Transparency and Adverse Selection: Evidence from an Electronic Platform for Annuities *

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Abstract

In this letter we show evidence that the introduction of an electronic platform in the Chilean annuity market in 2004 exacerbated adverse selection. Male annuitants who retired after 2004 live around two years longer than non-annuitants, while before the difference was smaller or non statistically significant. Moreover, post 2004 the fraction of annuitants decreased despite the fact that the deals offered by insurance companies improved. These two facts are consistent with the electronic platform bringing transparency, competition, and reducing the scope for sales agents to affect retirees' choices.

Keywords: Adverse selection, annuities, market transparency, Chilean pension system.

JEL: G14, G22, J32, D82.

1 Introduction

Upon retirement, Chilean workers choose between two main payment options: an annuity or a programmed withdrawal (PW) schedule. In the first case, retirees transfer their funds to an insurance company in exchange for a monthly inflation-adjusted payment until death. Under a PW schedule, funds remain invested in a pension fund and retirees receive decreasing

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payments until death or fund depletion. Remaining balance upon death is used to finance survivor's benefits or become part of the worker's inheritance. The choice implies a trade-off between insurance against longevity and financial risks versus leaving funds as bequest in the event of an early death.

Since August 2004, all Chilean retirees must use an electronic platform (SCOMP) in a three-stage decision process:[1] they request quotes for different annuity products, then insurance companies make sealed offers, and finally the retiree chooses between PW, one of the annuity offers, or attempts to bargain a better deal with one or more firms.

The introduction of SCOMP pursued two main goals: to increase competition and to help workers make better-informed decisions. Pre-SCOMP, workers were responsible for getting their own quotes from insurance companies and they were advised mainly by insurance companies' sale representatives, whose remuneration depended on the worker choosing an annuity.[2] Post-SCOMP, retirees receive a report including standardized information on the advantages and disadvantages of PW and annuities, a pension projection over time under a PW schedule, and the different annuity offers received from insurance companies, ordered from the highest to the lowest.

As agents make better-informed decisions, it is expected that adverse selection may emerge or exacerbate (Handel, Kolstad, and Spinnewijn (2019); Lester et al. (2019)). We find empirical support for this hypothesis. Using a dataset on male Chilean retirees between 1991 and 2014 we find no evidence of adverse selection during the pre-SCOMP period and strong evidence of it after its introduction. We confirm that the SCOMP had a relevant impact on selection by restricting the analysis to workers who retired three years before and three years after SCOMP.

Moreover, evidence presented in Morales and Larraín (2017) show that after the introduction of SCOMP the deals for annuitants improved and, at the same time, the fraction of retirees that chose to annuitize decreased. These puzzling stylized facts can be reconciled with a simple adaptation of the Handel, Kolstad, and Spinnewijn (2019) model.

In the next section we present our empirical results and explain the "transparency-mechanism" behind them. In Section 3 we present the conclusions.

[1] SCOMP is the Spanish abbreviation for System of Inquiries and Quotations of Pension Amounts (*Sistema de Consultas y Ofertas de Montos de Pensión*).

[2] As described by the pension authority of the time, before the introduction of SCOMP the decision process and the market for annuities had several important shortcomings: (a) potential retirees didn't have enough information about the product they were choosing, (b) intermediary commissions were excessive, and (c) there were obvious conflicts of interests between retirees and the intermediaries who advised them (Stewart and Reyes (2008), Morales and Zucal (2009), and Ferreiro (2015).

2 Data and empirical results

We have data on pension product choice (PW or annuity), pension amount, birth and retirement dates, and death date (censored at June 2014) of all workers who retired at normal age between 1991 and 2013 and were allowed to choose between annuity and PW.[3]

We compare individual mortality of annuitants and those who choose PW to evaluate the extent of adverse selection; i.e., if annuitants live longer than non-annuitants. In the vein of Finkelstein and Poterba (2004), we estimate a parametric continuous-time duration model with a Gompertz distribution and include the decision to annuitize as a control.

