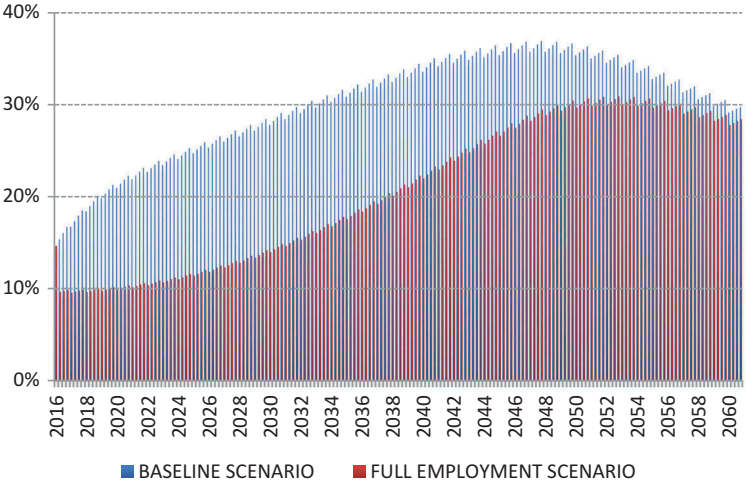

Figure 2. Pension expenditures as a percentage of the gdp.
Source: The authors.

exponentially until 2040, reducing thereafter and attaining similar levels by 2060. The disaggregated factors from Section 3 are shown in Figures 6, 7 and 8 in the Appendix.

The *PE/GDP* increases from 14.67% in 2016 to 33.52% in 2040 decreasing to 29.12% by 2060 for the *Baseline Scenario*, while for the *Full Employment Scenario* the maximum of 29.65% is attained in 2050 decreasing to 27.75% by 2060. Despite the similar levels by 2060, the *Full Employment scenario* yields substantially lower results by 2040. The increase in both scenarios is driven by the pension design and demographic profile.

The *PE/GDP* can be interpreted as the contribution rate needed to finance the pension expenditures. In Spain, the contribution rate to the Social Security is 28% of the contribution base and covers all contingencies: contributive and disability pensions, maternity leave and unemployment benefits. The exact proportion allocated to pensions is unknown. Researchers commonly assume it equals the proportion of pension expenditures to the total contingencies covered by Social Security. This yields a value of 15% in Devesa-Carpio, Lejárraga-García, and Vidal-Meliá (2002), Boado-Penas *et al.* (2008) and Domínguez-Fabián et al. (2011). The estimated contribution rate has recently increased to 17%, roughly half of the total Social Security contribution, to incorporate the systematic deficit of the system (Rosado-Cebrián and Domínguez-Fabián 2017).

Table 2 shows that the *PE/GDP* lies under the assumed 17%. However, if the post-crisis labour market dynamics persist, the *PE/GDP* would reach the current 17% financing cap by 2018. In the long term, the effect of low employment and ageing yields a value exceeding Security contribution rate of 28%, raising the need for parametric or structural pension reforms. The analysis shows that pension expenditures drastically increase if the transition probabilities remain in their current levels and immigration is not considered, even when considering the three deficit-reducing mechanisms (retirement age increase, *SF* and liquidity-linked pension indexation) recently introduced in 2011 and 2013. The results highlight that recent parametric reforms in such an economic scenario do not suffice.

The *Full Employment Scenario* is more optimistic than the *Baseline Scenario* throughout the forecasting period. This aligns with the aggregate accounting method in Equation (1). Under full employment, the increase in working population raises the value of the GDP. Similarly, higher employment leads to an increase in future pension liabilities. The ratio will subsequently decrease as the increase in GDP is higher than the increase in pension expenditures for the same period. However, in 2060 the values are quite similar due to the demographic factor. The life expectancy increase combined with the reduced entries in the system has a big effect on the pensions paid and future sustainability. Furthermore, everyone in the *Full Employment Scenario* receives a pension because they all have complete working careers, leading to a substantial increase in the number of pensioners and amounts received. This indicates that the current pension scheme is very sensitive to adverse demographic scenarios.

