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AN ESTIMATE OF PENSION SYSTEM FINANCIAL RETURNS

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ABSTRACT

This article estimates the financial return provided by the Spanish pension system for a sample of new retirees in 2017, calculated on the basis of the *Muestra Continua de Vidas Laborales.* The findings show an average real annual return (understood as the discount factor that equates the present value of the contributions paid over a working life with the value of the expected pension) of 3.5%, the 25th and 75th percentiles of the distribution of the estimated returns being 2.5% and 4.2%, respectively. By type of pension, the lowest returns are associated with early retirement, while late retirement produces higher returns, although these are still lower than for ordinary retirement. In terms of pension unit cost, the system would provide more than €1 of benefit for each euro of contribution for most of the individuals in the sample. The findings show that, on average, 2017 retirees receive €1.74 of pension for each euro of contribution; the 25th and 75th percentiles of the distribution are €1.25 and €2.03, respectively.

Keywords: pension system, internal rate of return, pension unit cost.

JEL classification: H55, J26.

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Introduction

The benefits paid by the Spanish contributory pension system are mostly financed by the contributions of current workers. They in turn accumulate pension rights through the payment of such contributions, which guarantees them a flow of income upon retirement.

This system, known as pay-as-you-go and to be found in most European countries, can be understood as an investment mechanism, whereby the participants contribute funds during their working lives (social contributions) in order to receive these funds in future, along with a certain return, in the form of income for life (the pension received during retirement).

From this standpoint, a pay-as-you-go pension system can be analysed from a financial-actuarial perspective, insofar as, for the participants, it acts as a mechanism for converting today's contributions into future income. From this perspective, the system has an associated return, which is simply the ratio of the funds contributed during a working life to the benefits received during retirement. Analysing the financial return provided by the system is highly relevant in this context, since it provides useful information to gauge the system's intertemporal financial balance, the incentives provided by each type of retirement and the attractiveness of the pension system relative to alternative investment options.

This article estimates the financial returns provided by the pension system for a sample of new retirees in 2017. Also, it characterises the distribution of such returns and the heterogeneity across different types of pension. For this purpose, the discount factor is calculated that equates the present value of the contributions made to the system during a working life with the present value of the expected pension flows received during retirement. This discount factor may be interpreted as the return a new retiree can expect to obtain from his/her participation in the pension system.

The findings show that the pension system provides an average real annual return of 3.5%, while the 25th and 75th percentiles of the distribution are 2.5% and 4.2%, respectively. By type of pension, ordinary retirement generates the highest average

return (4.1%), as compared with retirement following partial retirement (3.9%), voluntary late retirement (3.7%) and early retirement (2.8%).

Studies of the financial return provided by pay-as-you-go pension systems have a long tradition in the literature, going back at least to Samuelson (1958). In Spain, numerous studies have estimated the return provided by the Spanish pension system. For example, Devesa and Devesa (2009) use aggregate data to calculate this return. They find that retirement pensions had an associated real return of 3.8% in 2006 and a pension unit cost (which measures the number of euro received in benefit for each euro of contribution) of €1.28.[1] Also, on the basis of microdata from the *Muestra Continua de Vidas Laborales* (Social Security administrative labour records, MCVL),[2] which is also the data source for this article, Devesa et al. (2012) and Devesa et al. (2017) estimate that new retirees obtained returns of 4.5% and 3.6% in 2008 and 2014, respectively. The exercise conducted in this article is very similar to that of these two studies. However, the analysis of this article focuses on 2017 and offers a characterisation not only of the average return but also of the distribution of returns, both for the system as a whole and for different types of retirement pension. It should be noted that the return estimated for 2017 is similar, on average, to that obtained by Devesa et al. (2017) for 2014.

The rest of the article is structured as follows: the next section details how the system's financial return is calculated, Section 3 presents the findings and, finally, Section 4 summarises the main conclusions.