The hazard hazard and survivor functions are, respectively

$$\begin{aligned} h(t_i) &= \lambda_i \exp(\gamma t_i) \\ S(t_i) &= \exp\left\{-\lambda_i \gamma^{-1}(e^{\gamma t_i} - 1)\right\}. \end{aligned}$$

The model is implemented by parameterizing $\lambda_i = \exp(x_i'\beta)$ and γ is an ancillary parameter to be estimated from the data. In particular we maximize the (standard) log likelihood for a Gompertz mortality model:

$$\log L(\gamma, \beta) = \sum_{i=1}^{N} \left\{ d_i \log[h(t_i, x_i; \gamma, \beta)] + \log\left(\frac{S(t_i; \gamma, \beta)}{S(r_i; \gamma, \beta)}\right)\right\},$$

where d_i is a dummy equal to 1 if the person died during the observation window and 0 otherwise, t_i is the time elapsed (in days) between retirement and death, and r_i is retirement age (in days).

We also consider modeling duration with unobserved heterogeneity (or frailty) as an unobserved multiplicative effect (α_i) on the hazard function; i.e., $h(t_i|\alpha_i) = \alpha_i h(t_i)$. For estimation purposes we assume α is distributed as Gamma$(1/\theta, \theta)$.

In Table 1 we report the marginal effects of each variable on expected longevity. In the first specification –Panel A– the control variables pension, age at retirement, and age at SCOMP are treated as continuous variables, while in the second specification –Panel B– we work with pension deciles and two sets of dummy variables, defined by year of birth and age at retirement (in years).

For example, the first column of Panel A suggests that those who annuitized between 1991 and 2004 live 0.45 years less than those who chose PW; being one year older in August 2004 is associated with 0.09 less survival years; increasing initial pension by 1UF is associated

[3]We restrict attention to male annuitants, as the sample for women is relatively small and, more importantly, the fraction of deceased women is only 2% for those who retired after 2004. In Table A.1 in the Appendix we present a table with descriptive statistics.

with an additional longevity of 0.15 years;[4] etc. In Panel B we report only the marginal effect of the annuity dummy, which for the pre-SCOMP sub-sample is -0.88.

In columns 1 and 4 we report the results without frailty, in columns 2 and 5 the results when frailty and the annuity coefficient are estimated at the same time and separately for each subsample, and for columns 3 and 6 when we followed a two-step procedure, where a single θ is estimated in a full sample first-stage that excludes the variable *Annuity*, and then the estimated value is imposed in the second stage of the two sub-samples.

Table 1: Continuous Time Duration Models / Pre and post-SCOMP
Average Marginal Effects on Median Duration (Years of Life)

	Pre SCOMP			Post SCOMP		
	No frailty	With Frailty	Frailty 2S	No frailty	With Frailty	Frailty 2S
Panel A - Models controlling for year of birth, retirement age, and initial pension						
Annuity dummy (0 if PW)	-0.448**	-0.453**	-0.455**	1.934***	1.748***	1.922***
	(0.177)	(0.178)	(0.178)	(0.329)	(0.322)	(0.325)
Age at start of SCOMP	-0.087***	-0.091***	-0.093***	-0.300***	-0.253***	-0.297***
	(0.026)	(0.025)	(0.025)	(0.090)	(0.081)	(0.089)
Retirement age	0.050	0.054	0.057	0.210	0.196	0.208
	(0.079)	(0.080)	(0.081)	(0.145)	(0.147)	(0.145)
Initial pension	0.147***	0.145***	0.144***	0.135***	0.120***	0.133***
	(0.009)	(0.009)	(0.009)	(0.017)	(0.016)	(0.016)
lntheta		-1.740***	-1.330***		1.151**	-1.330***
		(0.639)	(0.381)		(0.578)	(0.381)
Panel B - Models with year of birth, retirement age, and initial pension decile fixed effects						
Annuity dummy (0 if PW)	-0.884***	-0.947***	-0.951***	1.299***	1.172***	1.265***
	(0.202)	(0.201)	(0.201)	(0.333)	(0.329)	(0.322)
lntheta		-0.715***	-0.639***		0.648	-0.639***
		(0.230)	(0.199)		(0.770)	(0.199)
Observations	40308	40308	117453	77145	77145	117453

Standard errors in parentheses. (*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$)

Focusing on the marginal effect of the annuity dummy, we observe that pre SCOMP the correlation between longevity and annuitization is negative and significant in all the specifications, while for the post SCOMP period all marginal effects are positive and significant at 1% (between 1.2 and 1.9 years). I.e., the electronic platform brought adverse selection to this market.

These results are confirmed when we focus on a narrower time window around SCOMP. In Table A.2 in the Appendix, we repeat our estimations for the subsample of workers who retired within three years of the SCOMP introduction, and in Table A.3 for those who retired in this time window and belonged to the top six deciles of the initial pension distribution.

