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To cite this article: Gonzalo Edwards, Raimundo Soto & Felipe Zurita (2023) Life expectancy at retirement and income in Chile, Applied Economics Letters, 30:2, 126-130, DOI: [10.1080/13504851.2021.1979187](https://doi.org/10.1080/13504851.2021.1979187)

To link to this article: <https://doi.org/10.1080/13504851.2021.1979187>



Published online: 23 Sep 2021.



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ARTICLE



Life expectancy at retirement and income in Chile

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ABSTRACT

Using a sample of over 579 thousand workers that retired under the annuity system in Chile, we find that, conditional on reaching retirement age, there is a three-year difference in life expectancy between the lower and higher income groups in both men and women.

KEYWORDS

Retirement; life expectancy; Chile; gender differences

JEL CLASSIFICATION

D31; J26

I. Introduction

Starting in 1981, Chile has been a pioneer in the implementation of a social security system, which is contribution-defined, privately managed, and based on individual accounts. It covers around 10.6 million workers and has around 1.3 million pensioners.

This paper documents that life expectancies at retirement differ significantly by income levels and gender in Chile. Using a database of 579 thousand workers that retired under the annuity system, we find that, conditional on reaching retirement age, there is a three-year difference in life expectancy between the lower and higher income groups. Differences are similar for men and women.

Beginning with the seminal contribution of Preston (1975) there is a large literature on the strong, positive relationship between life expectancy and income (the ‘Preston curve’). His results, obtained using cross-country data, also hold within a country. Chetty et al. (2016) found that higher income is associated with greater longevity throughout the income distribution in the United States for the period 2001–2014. Evidence has also been found for Germany (Luy et al. 2015), England (LSP 2020), and Spain (Pérez-Salamero, Regúlez, and Vidal-Meliá 2021), among others. Evidence for Latin American countries is scant, and no analysis has been published for the Chilean case.

Analyses of life expectancy and income at retirement age are less abundant. Haan, Kemptner, and Lüthen (2020) found that at age 65 the longevity gap between top and bottom deciles (D_{10} – D_1) of German workers is around 4 years for men born 1926–28. Sanchez-Romero, Lee, and Prskawetz (2020) estimate that the longevity gap between top and bottom income quintiles (QU_5 – QU_1) in the US was 3.3 years for the 1930 cohort. Kinge et al. (2019) found longevity gaps in Norway similar to those observed in the United States, despite the significantly more egalitarian income distribution of the Nordic country. Our result of a 3-year gap within a group that belongs to the top four deciles in the pension distribution, indicate that the ‘Preston curve’ also verifies at retirement age in Chile.

II. Background

The Chilean pension system operates, since 2008, based on a three-pillar structure. In the Mandatory Pillar, dependent workers must save 10% of their monthly wages up to a monthly limit of UF 80 (or USD 3,200).¹ The government provides minimum and complementary pensions through the Solidarity Pillar. Workers may increase their savings, with tax benefits, in the third Voluntary Pillar.

At retirement,² workers decide the destination of their accumulated funds: they can buy an annuity from life insurance companies; they can follow

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¹The data are recorded in UFs, an inflation-adjusted accounting unit.

²The statutory retirement age is 65/60 years old for men/women.

a programmed withdrawal scheme from pension funds; or a combination of these two. Pensioners who don't have sufficient funds to purchase an annuity of at least the Basic Solidarity pension (about USD 160) must follow a programmed withdrawal scheme.

For those choosing to buy annuities, accumulated funds are transferred to an insurance company using a centralized, anonymous and competitive auctioning system.

We analyse the universe of annuities issued since the inception of the new social security system in 1983. Table 1 shows that, after dropping disability and other pensions primarily inherited from the previous system, there are 579,116 annuities. By December 2018, 20% of pensioners had died but their records are kept in the database. Around 70% are males and 30% females.

Two variables are available for the analysis: monthly pensions, which indicate the flow of resources available for the pensioners during retirement; and the amount of savings in pension funds, which indicates the wealth stock the pensioner amassed during his/her working life.

