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Crowd-out, Adverse Selection and Information in Annuity Markets: Evidence from a New Retrospective Data Set in Chile

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Abstract

Annuitization is often considered a socially desirable payout mode from pension plans, because it provides a lifelong income stream and therefore ensures that retirees will not run out of money. However, annuitization is rare in most countries. This project examines workers' choices during the payout stage in Chile, the only country that has had mandatory personal accounts long enough to have had substantial experience with payouts. Upon retirement, workers in Chile have limited options for payouts: they must either annuitize or take gradual withdrawal. Two-thirds have annuitized. We expect that retirees are less likely to annuitize if their accumulation finances a pension in the vicinity of the minimum pension, whose value is guaranteed by the state. In that case, publicly-financed longevity insurance is likely to crowd out private annuity insurance. We expect that retirees with health problems are also less likely to annuitize, possibly leading to adverse selection. Finally, we expect that individuals with greater risk aversion, smaller time preference and better knowledge about the system are more likely to annuitize. A new retrospective data set from Chile yields evidence that is broadly consistent with these hypotheses.

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Crowd-out, Adverse Selection and Individual Preferences in Annuity Markets: Evidence from a new retrospective data set in Chile

Alejandra C. Edwards and Estelle James

Policy-makers often consider annuitization a socially desirable payout mode for defined contribution pension plans, because it provides a lifelong income stream and therefore ensures that retirees will not run out of money. Theoretical analyses also imply large utility gains for individuals. However, voluntary purchase of annuities by holders of 401k plans or other forms of retirement saving is extremely low in the US and in most other countries. This seeming paradox has been explained by the dominance of public DB plans that are close substitutes for annuities, adverse selection in annuity markets, and incomplete insurance markets for other risks of old age (Brown, Mitchell and Poterba 2001, James and Vittas 2001, James and Song 2001). This paper examines workers' choices during the retirement stage in Chile, the only country that has had mandatory personal accounts long enough to have had substantial experience with payouts.

The system adopted by Chile in 1981 requires workers to contribute to defined contribution accounts, which can only be accessed after reaching the normal pension age (or earlier if accumulations pass a minimum threshold), while the government provides a minimum pension guarantee (MPG) financed by general revenues. Pensioners are required to purchase annuities or to take gradual withdrawals according to a formula set by the regulator (lump sum withdrawals are severely limited). Programmed withdrawals are front-loaded, hence better for short-lived individuals, and allow retirees to retain some investment control as well as bequest rights. Annuitization, however, provides longevity and investment insurance. In sharp contrast to the experience of other countries, two-thirds of all current retirees in Chile have purchased annuities. Using a new retrospective data set, we analyze retirees' choice of payout mode, focusing on three issues: Will public insurance (the MPG) drive out private insurance (annuities)? Will adverse selection based on health status or life expectancy interfere with the efficient operation of private annuity markets? And, what role do individual characteristics, such as risk aversion, time preference, bequest motive and information play?

Part I summarizes the incentives and constraints faced by retirees in Chile. Part II lays out our data and main hypotheses about who annuitizes and why. Part III presents the results of our probit analysis. In the full sample and in the subset of normal age pensioners, proximity to the MPG is the key factor determining whether or not the person annuitizes. Having a pension below or close to the MPG indicates that the person does not have choice of payout mode (i.e. is required to take gradual withdrawals) or is strongly protected by public insurance, making private annuity insurance unnecessary. In the subset of early retirees, who have larger pensions, choice and only weak protection by the MPG, annuitization rates are higher—over 80%. Moreover, individual characteristics such as health status, risk aversion and time preference play important roles--but this result is sensitive to the measure used, with measures based on behavior having more significant effects than attitudinal measures. We find evidence of modest adverse selection. Knowledge about how the system works strongly encourages annuitization.

I. Incentives and Constraints on Payouts in Chile[1]

Payout options

Accumulations in the new Chilean pension system started in 1981 and old age payouts were permitted from 1983 on. The payout rules were fairly stable until August 2004, when they underwent a substantial change. In this paper we concentrate on the rules and their impact as of 2002, the year our data were collected.

Payouts are tightly circumscribed. Lump sum withdrawals are not permitted except under narrowly specified circumstances—the remaining accumulation must be large enough to produce a pension that is at least 70% of the worker's average wage over the past ten years and 120% of the MPG (gradually raised to 150%, starting in 2004). Few workers have met this requirement. Basically, workers must choose between annuities versus programmed withdrawals (PW).[2] Additionally, workers must choose their age of retirement, subject to eligibility conditions that are described below. In all cases, pensions must be price-indexed.[3] Married men (and other men and women with dependents) must purchase joint pensions, with the surviving widow receiving at least 60% of the husband's pension.[4]

How annuities and programmed withdrawals work

Under annuitization, the entire accumulation becomes a premium that retirees turn over to an insurance company in exchange for an annuity. The insurance regulator sets detailed rules, including reserves that the company must hold to back the annuity. The individual foregoes future control over investments and gives up the right to leave bequests (except for that embodied in a joint or guaranteed period annuity, which are commonly used), but gets a stable income stream that is guaranteed for life.

Subject to meeting regulatory requirements, insurance companies determine annuity payouts and bear the longevity and interest rate risk. The monthly annuity payout for a worker who retires at age x = initial premium/$a_{x,}$ where a_x is an actuarial factor that depends on the assumed mortality tables and interest rate. The actuarial factor is set such that, for the given survival and discount rates, the expected present value of the stream of payouts equals the initial premium and accumulation. While reserve requirements are calculated according to the regulator's interest and mortality rate assumptions, insurance companies can choose their own assumptions when determining the actuarial factor and resulting payouts. They also bear the risk that stems from this choice.