Limiting the sample period is important to make sure the SCOMP effect identified is not related to a simple time trend, while restricting attention to the top six deciles is relevant

[4] Annuities and many other contracts in Chile are expressed in *Unidades de Fomento* (UF), a unit of account that closely follows the CPI. On August 2004, 1 UF was approximately equivalent to US$ 27.

because a few regulatory changes affected the ability of low-savings workers to opt for an early retirement before the introduction of SCOMP. Arguably, the retirees in the sub sample considered were not affected by the regulatory changes.

The results reported in the Appendix are qualitatively similar to those of Table 1. For the post SCOMP period the annuity coefficient is positive, large and significant, while pre SCOMP is either non-significant or positive and significant, but much smaller than the corresponding post SCOMP coefficient.[5]

Altogether, the results indicate that the introduction of the electronic platform brought or exacerbated adverse selection to the Chilean annuity market. We now briefly propose a mechanism that explains this result.

2.1 The mechanism

We discuss a simple adaptation of the Handel, Kolstad, and Spinnewijn (2019) model. We consider a competitive market for a standardized annuity product in which individuals hold private and noisy information regarding their expected longevity. The introduction of the electronic platform is assimilated to a noise reduction, so that post SCOMP individuals have more precise information about the overall convenience of the annuity product given their expected longevity.

We denote by w_i the minimum annuity that individual i is willing to accept and assume $w_i = v_i + \epsilon_i$, where v_i is the correct or true valuation of the annuity and ϵ_i is an individual specific noise.[6] The distribution of ϵ, we assume, is affected by the introduction of SCOMP.

Figure 1 illustrates the equilibria pre and post SCOMP (left and right panels respectively). In the x-axis, individuals are sorted according to the minimum annuity they are willing to accept (w_i), represented by the solid line WW.

For a given q in the x-axis, MA (long-dashed line) represents the actuarially fair annuity for that marginal individual, while AA (short-dashed line) is the average actuarially fair annuity (across all individuals up to q).[7] The competitive equilibrium of the market is where AA and WW intersect and firms obtain no profits.

If we integrate curve MA from zero up to q_{eq} and from q_{eq} up to q_{max} and divide by q_{eq} and $q_{max} - q_{eq}$ respectively, we would obtain the average actuarially fair annuity for those

[5]The annuity coefficients pre SCOMP are negative and significant in some but not all specifications. A plausible explanation for this sign is that sales-agent were able to target low risk workers when selling annuities in that period.

[6]We here assume individuals are identical to the eyes of insurers, but the results of the analysis can be interpreted as conditional on the observable variables that may affect longevity and the annuity decision.

[7]Note that MA is increasing because individuals are ordered according to the minimum annuity they would accept, which is negatively correlated with expected longevity (individuals close to the y-axis are longer-lived in expectations and their actuarially fair annuity is smaller).

individuals that choose to annuitize and for those that opt for the PW: AA_{ann} and AA_{non-an} on the y-axis. The difference between these two averages reflects the difference in expected longevity between the two groups.

What is the effect of reducing or eliminating the noise that affects the decision? Naturally it depends on the nature of the noise (i.e., the distribution of ϵ). If we believe that the noise is heterogeneous across individuals and that sales agent were able to oversell annuities pre SCOMP, that would imply that ϵ had a negative mean before SCOMP. By facilitating the comparison between the two products and by forcing the individual to compare them in a structured decision-making process (and therefore reducing the influence of sales agents), SCOMP would reduce the mean (in absolute value) and variance of the distribution of ϵ.

In terms of our figure, there would be a re-sorting of individuals along the x-axis and the curves WW and MA will rotate: WW clockwise and MA anti-clockwise, as represented in the right panel of Figure 1.[8,9] As a direct consequence, the expected difference between the average actuarially fair annuities of the groups of annuitants and non-annuitants will be increased.

