

Sample Dissertation Fellowship Proposal

Abstract

Chile has one of the highest voluntary annuitization rates in the world, with more than 60 percent of retirees purchasing a private annuity. In contrast, less than 5 percent of U.S. retirees purchase annuities, despite theoretical predictions that annuity value is high. Novel individual-firm level data on annuity prices and individual level data on choices and deaths from Chile shed light on this divergence. We calibrate a life cycle model and estimate the value and cost of annuities relative to the baseline private social security offered in Chile. We propose that two effects, with opposite welfare implications, may be driving Chilean retirees to annuitize at a higher rate than U.S. retirees. On one hand, the government-mandated ‘outside option’ to annuitization has relatively low value, which may promote over-optimal annuitization. On the other, the design of the annuity market intensifies competition, decreases search costs and encourages price discrimination, resulting in lower levels of adverse selection and low equilibrium prices. We investigate the welfare effects of redesigning the outside option and of regulatory intervention common in public social security systems across the world. Finally, we set up a structural model that allows us to separately investigate in detail three specific phenomena within the annuity market. First, we investigate individuals’ decisions to limit their own choice set to a specific subset of contract types, prior to soliciting bids from firms. Second, we model firm’s bidding behavior and model the interaction between the auction mechanism and individuals’ private information. Third, we study the aggregate risk incurred by each firm, and the resulting possibility of bankruptcy, and the role of regulation in limiting this effect.

Proposal

Introduction and Literature Review

Around the world, most markets for voluntary annuities are sparse. In the U.S., it is estimated that less than 5 percent of retirees purchase life annuities. However, standard life cycle models predict that most risk averse retirees would benefit from annuitizing their retirement savings, to insure against outliving their savings. This “annuity puzzle” points to large potential welfare losses in late life. To investigate the reasons for the annuity puzzle, we turn to a counterexample: Chile. In Chile, more than 60 percent of retirees voluntarily annuitize their retirement wealth. This presents a unique opportunity to learn about the market forces which result in a high annuitization rate and the resulting welfare implications.

Two main forces are at work in this setting. First is the design of the social security system in Chile, which is entirely privatized. Workers save money in a private account, which can then be used to purchase an annuity or withdrawn according to a decreasing schedule set by the government (programmed withdrawal). If programmed withdrawal is relatively unattractive to retirees, they may annuitize simply to avoid it, which may not be a welfare good. Second, the annuity market is designed as a government-run exchange, where individuals submit information to companies, and companies bid prices simultaneously. In this way, search costs are negligible and companies are free to price discriminate on all the information that is submitted to them. This can result in annuity products that are priced low, and an equilibrium with high annuitization and low adverse selection – a welfare gain.

We aim to bring together two strands of the literature – one investigating the annuity puzzle and the other modeling and estimating equilibrium in markets with asymmetric information. The annuity puzzle literature focuses on explaining the low level of annuitization in the U.S. Mitchell, Poterba, and Warshawsky (1999) and Davidoff, Brown, and Diamond (2005) document the high utility values of annuities, and show they are robust to a variety of modeling assumptions. Friedman and Warshawsky (1990) document the relatively high price of annuities in the market, relative to other investments, which can partially explain the annuity puzzle. Lockwood (2012) demonstrates how significant bequest motives further lower the value of an annuity.

Scholarship on markets with asymmetric information have focused on detecting adverse selection, and using structural econometrics to model supply and demand. Chiappori and Salanie

(2000) and Finkelstein and Poterba (2006) test for asymmetric information in a reduced form way. Einav, Finkelstein and Schrimpf (2010) use a structural model to estimate demand for annuities in mandatory U.K. market, and study the interaction between adverse selection and regulatory mandates. Including a model of the supply side of the market, Starc (2014) studies equilibrium in the Medigap market, while Handel, Hendel, and Whinston (2015) examine equilibria in health insurance markets with regulatory intervention.