Under programmed withdrawals the worker's retirement savings stay in his account in the AFP system but face somewhat more conservative investment restrictions than they did during the accumulation stage. The retiree retains control over choice of AFP and, since 2002, of portfolio, as well as bequest rights over the accumulation, subject to rules established by the AFP regulator. As in the case of annuities, the initial PW payout = total accumulation/a_x. However, for PW the regulator determines a_x--usually making higher interest and mortality rate assumptions that produce a smaller a_x and larger initial payout than would obtain for annuities. But this payout is fixed for only one year, after which another calculation is made for the following year, and so on. In year 2 the new pension equals the new accumulation (= initial funds minus actual withdrawals plus actual investment earnings), divided by a_{x+1}.

In general, the PW formula leads to a pension that is higher than annuities at first, but declines dramatically over the individual's retirement years as the accumulation is drawn down. The individual, rather than the AFP, bears the risk that his pension will decline due to lower than expected investment returns or greater than expected longevity.

The minimum pension guarantee (MPG)

Regardless of the options chosen, government promises to keep the pension at or above the minimum pension guarantee (MPG), providing the worker has contributed at least 20 years. Currently the MPG is about 25% of the average wage for a normal age retiree. It jumps by about 9% once pensioners reach the age of 70. Since 2004 it jumps another 5% when they reach age 75. Older pensioners will therefore get 29% of the average wage. It is reduced for early retirees and is partially means-tested.[5]

If, upon retirement, the worker's own accumulation is not large enough to cover a lifetime pension at or above the MPG floor ($<MPG*a_x$, because of low wage rates or years of contributions), she must take PW and draw down her account at the MPG level. After the account is used up, the pension is financed by the public treasury, out of general revenues, providing she meets the 20-year eligibility requirement. If she does not reach the 20-year point, she draws down the balance at or below the MPG level and once the account is empty, the pension disappears.

By law the MPG is indexed to the consumers' price index, but in reality it has been rising with wages, due to political decisions. Over the period 1981-2002, real wages rose by 50% while the MPG for retirees under age 70 rose by 41% and for those over age 70 it rose by 54%. When the MPG rises, this increase applies to the old stock of retirees as well as the new flow. This means that annuitants who started above the MPG may nevertheless get a subsidy eventually, if the MPG rises above their annuity level as they age. For PW pensioners who started out above the MPG level, if their falling payout hits the rising MPG, payouts must stay at the new MPG level until the account is used up, at which point the government steps in and pays the entire pension. Since the real pension floor has been rising over time, low pensions are also likely to rise as the retiree ages.

Thus, the MPG reduces the retiree's longevity and investment risk under PW, the risk of running out of money due to early access and the risk of falling behind workers, on average, in standard of living. But the reduced risk to the pensioner is matched by an increased risk to the public treasury, which is left with a contingent liability. Three important implications of the MPG:

1) Many retirees do not have the 20 years of contribution needed for eligibility. To get insurance, they may purchase an annuity, providing their accumulation =>MPG*a_x; otherwise they must take PW and forego insurance.[6]

2) Among the eligible, those whose initial pensions are well above the MPG get only "weak protection", in the sense that their payouts would have to fall or the MPG to rise substantially for them to get a subsidy. In contrast, those whose initial pensions are close to the MPG get "strong protection" in the sense that the state subsidy will maintain virtually that full level, or even higher.

3) Thus, incentives stemming from the MPG differ widely across individuals depending on their years of contributions and initial pension size.

Choice between normal and early pension age

Besides this choice between PW and annuitization, workers must also choose the age at which they will begin to withdraw their money from the system. Normal pension age is 65 for men, 60 for women. After this age any worker may begin withdrawing funds, regardless of how much he or she has accumulated. But starting in 1988 regulations began to facilitate earlier withdrawals. Early withdrawal was permitted once workers had an accumulation large enough to finance a pension that was 110% of the MPG and 50% of their own average wage (gradually raised to 150% and 70%, respectively, starting in 2004). Workers have an incentive to start an early pension as soon as they meet this pre-condition, because after doing so they may continue working but do not have to pay any further pension payroll tax (see Edwards and James 2006). As of 2002, 60% of all pensioners were early pensioners.

Early pensioners get only "weak" protection from the MPG. Their initial payouts are considerably higher than the pension floor. Their actuarial factors are larger than would obtain if they had postponed pensioning and the applicable MPG is reduced for them in proportion to their higher actuarial factors.[7] Moreover, the floor does not apply at all until they reach the normal pension age. To get strong longevity and investment insurance they must annuitize, and we expect many to do so.

Since only workers with relatively large accumulations qualify for early pensioning, this leaves those with relatively small accumulations and pensions as normal age pensioners. Many of them are constrained to take PW, because they cannot cover the

price of an annuity at or above the MPG level. Others have the option to annuitize, but often with pension amounts that are fairly close to the MPG. Because they get "strong" longevity and investment insurance from the MPG (if they meet the eligibility conditions), we expect them to choose PW disproportionately.

Indeed, as of 2003, two-thirds of all normal old age pensioners were on PW and 79% of these were receiving a pension at the MPG level, although they did not all start out there. The 79% comprised 67% who were still drawing down their own accounts and 12% who were already getting the public subsidy. In contrast, only 15% of early pensioners were on PW, 18% of these were at the MPG level, but none were yet receiving a public subsidy. While 85% of early pensioners were annuitants, only 35% of normal age pensioners were annuitants. Table 1A displays the distribution of payouts to early retirees versus normal retirees, in the form of annuities versus programmed withdrawals, for the stock of pensioners in 2002. Table 1B does the same for our sample, which slightly over-samples annuitants among normal age retirees.

The choice and no-choice sub-groups

One sub-group of retirees does not have a choice between annuities and PW at the time of pension: those whom, upon retirement, do not have an accumulation large enough to purchase an annuity at or above the MPG floor. They must stay in PW. All members of this no-choice sub-group are normal age pensioners, but some normal age pensioners are members of the choice sub-group. In contrast, anyone who meets the pre-conditions for early pensioning could purchase an annuity that exceeds the MPG; hence all early pensioners are members of the choice sub-group.