Calculating the return provided by the pension system

In this article, two measures are used to calculate the return on the Spanish pension system for new retirees in 2017: the internal rate of return (IRR) and the pension unit cost (PUC). Both measures are standard in the literature (see, for example, *Instituto de Actuarios Españoles,* 2019).

In the context of this analysis, the IRR is defined as the discount rate that equates the present value of the contributions made by a worker during his/her working life with the present value of the pension received during his/her retirement. This is therefore a measure of the return that the worker would obtain on his/her contributions to the pension system. The present values needed to compute the return are calculated at the time that the new retirees commenced their working lives. Thus, the IRR can be interpreted as an expected return, since at the start of a working life the

1 In the same year, disability, widow(er)'s, orphan's and survivors' pensions show returns of 2.6%, 1.3% and 0.9%, respectively.

2 The MCVL is an annual set of individual data for those persons who have a relationship with the Social Security system. For persons included in the sample, the MCVL provides information on registrations and past benefits, which enables their working lives to be reconstructed.

flows of contributions, inflation, the pension that will be received and longevity are all subject to uncertainty. In practical terms, the values used are those observed for contribution flows and inflation over the working life, and the initial pension actually granted, which is assumed to increase in future in line with the CPI. Thus, it is an expected IRR, insofar as there is uncertainty surrounding future inflation, which determines pension increases, and longevity.

Following Devesa et al. (2002), the present value of contributions at the start of a working life is given by the following expression:

$$VP_{cot} = \sum_{t=0}^{j-1-a} P_{a,a+t} * cot_t * (1+\pi_t)^{-t} * (1+r)^{-t}$$

where t is the period, in months, j is the age at retirement, a is the age at which the first contributions are made, $P_{a,a+t}$ is the probability of survival from a until a+t, cot_t are the contributions made in periodt, π_t is the inflation rate and r is the discount rate.

The present value of the benefits, also at the start of the working life, is given by the following formula:

$$VP_{pen} = \sum_{t=j-a}^{w-1-\alpha} P_{a,a+t} * pen_t * (1+\pi_t)^{-t} * (1+r)^{-t}$$

where w is the age limit of the mortality table used and pen_t is the pension received in period t.

Thus, the IRR is the discount rate (r) that equates the present value of the contributions (VP_{cot}) with the present value of the benefits (VP_{pen}). From an actuarial viewpoint, therefore, it can be interpreted as the return that would need to be applied to social contributions during the working life in order for the sum of contributions to the system to be equal to the benefits received from it, in the form of a lifetime income, during retirement. Given the uncertainty surrounding the participant's longevity and the path of the CPI, as mentioned above, such return should be interpreted as an expected return.

The PUC, meanwhile, measures the amount of pension provided by the system for each euro of contribution made. It is calculated as the ratio of the present value of benefits to the present value of contributions, both calculated in accordance with the above formulae. In this case, real GDP growth is used as the discount factor to calculate the present value of contribution and pension flows.[3] Specifically, the

3 In this respect, it is assumed that the average investment should perform in a similar way to the economy's expected potential GDP growth. See Rachel and Smith (2015), who suggest that lower (higher) real GDP growth would lead to an increase (decrease) in household saving, in order to smooth life-cycle consumption, thereby producing a fall (rise) in the real interest rate

historic values of GDP growth are used to calculate the present value of contributions, and a discount rate of 1.3% to obtain the present value of the flow of future benefits, which coincides with the average of the potential GDP projections made by various agencies (see Chart 2.2).[4]

The calculation of the expected return obtained by participating in the pension system is important because it provides information on the system's financial balance. Moreover, it is useful to be able to rationalise the incentives that have a bearing on individuals' decisions as to when to make the transition from the labour market to retirement. To illustrate this latter aspect, consider the return that would be obtained by a notional worker retiring in 2017 at different ages (ranging from 63 to 67), with a specific contribution history.[5] In particular, the contribution period considered is 459 months (approximately 38 years) and a contribution base equal to 45% of the maximum contribution base in each month. Note that, although this notional contributor has not been specifically designed to be representative of the population of contributors, if he/she retires at the statutory retirement age of 65, a pension of €1,338 per month is generated, which is very similar to the actual average pension of €1,318 for new retirees in 2017.