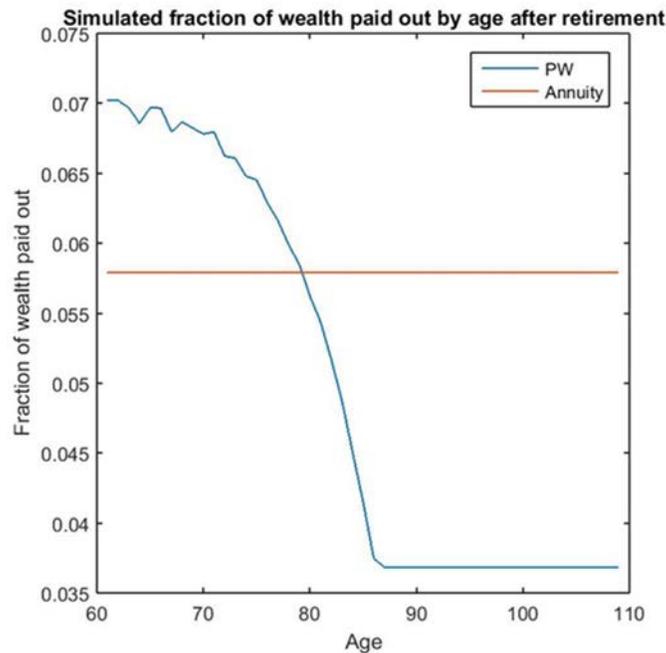
Institutional Details and Data

Prior to retiring, Chilean workers are required to deposit at least 10 percent of their income in a private social security account. In order to access their private retirement accounts, retirees must go through a government system, called SCOMP, which acts as a communication channel between retirees and companies. Retirees enter their demographic information and some preference information, which all firms receive. Firms may choose to offer each individual a menu of contracts, or may choose not to offer any contract at all. They are mandated by law to fund a minimum monthly payout to the individual. Therefore, some retirees have many annuity contract options but others have none. Firms are not legally required to bid for any individual and they are allowed to price on all observed attributes of individuals. Retirees receive a document including information about their full choice set within days of submitting their information.

Annuity contracts can differ on four dimensions: total wealth accrued, initial lump sum payout, benefit guarantee period (to heirs outside the spouse and minor children) and deferral period. Individuals can solicit prices for any set of combinations of these contract characteristics. A majority of retirees choose contracts that are not the most financially generous of their type.

All retirees have an outside option called programmed withdrawal, which provides a minimum guaranteed pension for life along with a front-loaded drawdown of pension account funds according to a standard schedule. When the entire balance of retirement savings has been withdrawn from the individual's account, they are provided a residual pension, called a minimum pension guarantee (MPG), which is constant across the population. Lower wealth retirees who don't receive any offers from firms must take programmed withdrawal. Of those retirees that receive offers for annuities, over 60 percent purchase an annuity.

Figure 1. *Fraction of Total Retirement Wealth Given to 60 Year Old Retiree Each Year Under Annuity and Programmed Withdrawal Options*



Our primary source of data is an individual-level administrative dataset from SCOMP, 2004-2013, which includes the retiree's date of birth, gender, geographic location, wealth, and beneficiaries. These data include contract-level information about prices, contract characteristics and firm identifiers. We observe the contract each retiree chooses, including if they choose not to annuitize, and can compare the characteristics of the chosen contract to the other choices they had. We supplement this data with two external datasets. First, we have data about the life insurance companies making offers, including measures of their bankruptcy risk as evaluated by risk rating companies. Second, we have individual-level observations of death dates for all retirees who died before 2015, allowing us to estimate and predict the cost of insuring each individual.

Methodology

To investigate this question, we use several different methodologies in conjunction – calibration, reduced form econometrics, and structural modeling. First, we want to document the price of annuities in Chile, relative to the rest of the world. To calculate this, we need an estimate of mortality probabilities, which can be obtained from our censored data on individual

deaths. We model the hazard rate of death (h) as a Gompertz distribution with a different scale parameter for each demographic type j (bins of age, gender, city, and wealth level).

$$h_j(t) = \lambda_j e^{\gamma t}$$

Given this, we can predict expected mortality for each individual and calculate the net present cost of annuity z , discounted at rate r . Subtracting that NPV from the total savings w , we calculate the percentage markup over cost that the firm is charging (equal to the inverse of the money's worth ratio minus one).

$$m_i = \frac{w_i - \sum_{t=0}^T \frac{\hat{\pi}_{it} z_i}{(1+r)^t}}{\sum_{t=0}^T \frac{\hat{\pi}_{it} z_i}{(1+r)^t}} = \frac{1}{MWR_i} - 1$$

Preliminary results show that annuity markups in Chile are very low, with accepted annuity offers having a markup of 3.8 percent over cost on average. By comparison, markups in the U.S. have been estimated to be around 20 percent over cost.

The other quantity of interest is the utility value of annuities in Chile, relative to not buying annuities and taking programmed withdrawal. To calculate these utilities, we need a life cycle model that accounts for the insurance value of annuities, which accrues to risk averse individuals. We define the utility function as the following function of consumption.

$$\beta \frac{c_t^{1-\gamma}}{1-\gamma}$$

Beta represents the bequest motive, which is equal to 1 during life, 0 after death if no bequest motive exists, and strictly between 0 and 1 after death if a positive bequest motive exists. Gamma represents the coefficient of relative risk aversion. The life cycle problem can be written as follows:

$$V = \max_{c_t, k_t} \sum_{t=0}^{\infty} \frac{\pi_t u(c_t)}{(1+\rho)^t} \text{ s.t. } k_{t+1} = (1+r)(k_t - c_t + z_t)$$

Here, z_t represents the annuity or programmed withdrawal payout in year t . The programmed withdrawal payout in each year is a function of the interest rate in that year, which is uncertain and modeled as resulting from i.i.d. draws from a normal distribution. This non-stationary stochastic dynamic programming must be solved numerically for optimal consumption and savings in each period, dependent on the state of the world. From these numerical calculations, we can find the expected utility resulting from the choice of an annuity, relative to taking programmed withdrawal.