An ideal set up to study payout choices would separate individuals with choice from those without and would focus the analysis on the sub-sample with choice. This would be possible if we had data about individual accumulation and average earnings at the time of first pension. In addition, the ideal setup would distinguish between choice-makers who were and were not protected by the MPG. This would be possible if we knew the number of contributory years at the time of first pension. Unfortunately, none of these variables are explicitly captured by our sample. Therefore, we are forced to look for an alternative way to proxy the choice group and the group that received strong protection from the MPG.

As described in Part II, we use early pensioners as our pure choice group. This excludes some normal age pensioners who had choice, but it does not make the error of including individuals who had no choice. Therefore we run one set of regressions for early pensioners only, and two other sets for normal age pensioners and for the sample as a whole; the latter two sets include people with and without choice. Also as discussed above, early pensioners get only weak protection from the MPG while normal age pensioners include many individuals with strong protection.

The model

Consider *Ai* to be the annuity person i can obtain at the time the choice is being made, given accumulated contributions, age, sex and survivors. If $A_i \geq$ MPG, the person is in the choice group. For those who are in the choice group, the probability of annuitzing, p_a, depends on its expected utility relative to the expected utility from PW, $EU_i(A)$ vs. $EU_i(PW)$. Expected utility depends on the time stream of income under these two options and the bequest left to heirs at the end. Payment per period is certain for annuities, uncertain for PW, depending on investment returns and time elapsed since the pension started. Payments continue until death under annuities and cease thereafter, except for joint and guaranteed period annuities, while payments may continue beyond death in the form of bequests under PW. Age of death is uncertain. Longevity and investment insurance are provided by the MPG

Then, $EU_i(A)$ vs. $EU_i(PW)$ is a function of the person's proximity to and eligibility for the MPG (A_i-*MPG* and *years of contributions,* y_i), life expectancy (le_i), risk aversion ($riskav_i$), subjective discount rate (ρ_i), bequest motive (B_i), and knowledge about the system (Kn_i). :

$p_a = 1$ if $EU(A) > EU(PW)$ s/t $A \geq MPG)$

$p_a = 0$ if $EU(A) < EU(PW)$ s/t $A \geq MPG)$

$p_a = 0$ if $A < MPG$

In reduced form:

$p_a = p_{a1}(le_i, riskav_i, \rho_i, B_i, Kn_i, A_i\text{-}MPG)$ if $y_i \geq 20$ and $A_i \geq MPG$

$p_a = p_{a2}(le_i, riskav_i, \rho_i, B_i, Kn_i, A_i)$ if $y_i < 20$ and $A_i \geq MPG$

$p_a = 0$ if $A_i < MPG$

II. Data and Hypotheses

Previous studies

Previous studies on annuitization in Chile have focused on explaining the high aggregate rate of annuitization. James and Vittas (2001) found a high money's worth ratio, close to and sometimes exceeding 100% for price-indexed annuities, which helps explain why annuities are a popular product. This result was confirmed by James, Martinez and Iglesias (2006) and Rocha and Thorburn (2006), who also emphasized the limited options allowable to retirees in the new system, the absence of other public or private defined benefit pension plans, and the aggressive marketing by insurance companies, as explanations for why the annuitization rate in Chile was higher than that in other countries.

Using aggregate data obtained from the insurance regulator (SVS) and the pension fund regulator, James, Martinez and Iglesias (2006) hypothesized that annuitization in Chile was less likely among groups with small accumulations (because of their proximity to the MPG) and very large accumulations (because they were better able to self-insure and placed a greater value on bequest rights and investment control). They also predicted higher rates of annuitization among groups that were targets of insurance sales agents. The aggregate data were consistent with these hypotheses.

However, the data set used in this earlier study did not contain information on size of accumulation or pension at the individual level, nor did it provide data on health status, risk aversion, discount rate, knowledge and other important individual characteristics. Therefore, the impact of multiple variables could not be separated out. The present data set will allow us to identify those with small pensions and to control for other characteristics at the individual level.

The previous study also investigated whether adverse selection existed in the annuity market. Since the aggregate data did not have information on health status of individuals or on mortality experience among PW pensioners, the study used actual/expected (A/E) death ratios among different groups of annuitants and found some modest indication of adverse selection in the first few years of exposure. As further evidence of selection, A/E ratios were higher among those who selected guaranteed

period rather than simple annuities. The data set in the present study includes information on past and present health status, family health histories and the individual's expectations regarding longevity, both for annuitants and PW pensioners, allowing us to investigate adverse selection more fully.

New data set—its advantages and shortcomings

A rich new Chilean data set (2002 HLSS) has just become available that enables us to carry out this analysis. The sample is representative of affiliates in the new and old systems, from 1981 to 2002. Through retrospective questions, the survey establishes if and when the individual was pensioned, what type of pension he receives, how large it is and why he chose that particular payout mode. It elicits information about the individual's health status, attitudes toward risk, other wealth and investment preferences, knowledge about the system and channels of information. The first survey was administered in 2002 to a representative sample of 17,246 working affiliates and retirees. We are particularly interested in the 676 individual we can identify as new system pensioners.[8] We use probit analysis to examine their choice of payout mode.

The data, do, however, have several shortcomings. Most important, we cannot identify the entire subset that had choice, because many questions pertain to the individual's status in 2002, rather than his or her status at the point of retirement when decisions about annuitization were made. For example, we do not know the person's total accumulation or pension amount at point of retirement. Instead, we know the person's current pension, which we use as a proxy for starting pension. For annuities these numbers are identical, but for programmed withdrawals the amounts change and in general decline from year to year. This means that some PW pensioners who are currently withdrawing at or below the MPG level, who appear to have no choice, may have started out well above this level and had choice about PW vs. annuities. Some pensioners took PW because they chose to do so whereas others took it because they had to do so, and we are unable to separate out these two sub-groups. In contrast, all annuitants, by definition, had choice.

Our general strategy for dealing with this problem is to look separately at early versus normal age pensioners. We are able to do this because we know the age of first pension. We know that all individuals who met the pre-conditions for early pensioning

had an accumulation >110% of MPG--large enough to give them the right to choose between annuities or PW. In contrast, the normal age pension group includes a mixture of those with and without choice. We therefore expect a higher rate of annuitization among early pensioners, and we also expect variables such as health, risk aversion and subjective discount rate to have a greater impact among early pensioners because they could choose in accordance with their preferences.