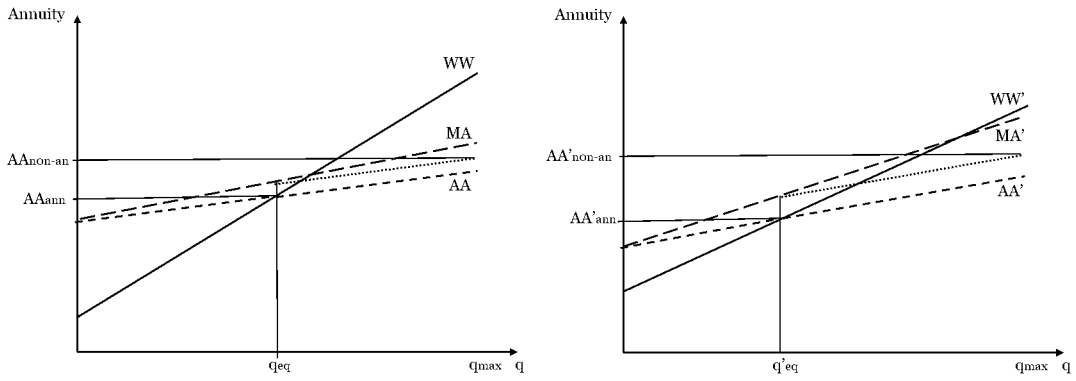
The intuition why the difference in expected longevity increases is simple when one analyzes what happens at the margin. When the noise is reduced, those who were buying an annuity in the pre SCOMP scenario and whose true value v_i were above the equilibrium value of the annuity would not buy in the post SCOMP scenario. And those who were initially not buying but whose v_i was below the equilibrium, would switch and buy an annuity. As a consequence, some individuals that expect to live longer would start buying annuities, and some that expect to live less would stop buying annuities, increasing the difference in expected longevity between the two groups.

Moreover, if the mean of the noise is also reduced in absolute value –e.g., because after SCOMP the ability of sales agents to steer consumers is reduced and the saliency of the PW option increased–, we can expect a lower fraction of individuals choosing to annuitize (even if annuity deals improved after SCOMP as suggested by Morales and Larraín (2017)). This phenomenon is observed in the data, as the fraction of annuitants fell from 67% to 60% in the ± 3 years window around SCOMP.

[8]The intuition why WW rotates clockwise is as follows. Pre SCOMP, those willing to accept the lowest annuities are individuals who expect to live long and, on top that, received a negative and large shock ϵ_i. As the shock is reduced or eliminated, the minimum annuity these individuals are willing to accept is increased. The opposite occurs at the other extreme with the individuals with the highest w_i.

[9]For the intuition on why MA rotates anti-clockwise, imagine that pre-SCOMP the variance of ϵ_i is very large compared to v_i. In such case the decision of buying an annuity would be barely correlated with longevity and MA would be flat, while post SCOMP the positive correlation between longevity and w_i generates a positively sloped MA curve.

Figure 1: **Competitive Equilibrium and the Effect of a Noise Reduction**



Note: The left figure represents the equilibrium pre SCOMP and the right one the equilibrium post SCOMP.

3 Conclusion

Our empirical findings are consistent with the view that SCOMP increased transparency in the annuity market. We consistently find strong evidence of adverse selection after 2004, while the evidence for pre SCOMP retirees is either mild or non-existent.

A natural concern when interpreting our results, however, is whether SCOMP may have brought other changes to the market that could explain the increased correlation between longevity and annuitization or that other changes introduced around the same time could explain our findings. Although we cannot completely rule out that other factors may have played a role, we briefly argue here why we consider that it is indeed the increased transparency what is behind our results.

First and foremost, one of the explicitly declared objectives of the introduction of SCOMP was to bring transparency to the annuity market. SCOMP indeed provides retirees with quote certificates that clearly compare the different annuity and PW offers, and succinctly describes the main differences between the two kinds of pension products. Pre SCOMP, individuals certainly faced larger search costs and many may not have been aware of the PW option (or its advantages).

Although the auction-type mechanism implemented thru SCOMP clearly increased the intensity of competition among insurers, there is no obvious argument why increased competition would affect the longevity gap between annuitants and non-annuitants. The key insight of the model discussed is that the policy must alter the correlation between expected longevity and the minimum annuity the individual is willing to accept to induce a change in the longevity gap between annuitants and non-annuitants. Even though the model discussed is one of perfect competition, this insight is obviously more general.

Furthermore, the introduction of SCOMP brought a reduction in the share of retirees choosing annuities. This is hard to reconcile with a competition effect only, since better deals for annuitants, ceteris paribus, should lead to increased annuitization. Increased transparency can reconcile these facts, specially considering that one of the dimensions of the increased transparency was to give more visibility to the PW option.