By calibrating this model with key parameters of interest taken from the existing literature, we can generate a demand curve for annuities in Chile, given the existence of private information. Private information about mortality risk means that with observable individual type, firms cannot differentiate in price between a longer lived and a shorter lived consumer. When a larger fraction of the population purchases an annuity, the average cost of insuring the population decreases. That population's willingness to pay for an annuity traces out a demand curve within observable type. The average cost curve may be shifted upward due to a load, the excess cost of providing an annuity above baseline average cost. The intersection between average cost and demand curves determines the equilibrium price and annuitization rate.

Calibration of market equilibrium for annuities in a U.S. style market, as opposed to a Chilean style market, differs for two reasons. First, the "outside option" to annuitization in the U.S. is Social Security, a type of annuity that on average constitutes half a household's retirement wealth, in addition to the unconstrained withdrawal of any private savings accounts. Chile, on the other hand, allows either for annuitization of all savings, or withdrawal according to the government's schedule. Second, due to the design of the Chilean market, firms bid against each other with prices tailored to individuals' age and gender, as in many other countries, but also to their city, wealth level, and decisions to enter the market through different intermediaries and other choice variables. In this way, the residual private information about mortality almost certainly has lower variance in Chile than in the U.S., and the cost of supply is driven down by competition. These effects lead to high annuitization in Chile and almost none in the U.S., with an ambiguous welfare effect.

To calculate the welfare effect, we estimate demand for annuities from our data, dealing with endogeneity in price using Hausman-style price instruments. Since prices depend on demand for annuities, we use average markup on all offered annuities as a right hand side

variable, with choice of an annuity as the left hand side variable. As an instrument for average markup for a particular individual, we use average markups on annuities offered to other individuals with different characteristics, by the same firm. This approximates a cost shifter and allows us to estimate a demand elasticity.

$$\text{Demand: } d_{annuitize} = \alpha + \beta avgMarkup + X' \Pi_D$$

Using this estimate and calibrated values of the associated average cost, we can calculate social welfare under the current institutions, as well as counterfactual welfare if the outside option was redesigned to more closely resemble Social Security in the U.S. We can also investigate the effect of placing regulations on annuities, such as limits on price discrimination that could be leading to low welfare and low annuitization in the U.S.

Finally, we set up specific structural models to examine three key phenomena in this setting. First, we investigate individuals' decisions to limit their own choice set to a specific subset of contract types, prior to soliciting bids from firms. In the first step of entering the annuity market, retirees enter their preferences for the types of annuity contracts they wish to receive bids for. Almost every retiree opts to get bids on less than the full set of potential contracts available to them. This follows the behavioral intuition that individuals often prefer to have fewer choices, due to their limitations in decision-making over large sets. The retirees' behavior in this case violates the basic van Neumann-Morgenstern assumptions that form the foundation of neoclassical utility theory. To study this, we need to understand whether individuals can improve their final prices by limiting their choice set, or whether it appears to result from a purely behavioral preference of the individual. We draw on the literature on estimating static games, where the players are the retiree and all the firms.

Second, we model firm's bidding behavior and study the interaction between the auction-style mechanism and individuals' private information. Firms who bid on individuals must account for selection in their bids, exacerbating the effect of the "winner's curse" already noted in common value auctions. That is, if one annuity offer wins against all the others and is chosen, it is likely that individual is more costly than the average retiree and that the offer is overly generous relative to other offers. Using data on individual deaths ex post, we can invert firm's bidding functions to recover private firm valuations. This can shed light on whether some firms

have private information on certain individuals, such as those that use a particular firms' intermediaries, and the resulting distributional consequences.

Third, we study the aggregate risk incurred by each firm, and the resulting possibility of bankruptcy, and the role of regulation in limiting this effect. The Chilean government reinsures annuities. This has the potential to reassure retirees about the long run financial health of their annuity provider, increasing transaction volume and potentially combating adverse selection. On the other hand, it can increase firms' incentive to take aggregate risks, building up a market bust. This is a particular concern in the aftermath of the financial crisis, which brought to light the possibility that many households are not fully aware of the risks they take when signing long term contracts, such as mortgages, because of their complexity. Summary statistics show that firms that are riskier provide offers that are on average \$5 per month more generous than firms with one point better risk rating. Using this, we can back out the hedonic value of risk rating relative to other firm and product qualities, and use it calculate the risk that retirees expect to face, and the resulting costs and benefits of government reinsurance.

Timeline

The first few months of the following year will be spent developing in detail the calibrations and reduced form results mentioned above. In addition, the utility calculations will be done and incorporated into the other results in a working paper draft. At this point, we plan to collaborate with government officials in Chile to redesign and optimize the government-specified programmed withdrawal. After that, the focus will shift to developing a structural model of demand that allows us to investigate the specific phenomena of interest in the Chilean market.

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