As Table 2 shows, there is a wide disparity in accumulated pension funds and monthly pensions. Their distributions are highly skewed, as indicated by means significantly higher than medians. Furthermore, annual real rates of return of pension funds have been heterogeneous: in the 1980s they were in excess of 12%, declining to around 10% per year in the 1990s, and to 6% in the past 20 years.

Table 1. Observations.

	Women	Men	Total
Total	194,360	536,419	730,779
• Disabilities and other pensions	28,131	123,532	151,663
Usable	166,229	412,887	579,116
• Alive with annuity	116,729	134,398	251,127
• Alive with early retirement	34,007	174,843	208,850
• Dead with annuity	10,329	31,858	42,187
• Dead with early retirement	5,164	71,788	76,952

Source: based on SVS (2019).

Table 2. Descriptive statistics.

	Savings in Pension Funds in USD	Monthly Pension in USD
Mean	83,640	436
Median	60,320	312

Source: based on SVS (2019).

Table 3. Income and wealth brackets.

	Low	Medium	High
Accumulated Wealth	Less than USD 48,000	USD 48,000 to USD 96,000	More than USD 96,000
Total pensioners	214,977	206,689	157,359
Monthly pensions	Less than USD 200	USD 200 to USD 400	More than USD 400
Total pensioners	124,124	242,948	212,044

Source: based on SVS (2019).

Based on this information we chose three income and wealth brackets for our analysis (Table 3). In terms of monthly pensions, the low-income group of less than USD 200 would locate pensioners slightly above the minimum pension. The medium-income-bracket threshold corresponds to twice the minimum pension and all pensions above that level are classified as high. Wealth brackets were chosen in a consistent manner: we computed the minimum accumulated wealth that, given the observed sales rate of December 2019, would produce a monthly pension of approximately USD 200 for the low wealth group and doubled that figure for the medium wealth group.

Some caveats on the data. Pensions are not the only source of income for pensioners; other forms of income arise from being partially employed after retirement, the return on investments and savings, government and private transfers, etc. Pension funds are not the only form of wealth for pensioners, with housing and other investments as obvious alternative forms of wealth. Finally, the data refer only to individual pensions and wealth whilst a comprehensive income measure is that of the household. Both effects suggest that our estimates below may be biased downwards and, therefore, the true effects may be higher than estimated.

Furthermore, we abstract from Dahl et al.'s (2020) criticism on the assumption that individuals remain in the same decile of income distribution throughout their entire life. They show that when accounting for mobility, survival gaps are reduced: the life expectancy gap between a man in the upper income level vis-à-vis the poor at age 40 in Denmark for the period 1983–2013 reduces from 4.6 years to around 2 years, when mobility is considered.

III. Analysis

We first recalibrate official mortality tables used by insurance companies to calculate reserves as required by the pension system authorities. This is needed because mortality tables include all risks (annuities, programmed withdrawals, and other pensions) whilst we concentrate only on those that purchase annuities after retirement. Mortality tables estimated in Chile for 2014 are dynamically adjusted on a yearly basis to reflect improvement factors (e.g. improved health leading to higher survival rates). Mortality rates are updated as follows:

$$Q_{x,t} = Q_{x,2014}(1 - AA_x)^{t-2014} \quad (1)$$

where $Q_{x,t}$ is the probability that at time ‘ t ’ a person of age ‘ x ’ dies within a year. AA_x is the improvement factor for a person of age x .

For re-calibration, we assume that current official improvement factors are valid for the full period from 1995 to 2017. We estimate a general adjustment factor – denoted by f – using maximum likelihood methods and separating by gender, so that $Q_{x,t} = fQ_{x,2014}(1 - AA_x)^{t-2014}$. If $f = 1$, official mortality tables match the observed mortality

during the period. If $f < 1$, official mortality tables assign too low a probability of survival vis-à-vis the observed mortality, i.e. those that retired after 1995 live longer than what official mortality tables estimate. The adjustment factor was estimated using every annuity pensioner who was exposed in the period 1995–2017, excluding those that retire prior to statutory retirement age.