Depending on the retirement age, the monthly pension ranges from €1,124 if the worker retires at 63 to €1,445 if he/she retires at 67 (see Chart 1.1). However, in terms of financial returns, the incentive to postpone the retirement age is very limited. In fact, the highest return is obtained when retiring at the statutory age of 65 (see Chart 1.2). If the worker postpones his/her retirement by one or two years, a larger pension is obtained (owing to the bonus associated with postponement of retirement), but it is received over a shorter expected period, so that the return does not increase relative to retirement at the ordinary age. Note, moreover, the step profile when returns are displayed as a function of the retirement age, which reflects the discontinuities that exist when the pension amount is calculated. Specifically, while the penalty for early retirement is applied on the basis of the number of quarters by which retirement is brought forward, the bonus for delaying retirement is computed on the basis of the number of complete years of work after the statutory retirement age. This asymmetry in the calculation of penalties and bonuses may give rise to discrete changes in benefits when retirement is merely brought forward or delayed by a small number of days.

It should be noted that the relationship between the return provided by the pension system and the retirement age described in the example above depends on many other factors, including the amount of contributions made and the possible application

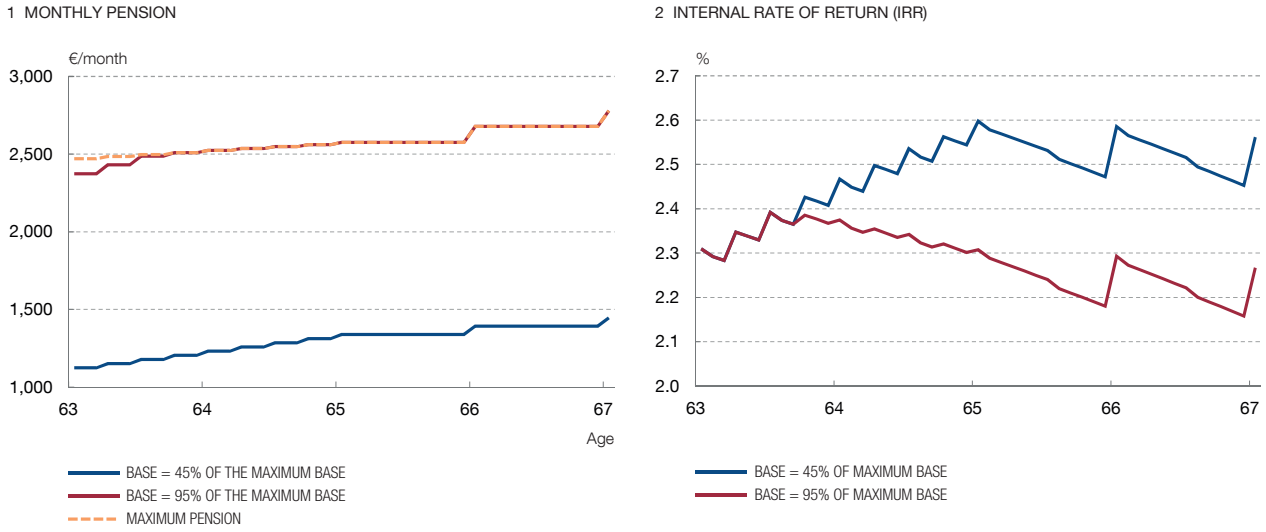
4 If the IRR itself is used as the discount factor when calculating the PUC, the result would, by definition, be a value of one.

5 In this exercise the contribution period is held constant for all retirement ages. In this way, the return obtained by the worker at each retirement age does not depend on the amount of contributions made, but basically varies as a result of the penalisation or reward coefficients applied according to the retirement age and the life expectancy upon retirement.