The remainder of the section discusses the forecast of three factors in the Aggregate accounting formula presented in Table 3:

(a) The dependency ratio increases from 28.61% in 2016 to 64.65% by 2060 in both scenarios. This ratio is independent of the labour state transitions.
(b) The second factor, *Inactivity rate*, increases from 33.35% in 2016 to 64.06% by 2060 following the decrease in *Employment rate* from 58.23% to 29.63%. This result highlights the effect of considering the current labour market situation as permanent

Table 3. DISAGGREGATED PUBLIC PENSION EXPENDITURE PROJECTION (2016–2060).

	Pensions/Workers				
Year	Pensioners to WAP	Inactivity rate	Economic factor	Employment rate	Dependency ratio
Baseline Scenario					
2016	16.66%	33.35	58.69%	58.23%	28.61%
2030	24.57%	54.69%	51.22%	36.93%	39.22%
2040	36.28%	54.69%	41.86%	36.97%	54.35%
2050	41.18%	54.53%	38.84%	36.98%	69.74%
2060	32.59%	54.57%	40.57%	36.87%	63.66%
Full Employment Scenario					
2016	16.66%	33.35%	58.69%	58.23%	28.61%
2030	30.02%	0.34%	46.53%	99.65%	39.22%
2040	44.93%	0.30%	48.73%	99.69%	54.35%
2050	59.20%	0.34%	49.60%	99.64%	69.74%
2060	56.84%	0.38%	48.64%	99.60%	63.66%

Source: the authors.

during the forecasted period. In contrast, the *Employment rate* for the Full Employment Scenario is close to 99.60% by 2060.

(c) The third factor, *Economic factor*, indicates the degree of generosity of the pensions paid. This factor decreases from 58.69% in 2016 to 40.12% by 2040 and further decreases to 38.64% by 2060 because the inclusion of unemployment and inactivity decreases the contribution bases. Furthermore, the consideration of the *SF* reduces the pension at retirement and the *PRI* reduces the subsequent real pension as the forecasted indexation is lower than the wages' increase. However, for the *Full Employment Scenario,* this factor stays relatively stable from 58.69% in 2016 to 48.47% by 2060.

(d) The ratio between the *Pensioners to the Working Age Population* increases with time in both scenarios, even though this increase is much higher in the *Full Employment Scenario* where it goes from 16.66% in 2016 to 57.79% by 2060. This increase is the main driver of the increase in the *PE/GDP*.

The results obtained in our forecast differ from those made by the European Commission (2015). They estimate that the *PE/GDP* will increase from 11.8% to 12.5% by 2045 and then stabilize at 11% by 2060. The difference observed can be explained by the inclusion of unemployment and inactivity in our analysis, and exclusion of immigration. Indeed, their labour and population hypotheses are far more optimistic than ours. For instance, they assume that there are around half a million individuals immigrating to Spain between 2013 and 2060. However, the Spanish Statistics Institute indicates that the net migration rate has been negative between 2010 and 2015, indicating that more individuals migrating out than into the country.

The *employment rate* in 2016 of 58.23% is very similar in both studies. However, including labour states decreases this rate to 29.63% by 2060 while the European Commission considers that it will increase to 73% by the same year. Similarly, they assume that unemployment will decrease from 21% to 7.5% by 2060.

The *Economic Factor* from the European Commission is 59.7% in 2016 and decreases to 39.8% which is close to our results. The *Dependency ratio* increases in their study from 27% to 53% in 2060 aligning with Table 3. Our dependency ratio is higher since we abstract from immigration. Indeed, the difference goes from 2% to around 10% difference by 2050. Assuming an increasing working age population and optimistic labour market conditions contribute to their more stable spending in pensions.

We acknowledge that the two scenarios considered can be viewed as extremes. First, the *Baseline Scenario* assumes that the poor labour market performance during the GFC (2008–2016) is projected into future decades. This working assumption, despite being unrealistic, highlights the long-term effects of increasing inactivity. In this context, it is not just the pension system that becomes unsustainable; it is the whole economy that seems incapable of generating an adequate level of work and income.