Also problematic is the lack of identifier for individuals who are eligible for the MPG, that is, had at least 20 years of contributions. We test the crowd-out hypothesis by using a dummy variable to identify individuals receiving pensions in the vicinity of the minimum pension. We expect this strong protection from public insurance to have a negative impact on the probability of purchasing private annuity insurance. However, we know that some pensioners in this neighborhood are not eligible for the MPG—in fact, they have small pensions precisely because they did not contribute for 20 years--but we don't know which ones. This should lead us to understate the negative impact of MPG protection upon annuitization probabilities, among those who are eligible.

A related problem stems from survivorship bias. The fact that PW pensions decline through time means that some individuals who took PW initially have now run out of funds. Since the survey does not ask about initial pension, these individuals may not be included in our sample of pensioners, even though they were pensioners at one point. Because this "survival" bias is not present among annuitants, our sample likely understates the over-all propensity to take PW. However, this survivorship bias has the fortuitous effect of counteracting the problem described in the previous paragraph. Since the disappearing pensioners are inevitably those who are not eligible for the MPG, the surviving individuals are disproportionately eligible for the MPG, justifying our use of small pension size to test the crowd-out hypothesis.

The disparity between current conditions and condition at point of retirement creates problems with regard to several other independent variables. For example, the survey asks about individuals' health status in 2002. While recent past and current health levels are probably correlated, the correlation is far from perfect. For this reason, we would expect only a weak relationship between annuitization propensity at retirement and health status in 2002. The survey does include a question directed to early retirees only,

giving them an opportunity to identify "bad health as a reason for early pension". We expect to find a stronger relationship between the answer to this question about health and the rate of annuitization among early pensioners—because it informs us of bad health at the point when payout mode was selected.

Similarly, complex characteristics like risk aversion, discount rate and knowledge about the system may be different in 2002 from their values at date of retirement. Yet these variables are measured at the time of the survey, which is several years after the decision point for many pensioners. Beyond that, the survey measures these variables in several different ways—asking about attitudes and also about behaviors that may stem from these attitudes--and the answers are not always consistent. We test both approaches and, as discussed below, generally find that behavior has greater explanatory power than expressed attitudes. It is possible that the "attitudes" questions were misunderstood and behavior is a better expression of how individuals really feel; or it may be that the behaviors capture long-run tendencies and are therefore more strongly correlated with attitudes that prevailed at point of retirement.

A final data problem is that the sample includes only a small number of pensioners who died and omits many important questions about these individuals. Therefore, we are unable to include an analysis comparing mortality rates of annuitants and PW pensioners, a direct measure of adverse selection.

Variables used in our analysis

We include publicly observable variables and variables depicting private information in our analysis. Public variables include gender, marital status, education and pension size. Private variables include individual characteristics such as health and life expectancy; preferences about risk aversion, time horizon and bequests; and the individual's knowledge about how the system works.

Insurance companies can take the publicly observable variables into account in their annuity pricing decisions. Individuals respond according to their private information about characteristics and preferences. Since insurance companies gather statistics, their payout rates are likely to adjust for any correlations between the publicly observable variables and expected longevity. That is, the true money's worth ratio (total premium/PDV of expected lifetime payouts) is likely to be similar for most sub-groups

defined according to public variables, so average members of these groups do not face "price" distinctions in the form of differential rates of return.[9] Therefore, the public variables will have significant coefficients on payout mode only if they signal membership in the choice vs. no-choice groups or the strong vs. weak MPG protection groups, or are correlated with private information about preferences. Pension size is likely to be the most important publicly observable variable, as it clearly indicates probability that the individual had choice and whether strong protection was provided by the MPG. Other public variables should diminish in significance as private information is added to the equation.

We considered using early pension status as an independent variable for the full sample and, not surprisingly, when we tried this it swamped all other effects. However, this does not provide an explanation for annuity choice. Instead, early retirement status is likely a proxy for the underlying variables, such as pension size, that determine both the ability to retire early and the propensity to annuitize. Putting early pension status into the equation hides these underlying causes. Therefore, we exclude early pension status from our full sample specifications, but we analyze early pensioners separately.

Table 2 presents data on means and standard deviations of these variables for the sample as a whole and for the early pension (EP) vs. normal pension age (NP) sub-groups. We see that the composition of these sub-groups is quite different. The proportion of women is much higher among NP (women are 40% of the total for NP vs. 15% for EP) and, as a corollary, married men are much more prevalent among EP (71% for EP vs. 46% for NP). Not surprisingly, over half of all NP but only a quarter of EP had pensions at or below the MPG level, while the proportion of top-level pensioners **(>** 5MPG) was 4% for EP, higher than the 3% for NP.[10] Current bad health was claimed by 14% of NP, only 6% of EP. But additionally, 11% of EP said they started their pension early because of bad health. EP members are less likely to invest in risky assets, more likely to engage in long term planning and had better knowledge of the pension system. These differences in characteristics probably help account for the fact that, on average, annuitization probabilities are higher for early than for normal age retirees; but substantial variation remains within each group.

Impact of accumulation and pension size on choice

Size of accumulation and initial pension are probably the most important factors that determine payout mode, because they tell us whether the person was in the choice group and was strongly protected by the MPG (if eligible).

To begin with, consider a pensioner with a small accumulation that could buy him an annuity below the MPG level, say, 90% of the MPG. This individual cannot take an early pension not can he take an annuity. At the normal retirement age, if this individual is eligible for the MPG, he or she will have to start a PW pension at the MPG level. When the individual runs out of money, the state will pay the pension. If this individual is not eligible for the MPG, he or she will start a PW at or below the MPG level, and will likely run out of funds eventually, at which point the pension will cease. These individuals will be clustered at or below the MPG, as a result of regulation rather than choice.