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Table A.1: Average and Standard Deviations by Sample Period

	Mortality Tables Dataset				
	1991-2013	Pre-SCOMP	Pre-SCOMP 3 years	Post-SCOMP	Post-SCOMP 3 years
Annuitized	0.6209	0.6655	0.6682	0.5976	0.6015
	(0.485)	(0.472)	(0.471)	(0.490)	(0.490)
Birth year	1940.2	1932.3	1936.9	1944.3	1940.0
	(6.529)	(3.883)	(1.385)	(2.730)	(1.375)
Deceased	0.1753	0.4030	0.2255	0.0563	0.1435
	(0.380)	(0.491)	(0.418)	(0.230)	(0.351)
Age at retirement	65.673	65.621	65.565	65.700	65.659
	(1.007)	(1.037)	(1.013)	(0.989)	(0.974)
Age at death or	72.626	78.706	75.834	69.450	73.362
last observation**	(5.710)	(5.012)	(2.800)	(2.665)	(1.985)
Age at death***	74.428	75.863	72.198	69.057	70.410
	(5.637)	(5.372)	(3.404)	(2.471)	(2.622)
Initial pension all	485.78	469.83	599.46	494.12	656.88
(US$)	(482.17)	(473.76)	(574.32)	(486.31)	(628.85)
Initial pension annuitants	476.12	454.76	534.93	488.54	531.60
(US$)	(409.74)	(418.90)	(465.31)	(403.80)	(434.47)
Initial pension PW	501.62	499.82	729.43	502.40	845.94
(US$)	(581.29)	(566.15)	(730.02)	(587.75)	(805.00)
Months of exposition	82.858	156.466	122.681	44.398	91.905
	(67.995)	(59.533)	(31.813)	(29.614)	(20.712)
Observations	117,453	40,308	10,392	77,145	13,025

Source: own calculations. Standard deviations in parenthesis.

(**) The end of the observation window is June 1st, 2014.

(***) Only considers individuals who died during the observation window.

Table A.2: Continuous Time Duration Models. ±3 years around SCOMP
Average Marginal Effects on Median Duration (Years of Life)

	Pre SCOMP			Post SCOMP		
	No frailty	With Frailty	Frailty 2S	No frailty	With Frailty	Frailty 2S
Panel A - Models controlling for year of birth, retirement age, and initial pension						
Annuity dummy (0 if PW)	0.968**	0.531	0.556	2.474***	2.443***	2.430***
	(0.487)	(0.533)	(0.474)	(0.501)	(0.511)	(0.501)
Age at start of SCOMP	0.042	0.033	0.032	0.261	0.261	0.262
	(0.227)	(0.214)	(0.215)	(0.233)	(0.227)	(0.226)
Retirement age	-0.402	-0.250	-0.261	-0.171	-0.078	-0.067
	(0.301)	(0.338)	(0.319)	(0.319)	(0.339)	(0.328)
Initial pension	0.149***	0.131***	0.132***	0.114***	0.105***	0.105***
	(0.021)	(0.017)	(0.016)	(0.019)	(0.018)	(0.016)
lntheta		1.464***	1.419***		1.328*	1.419***
		(0.428)	(0.379)		(0.761)	(0.379)
Observations	10392	10392	23417	13025	13025	23417

Standard errors in parentheses. (*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$)

Table A.3: Continuous Time Duration Models.
±3 years around SCOMP - top 6 deciles
Average Marginal Effects on Median Duration (Years of Life)

	Pre SCOMP			Post SCOMP		
	No frailty	With Frailty	Frailty 2S	No frailty	With Frailty	Frailty 2S
Panel A - Models controlling for year of birth, retirement age, and initial pension						
Annuity dummy (0 if PW)	-0.106	-0.429	-0.382	1.958***	1.475	1.815***
	(0.602)	(0.671)	(0.604)	(0.611)	(1.165)	(0.639)
Age at start of SCOMP	-0.098	-0.056	-0.065	0.187	0.233	0.206
	(0.270)	(0.271)	(0.266)	(0.271)	(0.270)	(0.279)
Retirement age	-0.210	-0.258	-0.258	-0.058	0.030	-0.046
	(0.335)	(0.361)	(0.358)	(0.378)	(0.466)	(0.383)
Initial pension	0.075***	0.074***	0.074***	0.071***	0.063**	0.069***
	(0.020)	(0.019)	(0.019)	(0.020)	(0.025)	(0.020)
lntheta		1.057	0.917		2.002	0.917
		(0.805)	(0.760)		(1.785)	(0.760)
Observations	6207	6207	14081	7874	7874	14081

Standard errors in parentheses. (*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$)