Chart 1

PENSION AMOUNT AND FINANCIAL RETURN ACCORDING TO RETIREMENT AGE (a)

The incentive to postpone the retirement age, in terms of the financial return, would be limited for a conributor with a long contribution history, since the increase in the pension amount would not compensate for the shorter period of receipt.



SOURCE: Banco de España.

a Calculation of the pension and the real rate of return that would equate the present value of the contributions with the present value of the benefits. Exercise assumptions: contributors who retire in 2017 at different ages with a contribution period of 459 months (approximately 38 years), contribution bases equal to 45% or 95% of the maximum base at each point in time and a contribution rate equal to 64% of the common contingencies rate. Note that the supplement associated wiith retirement over the statutory age has been introduced as an increase in the maximum ordinary retirement pension.

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of upper and lower limits to pension amounts. These factors may make some types of retirement more attractive than others. To illustrate this, consider another example in which the worker has the same contribution period as established above, but higher contribution bases, specifically 95% of the maximum base in each month. In this case, the highest return would be obtained by retiring early, at the age of 63.5 (see Chart 1.2), since the pension generated approximately from this retirement age would be limited by the maximum pension (see Chart 1.1). Thus, postponing retirement by a few months slightly increases the amount of the pension,[6] but this does not make up, in terms of financial return, for the shortening of the period during which the pension is received. Thus, workers with high regulatory bases tend to find it more attractive to leave the labour market early than others with lower bases.

Financial return for new retirees in 2017

To calculate the financial return that the pension system provides, a sample of new retirees from the 2017 MCVL is used. The analysis is confined to retirees from the

6 In practice, the maximum pension is an increasing function of the age of retirement.

General Social Security Regime and the Special Regime for the Self-Employed. The sample also includes persons starting to draw ordinary retirement pensions following partial retirement pensions, but it excludes persons starting to draw partial retirement pensions, which allow them to receive retirement benefits while engaging in part-time work, whose contributions are not observed. The analysis also excludes persons starting to draw full retirement pensions who were previously receiving disability pensions, and persons receiving pensions below the lower limit. Lastly, excluded from the findings are pensions that give IRRs or PUCs below the 1st percentile or above the 99th percentile of the distribution, so as to prevent outliers having an excessive impact on some of the statistics. The final sample contains 7,627 observations, which is approximately equivalent to 64% of total new retirees in the 2017 MCVL.

The IRR is calculated as described in the previous section. The present value of contributions is calculated in the month in which each pensioner joins the labour market. Each month's contribution is a result of multiplying the observed contribution base by 64% of the contribution rate for common contingencies.[7] Note that the MCVL has numerous records of social security registration where there is no information available on the contribution base, specifically most of the pre-1980 records. For this reason, where this information is missing the contribution bases have been imputed.[8] This lack of information introduces a significant note of caution into the interpretation of the findings presented below.

To calculate the flow of benefits, the starting pension granted to each individual is taken and future values are calculated using the CPI.[9] The survival probabilities are taken from the mortality tables for men and women produced by the National Statistics Office (INE). As these tables are expressed in annual terms, while contribution and pension flows are calculated for each month, the same probability of survival is used for all the months in which a person's age in years remains unchanged. Lastly, for purposes of simplicity, the maximum age is limited to 100.

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7 Contributions for common contingencies cover not only retirement but also other benefits such as temporary and permanent disability benefits, maternity and paternity leave and survivors' benefits. Average expenditure on retirement pensions as a proportion of all the benefits covered by the contributions for common contingencies may be estimated as approximately 64% in the period 1977-2018; accordingly, this percentage is used to approximate total retirement contributions. It is important to note that this percentage is a theoretical approximation of the amount of workers' contributions that go to their pensions. A higher percentage would signify higher contributions to the system in the context of calculation of the IRR and, therefore, a lower rate of return.