If this individual had a slightly larger accumulation that could finance an annuity just above the MPG level, say, 100-120% of the MPG, she would have a choice between PW and annuity. By choosing PW she gets a larger initial payout, while maximizing the potential bequest to her heirs. She also gets the opportunity to choose her investment strategy and possibly obtain higher returns than an annuity would provide. In the absence of the MPG she would risk a dramatically falling pension if her PW account is depleted due to long life or falling returns—and this risk might lead her to annuitize. But the MPG floor avoids this declining pension—providing she has the 20 years required for eligibility. The MPG gives her "strong protection"--almost completely protecting her from the downside of investment and longevity risk in PW, while allowing her to receive any upside gain. She is unambiguously better off choosing PW, regardless of her expected longevity or risk aversion. Thus, the availability of strong public insurance is expected to crowd out private insurance provided by annuity companies. This protection is particularly great if the MPG is wage-linked, therefore rising over time, as it has been, de facto. Readers should recall that such workers are unlikely to take an early pension, both because they don't meet the pre-conditions and because they wish to retain access to the full MPG.

Next, consider a pensioner whose initial accumulation could purchase a moderately large annuity that is 200-300% of the MPG. He, too, would get a larger initial payout and retain investment and bequest rights if he chose PW. However, if he lives long or if investment returns plummet, his PW pension eventually falls all the way to the MGP level, which is far less than he would have gotten as an annuitant. Thus, this worker pays a risk-price for his higher expected income and bequest rights in the early years. Moreover, he is likely to be the target of intense marketing efforts by insurance companies, which earn higher profits by selling policies to individuals with large premiums. Sales agents will inform him at the point when he qualifies to retire early, will offer to handle the paperwork for him, and in the process will sell him an annuity. (In contrast, regulations constrain the ability of AFPs to market PW pensions). Therefore, we expect that retirees with large accumulations are more likely to retire early and to annuitize than those with small accumulations, unless they are in ill health or prefer risk.

Finally, consider a top-earning pensioner whose initial accumulation is very large—enough to purchase an annuity that is 400% or more of the MPG. He may have a stronger bequest motive (if bequests are a superior good) and confidence in his own ability to manage investments. Like his middle-income counterpart, he faces weak protection from the MPG, hence high longevity and investment risk, but he may have greater capacity to self-insure. These forces may push him to retire early but to choose PW. [11]

In sum, we expect to find a positive or inverted U-shaped relationship between pension wealth and probability of annuitizing. Individuals with small accumulations will take PW if they are in the no-choice group or in the choice group but strongly protected by the MPG—regardless of their individual characteristics. Workers with moderately large accumulations (the biggest group) are likely to annuitize—but individual characteristics can moderate this choice. Workers with top accumulations may choose annuities or PW, depending on their preferences for insurance versus bequest rights and investment control.

As a corollary, **a**nnuitants will be concentrated among early pensioners, because large accumulations lead to annuitization and also enable individuals to retire early. All early pensioners have relatively large accumulations, choice and weak protection from

the MPG. In contrast, normal age pensioners include many with no-choice, strong protection from the MPG, and therefore will have a smaller proportion of annuitants.

To test these hypotheses, we use pension in 2002 as a rough approximation of pension size at point of retirement. We suspect that reported pensions have a margin of error around the true pension and they tend to understate initial pension in the case of PW. Because of the imprecision in our measurement, we do not treat pension size as a continuous variables. Rather, we include two dummy variables to designate individuals with pensions ≤ MPG and > 5MPG, respectively. The first dummy is expected to have z negative effect on the probability of annuitization among normal age pensioners and for the full sample, because it indicates no-choice or strong protection from the MPG. It will have a much smaller and insignificant effect among early pensioners, all of whom had choice and weaker protection from the MPG. The dummy for pensions >5 MPG might have a negative sign, depending on relative preferences for insurance versus bequests and investment control. The omitted group, with moderately large pension, is expected to annuitize heavily.

Expected impact of other publicly observable variables

As discussed above, we expect the publicly observable variables to have an impact on annuitization choice only if they signal membership in the choice vs. no-choice groups or in groups that get strong vs. weak protection from the MPG, or if they are correlated with information about characteristics and preferences. We also expect them to become less significant as direct information about pension size, preferences and system knowledge are added to the equation.

Gender and marital status: Married men must purchase joint pensions in Chile, which means that they get a lower payout from their accumulation than single men. This makes it less likely that they will fall into the choice group and more likely that they will get strong protection from the MPG—both of which should lead them to take PW, compared with single men. On the other hand, if they have choice and want to protect their wives from longevity risk, they are more likely to annuitize.[12] The net impact of marital status among men is therefore uncertain a priori and probably small.

If unisex tables were required, this would give a higher rate of return to women, increasing their propensity to annuitize compared with men. However, gender-specific

mortality tables are used in Chile so this effect is absent (see James, Edwards and Wong 2003; James, Martinez and Iglesias 2006). Instead, women may have relatively low annuitization rates for two reasons: 1) they have smaller accumulations, hence less choice and stronger protection from the MPG than men (this effect should be absent in the earlyi pensioner group); and 2) married women are already protected by the joint pension purchased by their husbands (women do not have to purchase joint pensions in Chile). Married women should therefore have less residual risk aversion and should annuitize less than single women.

Education: Retirees with higher education are more likely to be in the choice group and to have weaker MPG protection because they have larger accumulations. They are also likely to have greater knowledge of the system, hence about the utility they will gain from longevity insurance. Both these forces should lead to positive effects on annuity probabilities. Once we control for pension amount and knowledge, these effects should disappear.

Agent: Insurance agents and independent financial advisers who receive commissions from insurance companies (but not from AFPs) play a large role in selling annuities. The survey asks how individuals chose their payout mode. We expect that the answer, "contact with insurance sales agents" will have a positive impact on annuitization rates. Although agents are very active in the early pension market and probably raise the average annuitization rate there, their effect on differentiating across individuals should be stronger among normal age pensioners because, within this group, agents are likely to concentrate their efforts on the minority of individuals with large accumulations. Thus, among normal age pensioners "agent" signals individuals who are in the choice sub-group and are not strongly protected by the MPG.