Consequently, not only the retirement period should be fixed, but also the active period. The *Baseline scenario* emphasizes that pension reforms need to go hand in hand with a labour market reform, accommodating higher participation, higher employment and higher productivity. Indeed, Spain (and other European countries as well), has

introduced labour market reforms trying to enhance flexibility, to increase participation of informal workers and older workers through active ageing policies.[15] Labour market reforms should be complemented by comprehensive policies to increase the work–life balance of Spaniards, having a double positive effect: increasing labour force participation and fertility. Active policies to reduce youth unemployment and youth migration would yield positive demographic outcomes that would decrease the financial burden of the pension scheme.

As a contrast, in the *Full Employment Scenario,* we show the extreme of a highly efficient labour market where everyone participates. Even in this scenario, the *PE/GDP* would increase by 50% by 2040 and double by 2060. This is mainly driven by the dependency ratio which also doubles during the same period. However, despite this long run convergence to high expenditure levels, in the short run, an increase in labour force participation would half the expenditure levels (as a % of GDP) and would increase the adequacy of pensions, affecting positively the standard of living during retirement (Figure 8). We note that a more realistic scenario, including longevity improvements, and higher indexation rates would yield even more pessimistic results.

Possible venues to reform, which intersect the areas of labour and pension economics, are raising retirement age with life expectancy to correct to reduce the ratio of pensioners to workers. Indeed, Alonso-García, Boado-Penas, and Devolder (2018) show that raising the retirement age with life expectancy would yield to favourable sustainability outcomes compared to the case where the retirement age is fixed. However, this policy may increase inequality. Indeed, as Chetty et al. (2016) and Holzmann et al. (2017) note, the empirically observed relationship between educational attainment, income and life expectancy would render this policy unfair for a non-negligible part of the population that lives less long than average.

A more favourable demographic profile would impact the pension scheme's adequacy positively, measured by the *Economic Factor* in our Aggregate Accounting framework. Indeed, even in the optimistic *Full Employment Scenario*, this factor would decrease to slightly under 50%. To overcome this low outcome, exacerbated by subsequent applications of the *SF*, policymakers should create a legal and fiscal environment to increase the participation in occupational, second and third pillar schemes to complement the public pension pillar.

5. Conclusion

We analyse the sustainability of the Spanish pension system in an Aggregate Accounting framework and consider the three deficit-reducing mechanisms of the 2011 and 2013 pension reforms. We estimate reversible transitions from the Labour Force Survey database for the period 2008–2016 following the GFC. We contribute to the pension economics literature by incorporating labour risk endogenously in our multi-state labour states model within the Aggregated Accounting framework. The future retired population and their pensions depend directly on their contributory and non-contributory periods.

Considering the current labour market situation as permanent increases the pension expenditures as a percentage of the GDP exponentially, attaining a maximum of 35% by 2050 (*Baseline Scenario*). Whilst full employment enhances sustainability in the short term, in the long term it yields similar levels. The labour transitions have a lesser effect

because the pensions paid and the number of pensioners are far lower than the beginning of the forecasting exercise due to the high periods of unemployment and inactivity. In fact, the main driver in the last 20 years of forecasting is the increasing ratio between pensioners to the working population.

Even though the Ministry of Employment and Social Security reported in 2013 that the reforms put in place in 2011 and 2013 were enough to guarantee the sustainability of the pension system, we observe that whenever unemployment and inactivity are included their conclusion no longer holds. The results shown in this paper suggest that future social security reforms should go hand in hand with structural changes to the labour market to increase employment, positively impacting the sustainability of the system. Analysing labour transition for different kinds of contract (full time, partial, casual), as well as the gender dimension of labour and pensions, could enhance the analysis of the sustainability of the system and would provide some insights to the policymakers to assess which working groups should be targeted. The framework presented in this paper abstracts from immigration. In practice, migration plays a big role in the population dynamics of most developed countries. Subsequent longevity improvements may impact the long-term sustainability too. Accounting for transitions between contract types, migration, dynamic life tables and more heterogeneity are factors which will be included in our future research.