8 For contribution bases prior to the first contribution base of each individual, the rates of change in nominal wages in Spain reported by Domínguez et al. (2011) have been used (see their Table 1.5). In cases where information is missing on contribution bases subsequent to a worker's first contribution base, the nearest base within the same year and for the same employment relationship has been used, if that information is available, or the contribution bases for the same employment relationship for previous years, together with the wage increase if they are before 2009. Account has been taken of the existence of maximum and minimum contribution bases. Lastly, for employment relationships where there is no information on any contribution base, the minimum contribution base has been used.

9 For 2018 and 2019 the observed CPI is taken, and for 2020 and 2021 the Banco de España's CPI forecasts made in September 2019. For 2022 onwards it is assumed that the CPI will rise by 2% per annum. Note that this path for pension values assumes the derogation of the Pension Revaluation Index introduced in the 2013 pension reform.

Table 1

DISTRIBUTION OF ESTIMATED RETURNS FOR NEW RETIREES IN 2017 (a)

The average real return for new retirees in 2017 is 3.5%. The highest return corresponds to ordinary retirement (4.1%), while the lowest return is associated with early retirement (2.8%).

	Sample size	Mean (standard deviation; %)	5th percentile (%)	25th percentile (%)	Median (%)	75th percentile (%)	95th percentile (%)
All new retirees	7,627	3.53 (1.49)	1.70	2.55	3.21	4.23	6.31
Normal	3,462	4.11 (1.75)	1.81	2.81	3.77	5.12	7.41
Early	3,154	2.80 (0.82)	1.55	2.29	2.76	3.24	4.22
Voluntary late	261	3.69 (1.72)	1.48	2.41	3.38	4.70	6.55
Following partial retirement	750	3.90 (0.79)	2.79	3.40	3.80	4.31	5.47

SOURCE: Banco de España, based on the *Muestra Continua de Vidas Laborales* (MCVL).

a Note that this distribution relates to the estimated returns and not to pension levels.

Table 1 shows the return provided by the pension system for new retirees in 2017 according to our findings. The average return calculated, expressed in real and annual terms, for these retirees as a whole is 3.5%, albeit with a considerable degree of heterogeneity. For example, the 25th and the 75th percentile of the distribution are 2.5% and 4.2%, respectively, and the median is 3.2%. By pension type, the lowest average rate of return is for early pensions (2.8%), while the average return for ordinary pensions is 4.1%. Note also that the distribution of the return for early pensions shows a lower level of dispersion: 90% of early pensions have an associated rate of return between 1.6% and 4.2%, compared with between 1.8% and 7.4% for ordinary pensions.

In the case of voluntarily deferred pensions, the average rate of return is 3.7%, close to but lower than that for ordinary pensions. Insofar as financial returns are concerned, this suggests little incentive for persons to prolong their working lives. This finding should, however, be treated with caution, given the relatively low number of pensions of this kind in the sample.

Lastly, in the case of ordinary retirement pensions following partial retirement pensions (drawn by those engaged in part-time work at the same time as they received a pension), the average associated rate of return is 3.9%, very close to that of ordinary pensions in general. This finding suggests that partial retirement may be an attractive option, from a financial standpoint, as a form of gradual transition between the labour market and retirement.[10]

10 See Anghel and Lacuesta (2020).

Table 2
CHARACTERISTICS OF THE NEW RETIREES INCLUDED IN THE SAMPLE

Early retirement, relative to ordinary retirement, is associated with a lower retirement age, longer contribution histories and higher regulatory bases. These latter two characteristics generate a higher average pension.

	Retirement age (years)	Contribution period (years)	Regulatory base (€)	Percentage applied to base (%)	Pension (€/month)
All new retirees	64.2	37.6	1,557	87.8	1,398
	(1.7)	(8.2)	(810)	(12.7)	(707)
Ordinary	65.2	33.6	1,224	88.9	1,163
	(0.8)	(9.2)	(717)	(14.7)	(648)
Early	62.6	40.7	1,772	83.1	1,478
	(1.2)	(4.4)	(785)	(8.2)	(667)
Voluntary late	67.7	35.9	1,492	98.0	1,458
	(1.3)	(9.1)	(842)	(15.3)	(818)
Following partial retirement	65.0	44.0	2,209	99.5	2,122
	(0.4)	(4.3)	(578)	(2.7)	(482)

SOURCE: Banco de España, based on the *Muestra Continua de Vidas Laborales* (MCVL).
NOTE: The table shows the mean and standard deviation (in brackets) of the characteristics of the pensions by type of pension.