Results in Table 4 indicate that annuitants live slightly longer than the general population. The estimated f -factors are quite close to 1 (0.951 for men and 0.977 for women), indicating that official tables, *on average*, are not far off. These differences in survival rates would imply that life expectancy at statutory retirement age would increase by around 3 months for men and 4 months for women. However, when we replicate the recalibration by income or wealth brackets, results are markedly different: mortality rates decrease with higher levels of pension income or wealth at retirement. Differences between rich and poor retirees are significant: life expectancy for the affluent is around three years higher than the low-income group in our sample. The gap is about the same for men and women.

	Official Mortality Table	Adjusted Mortality Table	Wealth at Retirement			Monthly Pension		
			High	Medium	Low	High	Medium	Low
Correction Factor								
Men	1	0.951	0.745	0.969	1.098	0.798	1.021	1.155
Women	1	0.977	0.722	0.926	1.082	0.817	0.986	1.165
Life expectancy (in years)								
Men (after 65)	20.7	20.9	23.1	20.9	19.9	22.5	20.5	19.5
Women (after 60)	30.8	31.2	32.9	31.4	30.1	32.4	30.9	29.5

Source: based on SVS (2019).

Note: The estimation uses exposures during or after 1995, since data prior to 1995 is considered weak. The number of exposures were 1.91 and 1.00 million person-years for men and women respectively.

Table 5. Necessary capital per unit of pension.

	Official Table	Adjusted Official Table	Wealth at Retirement			Monthly Pension		
			High	Medium	Low	High	Medium	Low
Man, single	183.38	184.65	199.31	185.09	178.26	195.62	182.24	175.48
Man, married	228.03	229.65	241.22	230.40	223.82	238.25	227.21	220.90
Woman, single	245.17	247.33	256.09	248.47	241.73	253.75	245.77	238.47
Woman, married	252.75	254.73	263.93	255.75	249.21	261.50	253.12	246.10

Source: based on SVS (2019).

Note: Calculated using official mortality tables CB-H-2014 and RV-M-2014, updated to 2019. Couples at the time of pension are assumed to be 65 (husband) and 60 (wife), with no other beneficiary. Surviving spouses receive 60% of the pension obtained by the pensioner.

Table 5 shows the implications of our previous findings on the Necessary Capital per Unit of Pension at statutory retirement age (NCUP). The NCUP is the capital required to finance an annuity which will pay \$1 per month starting at a specific date, and for the rest of the pensioner's life. Consequently, it is the expected 'present value' of future payments of one unit of pension and it depends on mortality and interest rates. The lower the probability of being alive in the future, the lower the NCUP. The lower the interest rate, the higher the NCUP, because less funds will be needed today to produce a unit of pension in future periods.

Column 2 shows the NCUP for men and women. Values are higher for married individuals because they need to finance pensions for the surviving spouse. Values are also higher for women than men because they can retire five years earlier and live longer. Adjusting the official tables using the *average* life expectancy induces only small changes in computed NCUP (column 3). However, when computing NCUP according to wealth levels or monthly pensions, differences are substantial. For example, the NCUP of single men computed using Official Tables underestimates the value computed using wealth-adjusted tables by around 8% when wealth is high, but overestimates it by around 3% in the case of the low-wealth bracket.³

IV. Conclusions

We study mortality rates among 579,000 workers that chose to retire using the annuity system. We found that mortality rates differ significantly by income/wealth levels, independently of whether income is measured as pension received or accumulated funds at retirement. Differences between rich and poor workers are in fact quite significant: life expectancy for the high-income pensioners is around three years higher than high lower-income pensioners. The gap is about the same for men and women. This is a lower bound for such gap since annuities are available only for middle-to-higher earnings workers: exclusion of low-income individuals

may underestimate the real difference between the lowest and highest income groups in Chile.

Acknowledgement

We thank G. Alves and P. Comelatto for comments and J. Rojas, V. Martínez, and H. Mena for relentless support. We thank *Corporación Andina de Fomento* for financial support. The usual disclaimer applies.

Disclosure statement

No potential conflict of interest was reported by the author(s).

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³For more analysis on this issue, see Edwards et al. (2020).

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