Age at which pension started. We considered using "pension age" in our specifications. Clearly, this is an important variable that insurance companies use in determining annuity payouts. But age at which pension started is highly correlated with early pension status. Consequently it suffers from the same disadvantage as the early pension variable did in the full sample—it swamps the effect of the underlying variables, particularly size of accumulation and pension, which determine both retirement age and choice of payout mode. Further, among normal age retirees there is practically no

variance in pension age, except that due to gender (65 men, 60 women). However, within the early pension sub-group there is substantial variation in pension age, which may be related to the propensity to annuitize.[13] We expect this effect to be small.

Expected impact of private information and preferences

Among those with choice and weak protection from the MPG, we expect that private information about health and preferences will play an important role in the decision about payout mode. Annuitization is more likely for individuals who have a relatively high life expectancy and risk aversion, who fear they might end up with little or no pension under PW. It is also more likely for those with a low subjective discount rate and bequest motive, who place a relatively high value on their own future income. People with greater knowledge about the system will be more likely to act consistently with the utility gains that annuitization brings. However, these characteristics are irrelevant for those with no choice and those who receive strong protection from the MPG. Therefore, private information and preferences are expected to be more significant for early retirees than for normal age retirees. We use several measures to capture each effect.

Health and other expected longevity variables. It is often claimed that asymmetric information about health and expected longevity could lead to a breakdown of the annuity market through the well-known process of adverse selection. If insurance companies expect that annuities will be purchased disproportionately by people with above-average health they will set their actuarial factors and payouts accordingly. This will imply bad terms for people with average or poor health, who consequently will not purchase annuities. This is sometimes used as a rationale for a public DB plan or for compulsory annuitization under a private DC plan. We investigate whether adverse selection exists in Chile.

We use several indicators of health and life expectancy, including the answers to the questions: Would you say that in general your health is… (we coded bad or very bad as 1); did you have a health emergency within the past 3 years? (we coded hospitalization or surgery as 1); and, for early retirees, why did you retire early (bad health is coded as 1)?[14] The first question applies to 2002 and the second 2000-2002, which may not be highly correlated with health status at the point when the person made the payout mode

decision, so we do not expect a large impact. The question regarding reason for early retirement is more pertinent, so should have a stronger effect.

Additionally, we used the question: Until what age do you expect to live (question 1, module III, top and bottom tails for each cohort coded as optimistic and pessimistic, respectively)? Although life expectancy is measured in 2002, it is likely that the optimistic and pessimistic tails also applied at the point when pension mode was chosen. We also experimented with some of the potential arguments in the determination of survival rates, such as parental longevity and whether or not the person is a smoker.

However, a key question is whether pensioners understand the determinants of life expectancy and its relevance to choice of payout mode. Regressing life expectancy on age in 2002 and a number of other variables such as gender, current health, parental longevity and smoker, we found that all of these were significant at the 1% level for the sample of affiliates. But among pensioners, who were much older than working affiliates, only current age was significant (health and smoker were marginally significant at the 10% level). Moreover, for both samples, women had lower life expectancies than men, after controlling for these other variables, although we know that objectively, the opposite is likely. This leads us to expect that the underlying determinants of life expectancy are not well understood and may not influence the annuitization choice.

Risk aversion. The survey asks several questions related to attitudes and behaviors regarding risk, based on hypothetical and actual situations. For example, individuals are asked to choose between hypothetical jobs that involve lower mean wages that are very secure versus higher wages with greater risk (question 30, module VI). We coded as "risk-averse" any willingness to give up some security for higher expected income—which only a small minority was willing to do. In addition, individuals were asked how they invest their own savings and how they would have invested their retirement savings if contributions to the AFP system were not mandatory (questions 8 and 9, module III). We coded individuals as "risk-preferring" if they invested their saving or would have invested their retirement saving in their own business or in stocks, rather than options like life insurance or bank deposits. We expect that individuals with a preference for risky jobs or investments would be less likely to annuitize.

Time horizon, subjective discount rate and bequest motive. We expect that people with a longer time horizon and lower discount rate are more likely to annuitize, since they place relatively less value on the higher pension they will get in the first few years from PW and greater value on the continuation of the pension in later years. Again, the survey asks several questions that pertain to time horizon. Respondents are asked directly: when you plan your family saving and spending, what period of time do you consider (question 22, module VI)? We coded as "long term" if they chose more than 1 year (only 14% did so). We also have information on the individual's wealth, as proxied by receiving interest or dividend income, owning stocks, insurance or deposits (question 26, module II and question 8, module III), having voluntary saving (question 7, module III) or owning one's own home (question 30, module II). Wealthier people have signaled their longer time horizon, which led them to acquire wealth; hence are more likely to annuitize. Also, their voluntary wealth gives them a source of bequests, so they may have a smaller preference for leaving bequests from their mandatory pension saving. We therefore expect that wealthier people are more likely to annuitize. We experimented with several alternative wealth indicators, including an aggregation of several forms of wealth and simply home ownership. We expect that wealth, which is an actual consequence of long term planning, will be a more significant variable than stated attitudes toward long term planning.

Knowledge about the system. The new system gives individuals some choice about investment strategy and payout mode, so knowledge plays a more important role than it did in the old system, where a formula automatically determined the pension. We would expect that more knowledgeable individuals might be more likely to annuitize, because they recognize the value of longevity and investment insurance. Poorly informed individuals might make choices that do not maximize their utility.

The survey asks a series of questions that allow us to measure the person's knowledge (module III, submodule 3)

Q35: Consider two individuals with the same history of contributions, one of whom retires at 60 and the other at 65. Who has the larger pension?

Q 36: Do you know how the pension is calculated?

Q37: Do you understand the modalities of annuity? of programmed withdrawal? of deferred annuity with temporary payouts?

Q45: After the death of a female contributor, is there a survivor's pension left for the spouse?

Q47: What is the legal retirement age for men and women?

Q48: Do you know that, if you meet some conditions, you can take early retirement?

Q49: What is the level of the minimum pension guarantee?