Tellingly, there is a very high level of heterogeneity both in terms of age and number of contribution years between pensioners drawing the different types of pension. This would go a long way to explaining the different rates of return associated with each pension type. Indeed, Table 2 shows that pensioners who draw an early pension do so, on average, 2.6 years earlier than pensioners who draw an ordinary pension. This increases the rate of return associated with early pensions, as in terms of expected value they are drawn for longer. However, early pensions are associated, on average, with substantially longer contribution histories (40.7 years compared with 33.6 years for ordinary retirement pensions) and lower percentages applied to the regulatory base (owing to the earlier retirement age). Accordingly, as they have been making contributions for longer and as they are penalised, in terms of the amount of pension received, for taking their pension early, for workers taking early retirement the aggregate rate of return is lower than that of ordinary retirement pensions.

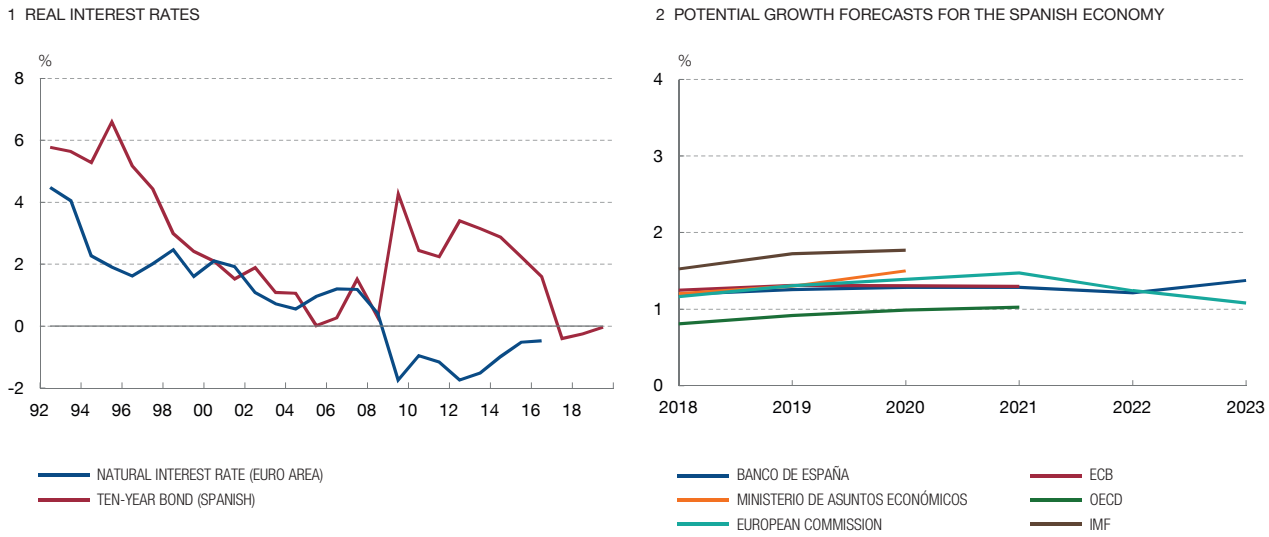
The average return for new pensions overall in 2017, which as indicated above is estimated to be 3.5%, can be placed in context by comparing it with the return obtained on other investments in recent decades. For example, the real interest rate on Spanish 10-year bonds has fallen from 6.6% in the mid-1990s to slightly negative levels in the more recent period (see Chart 2.1). Considering the present and future setting, characterised by population ageing, modest potential economic growth in Spain and very low interest rates (see Chart 2.2),[11] it is to be expected that returns on other investments will tend to be substantially lower than the average of recent decades.