Notes

1. Southern European countries such as Portugal, Italy and Greece share a similar ageing profile than Spain and were also severely hit by the Global Finance Crisis lowering their overall employment rates, especially among their youngest (Eurostat, 2018b). Their replacement rate is among the highest in the European Union (OECD 2017), with the exception of Greece following recent pension cuts. Finally, Spain is a good proxy for an ageing population: high fertility rates during the post-war period, low fertility rates in the past decades, low immigration, and among the highest life expectancies among the 28 countries of the European Union (Eurostat, 2018a). However, our results should not be extrapolated to those countries as some have recently undergone major structural pension reforms.
2. "Bill 27/1 August 2011st on the Update of Adequacy and Modernization of the Social Security System" and "Royal Act – Bill 5/15 March 2013th" focus on active ageing. "Bill 23/23 December 2013rd" describes the parametric reform involving the indexation and sustainability factor.
3. Guerrero (2014) argues that *SF* guarantees sustainability only by means of pension reduction. Ideally, the Bill 27/2011 on Modernization of the Social Security System should have also increased the income from contributions by increasing the contribution base, tackling the informal workforce and complementing pensions to obtain adequate pensions as suggested by the White Paper on Pensions from the European Commission (2012).
4. A similar reform has been put in place in Finland since 2010 (OECD 2012).
5. Aggregate accounting in a pension context analyses the relationship between individuals earning wages and receiving benefits. The old-age dependency ratio, while informative, is not an accurate way of analysing the pension benefits and its sustainability as not all individuals in working-age earn an income and not all old-age individuals receive pensions. This is especially important in our setting with reversible labour market dynamics.
6. We abstract from the gender perspective of labour market transitions and the effect of the latest 2015 reforms due to data constraints. Women have more frequent work-profile interruptions linked to child-rearing activities, lowering their contributions to Social

Security. To successfully address the gender dimension, data on household level would be needed. The LFS database is silent about household composition, marital status, wages and number of children. Interactions between gender and household composition could inform labour market dynamics post-GFC. Women entered the labour market following their partner's loss of income. However, this transition may not be permanent, leading to low contributory periods and pensions (Addabbo, Rodríguez-Modroño, and Gálvez Muñoz 2015). Furthermore, women have a higher life expectancy but also a higher probability of living in bad health conditions (Serrano-Alarcón and Perelman 2017). The lower pensions combined with longer (healthy and unhealthy) lifespans make the labour market inequalities persist during retirement (Vara 2013).

7. Markov processes assume that the probability of an individual i aged x in a state j_t by time t, only depends on the most recent information available at the last period and is independent of its path before. We do not consider the duration in each state in our model. To estimate the duration of the sojourns on either employment, unemployment and inactivity, longitudinal individual-level data should be used to track their working careers.
8. We do not view this assumption as a shortcoming since we consider trimestral labour transitions.
9. Bill 27/2011 establishes a retirement age of 67 by 2027 with a long transition period. We consider a retirement age of 67 to assess the long-term sustainability of the scheme.
10. Migration is often not considered when theoretically studying pension schemes (OECD 2016). We abstract from migration despite the recently observed positive trend, to ensure tractability of our results and to show the effect of labour market transitions. Considering immigration has a positive effect on the income from contributions in the short term but affects the long-term pension liabilities too.
11. The number of pensioners in 2016 resulting from our model is similar to those provided by the Statistical Reports from the Ministry of Employment and Social Security, confirming the accuracy of our model.
12. Annual wages are based on gross work-related earnings, both in cash and in fringe benefits.
13. Year 2015 wages' increase data for the employed, and year 2016 forecasted CPI for the unemployed.
14. The Spanish pension system has four pension schemes. The "General" pension scheme has a coverage of 80% and includes most employees, artists, house-keepers and agricultural workers. The remaining schemes are the "Self-employed scheme", "Coal-miners scheme" and "Seafarers scheme".
15. Bill 27/1 August 2011st, Royal Act – Bill 5/15 March 2013th, Royal Act – Bill 11/2 August 2013nd, Bill 23/23 December 2013rd.

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