Q50: What are the requirements for obtaining the minimum pension guarantee?

We assigned a 1 to the correct answers to these questions, a zero otherwise, and calculated means for the sample of affiliates and pensioners (reported in Table 3). The majority of affiliates know the legal pension age and understand there is a possibility to get an early pension—two variables that obviously interest everyone. However, when asked about more specific details of the system, such as various pension modes or the way pensions are calculated, most affiliates don't know—although most pensioners do know. In some instances, the response is very sensitive to the way the question is framed. For example, in response to question 35, 75% of the respondents correctly answered that the person who retires at age 65 gets a larger pension than one who retires at 60. However, in question 36, where individual are asked if they know how pensions are calculated, the modal answer is "I don't know", when they could have picked the answer "according to the amount in the account and other factors such as age of retirement." The correlation between the correct answers to questions 35 and 36 is only 5%.

We constructed a "Knowledge Score" variable on the basis of the ten questions listed above, all redefined as 0,1 dummies, where 1 represents a correct answer. "Score" is the sum of correct answers, so it varies between 0 and 10. The mean value for Score for all affiliates is 3.1 while for pensioners in our sample it is 4.3. We report the mean percentage correct for each question and the mean Score in Table 3.

It takes experience and effort to acquire knowledge. Therefore, we would expect answers to these questions to become more accurate as a person ages, when the retirement system becomes more salient to them. In particular, individuals are more likely to become informed at the point when they have to use that information to make a specific decision—that is, at the point of retirement. So individuals who have recently

pensioned should be better informed than workers; and the means in Table 3 show this to be the case. In explaining the probability that an individual knows what an annuity is (20% over-all), this proportion increases with age—up to age 72.[15] It is 40 percentage points more likely if the person is an old-age pensioner and 16 points more likely if the person is a disability pensioner (Tables 3 and 4A). We would expect that education adds to knowledge, and that people with more resources in the system will find it worthwhile to acquire knowledge. Consistent with this expectation, each year of schooling adds 3 percentage points to the probability of knowing what an annuity is, and individuals who make voluntary contributions to their accounts or have a higher contribution density are more likely to know.

The determinants of other dimensions of knowledge are very similar to the determinants of knowledge about annuities. Score is much higher for older individuals and pensioners. (Most striking here is the fact that 89% of pensioners but only 4% of all affiliates know the MPG amount). It rises with years of schooling, voluntary contributions and density of contributions. But women, who have smaller accounts and less financial experience, also have less knowledge (Table 4B). We expect that a higher knowledge Score will increase the probability of annuitization and, further, that education and gender will become less significant when Score enters the equation because these publicly observable variables operate, in part, through their impact on knowledge.

III. Results and Discussion

Our results are summarized in Table 5 for normal age pensioners (NP), Table 6 for early pensioners (EP) and Table 7 for the full sample. Because of the strong possibility of multicollinearity, we start with specifications that include publicly observable variables without pension size and we then sequentially add pension size and private information about health, preferences and knowledge. The very high proportion of retirees who annuitize means that, essentially, we are looking for explanations for the minority who do not annuitize. As expected, we find very different patterns for normal age versus early pensioners, with the former giving the effects of the division into choice vs. no-choice, weak vs. strong MPG protection sub-groups and the latter giving the

effects of individual variation based on private information among those who have choice and weak MPG protection.

Pension mode among normal age pensioners

Looking first at normal age pensioners, half of our sample (but two-thirds of the population) in this sub-group take PW. The only highly significant variables (at the 1% level) is the dummy for pension size ≤ MPG, which consistently reduces the probability of annuitization by 16 percentage points. This dummy identifies individuals whose accumulation was not large enough to give them the right to purchase an annuity (the no-choice group) and those who got strong protection from the MPG (if eligible). Recall that half of the normal age pensioners in our sample have pensions in this range and these are apparently the individuals who do not annuitize.

Using agents to make the payout decision was also consistently significant or close to significance, increasing the probability of annuitization by 13-15 percentage points. We interpret this as evidence that agents only seek out those individuals who, they know, have choice and weak MPG protection. Indeed, the impact of agent becomes smaller and less significant when pension size is added to the equation The other publicly observable variables are not significant, although single men and married women have lower annuitization probabilities by amounts that are close to significance. None of the private information variables have a significant impact, in this sub-group where a large proportion have no choice or receive strong protection from the MPG. For them, PW dominates, regardless of their preferences.

Choice of pension mode among early retirees

Moving on to early pensioners, the most important point here is that 82% of our sample (85% of the entire population) in the sub-group annuitizes. Which characteristics account for the small number of individuals who do not annuitize?

Pension size. We expect that small pension size will be irrelevant for this group, all of whose members have choice and weak protection from the MPG. Indeed, none of the publicly observable variables are significant, except for very large pension size, which has the expected negative size (in specifications when private information is added). We interpret this as capturing the ability to self-insure, holding everything else constant.

Health and life expectancy. Among early pensioners, the action is all in the variables denoting private information about health, preferences and knowledge. We expected this, based on the fact that all early pensionrs have choice and weak protection from the MPG. While bad health in 2002 has no significant impact, giving bad health as the reason for early pensioning is highly significant at the 1% level, decreasing annuitization probabilities by 18-20 percentage points. At the same time, being relatively optimistic or pessimistic about your life expectancy compared with other members of your cohort has no impact, nor do variables like parental longevity or being a smoker, which influence one's mortality rate. This may be the case because pensioners have little understanding of what determines life expectancy or the relationship beween life expectancy and optimal payout mode. It may also be influenced by the common use of joint and guaranteed period annuities, which weaken the link between the longevity of the primary beneficiary and the present value of the total payout stream. Thus, we find some evidence of adverse selection, in cases where the health emergency is substantial enough to influence behavior (leading to early pensioning). But adverse selection is not large enough to deter annuitization rates of 82-85% among early pensioners.