11 See Banco de España (2019).

Chart 2

REAL INTEREST RATES AND POTENTIAL GDP FORECASTS

Interest rates, including the natural rate, have fallen notably in recent years. The structural factors of the Spanish economy (e.g. population ageing and low productivity) suggest moderate potential growth in future.



SOURCES: Banco de España, estimates based on the model of Fiorentini, Galesi, Pérez-Quirós and Sentana (2018), ECB, Ministerio de Asuntos Económicos y Transformación Digital, European Commission, OECD and IMF.

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Another metric that may be used to place the estimated rate of return for pensions in context is the PUC. As indicated above, the PUC measures the amount of pension received from the system for each euro of contribution made. In this case, as (historical and forecast) real GDP growth has been used as the discount factor in the calculation, rates of return above the rate of economic growth would result in a PUC greater than one, i.e. the benefits provided by the system would be higher than the contributions made. Note that average real GDP growth in Spain in the period 1980-2018 was 2.3%, while potential growth, according to various bodies, is around 1.3%.[12]

Table 3 shows the PUC estimates for the different types of pension. On average, the system provides €1.74 of pension for each euro of contribution, although in this case also there is a high degree of heterogeneity both across the distribution and by pension type. The lowest PUC for new retirees is below €1, while at the top end of the distribution PUCs are over €2 or even €3. The distribution median is €1.54 of pension for each euro of contribution. By type of pension, early retirement has the lowest PUC (€1.39 of pension per euro of contribution). Voluntarily deferred pensions and pensions following partial retirement also have an average PUC slightly below that estimated for ordinary retirement pensions. However, in the case of full retirement

12 Specifically, 1.3% is the average of the following projections: Banco de España (1.4 % in 2023); ECB (1.3 % in 2021); Spanish Ministry of Economic Affairs and Digital Transformation (1.5 % in 2020); OECD (1.0 % in 2021), European Commission (1.1 % in 2023) and IMF (1.8 % in 2020)

Table 3
ESTIMATION OF THE PENSION UNIT COST (PUC) OF NEW RETIREES IN 2017

On average, the retirement pension system provides €1.74 of pension for each euro of contribution made, with a significant degree of heterogeneity across the distribution and by type of pension.

	Sample size	Mean (stand. dev.)	5th percentile	25th percentile	Median	75th percentile	95th percentile
All new retirees	7,627	1.74 (0.75)	0.92	1.25	1.54	2.03	3.16
Ordinary	3,462	2.03 (0.90)	0.95	1.35	1.81	2.51	3.86
Early	3,154	1.39 (0.38)	0.87	1.15	1.34	1.57	2.06
Voluntary late	261	1.74 (0.77)	0.84	1.17	1.57	2.15	3.11
Following partial retirement	750	1.89 (0.45)	1.32	1.61	1.81	2.09	2.81

SOURCE: Banco de España, based on the *Muestra Continua de Vidas Laborales* (MCVL).

pensions following partial retirement, the distribution is much more uniform, with the PUC being higher than that for ordinary retirement pensions approximately up to the mid-distribution level.

Conclusions

These findings show that the average annual financial return provided by the Spanish pension system for a sample of new retirees in 2017 is 3.5%. The analysis also reveals a high degree of heterogeneity in the returns provided by the system, both between individuals and by type of pension. For example, the associated rates of return for 25% of these new pensions are over 4.2%, while for a further 25% they are under 2.5%. Moreover, by pension type, the associated rates of return for early retirement pensions are lower than for ordinary retirement pensions, while those for partial retirement and voluntarily deferred pensions are similar to or slightly lower than for ordinary retirement pensions. Lastly, in terms of pension unit cost, the analysis shows that, on average, the system provides approximately €1.7 of pension for each euro of contribution, in this case also with a significant degree of dispersion across the distribution and by pension type.

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