Risk aversion and time horizon. While hypothetical risk aversion with respect to job choice is not significant, demonstrated risk-preference with respect to investment behavior is, decreasing annuitization rates by 14-18 percentage points. Claiming that you have a long time horizon is not significant, but owning a home—that is, behavior indicating a long time horizon and ability to leave a bequest--is significant and increases annuitization probabilities by 11-14 percentage points. Evidently, behaviors that imply preferences are stronger predictors than hypothetical stated preferences. The behaviors may be a better reflection of attitudes at the point when the decision about payout mode was made; or respondents may simply be confused by the attitudinal questions.

Knowledge Score. Finally, increased knowledge about the pension system is highly significant at the 1% level, increasing annuitization rates by 4 percentage point for every incremental correct answer, even after controlling for the other variables that may determine knowledge. Moreover, Score increases the negative impact of very large pensions on annuitization rates. Perhaps very knowledgeable people tend to have very large accumulations, the former leading toward and the latter deterring annuitization.

When knowledge is missing from the equation, the impact of very large accumulations is weak since it captures both (counteracting) effects; but when knowledge is explicitly added to the equation, with a strong positive effect, the negative impact of very large pension grows stronger. As a result of these factors, the pseudo R^2 jumps from 2% to 8% when these private information variables are added.

In sum, among early pensioners the small number of people who don't annuitize are those who pensioned early because of bad health, have a low Score, or have very large pensions that enable them to self-insure.

The full sample

The full sample, which consist 60% of early pensioners and 40% of normal age pensioners, combines results for these two sub-groups. The private information variables have much the same significant impact as they did for early pensioners (except that bad health as the reason for early retirement was omitted from the full sample because it doesn't apply to normal age pensioners). Additionally, the publicly observable variables now play a role, as they did for normal age pensioners. However, most of the other public variables become insignificant once pension size is added to the equation; apparently they operate mainly through their correlation with pension size.

Small pension size itself is highly significant at the 1% level, identifying individuals who did not have choice or had strong protection from the MPG, therefore were likely to become normal age pensioners and take PW. The vast majority of other individuals, especially those with a high knowledge Score, are likely to annuitize.

Reasons pensioners give for their choice

Besides giving individual-level data that enable researchers to analyze payout mode, the survey also asks pensioners the reasons for their choices (question 17, module III, submodule 1). This enables us to evaluate whether the actual choices are consistent with their stated reasons. Table 8A summarizes these results. They show much greater consistency between preferences and behavior among annuitants than among PW pensioners.

Among annuitants, 78% gave reasons that were clearly consistent with the advantages of annuities—they wanted a pension that would last their entire life or they were afraid that they would run out of money and be without a pension if they made

some other choice. Only 8% gave reasons that indicated clear misinformation—they couldn't afford other modes, didn't know that other modes existed, or wanted to leave a bequest. Consistency for the remaining 13% was ambiguous.[16] This is in accordance with our finding above, that knowledge leads to annuitization. The high degree of consistency between preferences and choice among annuitants may stem from their relatively high income and education levels plus the fact that they all had to actively make a choice—about payout mode and probably about starting date of pension, as well.

Among PW pensioners, the story is quite different, with less than half giving reasons that are consistent with the attributes of the PW mode. 22% indicated they didn't have enough money for other modes and 20% said they didn't know that other alternatives existed—which is incorrect generally but might have been true for these individuals if they had only a small accumulation. Among the others, who presumably had choice, only 6% gave reasons that were clearly consistent with PW—they got a larger income initially or wanted to leave an inheritance.

More than half of PW pensioners gave reasons that seem to be inconsistent with the effects of PW. For example, 26% chose PW because they wanted a pension that would last their entire life or were afraid of running out of money and being left without a pension. Another 17% thought that PW would give them a larger pension (in addition to the 3% who said that they would get more income initially).

To examine whether these individuals should have made different choices for consistency with their preferred outcomes, we broke these reasons down further, by size of pension (Table 8B) and by EP vs. NP (Table 8C). This enables us to determine whether the seemingly inconsistent responses came from individuals who had no choice or had strong protection from the MPG. We see that the proportion of individuals who didn't have enough money for other choices or didn't know that other options existed was much higher among normal age PW pensioners with small pensions—consistent with the likelihood that they had no other choice or no other choice that made sense for them. However, a majority of those with choice and only weak MPG protection continued to believe that PW would give them a pension for life or would give them a larger pension. For these individuals, the short run higher return on PW might have been mistaken for a reliable long run return, thereby misleading retirees.

Finally, it is worth noting that only 3% of PW pensioners and 1% of annuitants gave the desire to leave a bequest as their reason. Although the larger proportion for PW is consistent with theory, the striking point here is the small percentage in both cases. While the choice between PW and annuities is often framed as a choice between bequests and longevity insurance, very few people in either payout indicate a concern about inheritance and many people in both categories indicate a concern about longevity insurance. PW pensioners who care about bequests are disproportionately individuals with larger pensions, as suggested above.

In sum, the vast majority of pensioners in Chile have annuitized, presumably because this was the only way they could obtain investment nad longevity insurance. The minority who took PW did so mainly because they had to or because publicly financed MPG insurance crowded out private annuity insurance. Adverse selection seems to be present but to have only a small effect. More troubling is the possibility that misinformation and mistaking short-run for long-term advantages may also have deterred annuitization, among those with choice and weak protection from the MPG. Reducing the short run advantage of PW for those with large accumulations and the prohibition on annuitization for those with small accumulations may be the most effective ways to increase the annuitization rate still further.[17]

IV. Conclusions

Three important issues in the pension field are: Will public insurance drive out private? Will adverse selection by expected longevity interfere with the efficient operation of private annuity insurance markets? And, do people have enough knowledge to make informed choices? We use a new retrospective data set from Chile to throw light on these issues. We identify the characteristics of individuals who did and did not annuitize, in a context where payout options are very limited so two-thirds of all pensioners have taken annuities. In this context, it may be more useful to ask—which characteristics define the minority who did not annuitize?

We find that small pension size is the strongest (negative) predictor of annuitization—which we attribute to the fact that it identifies retirees who did not have

the right to choose an annuity and/or have strong protection from the minimum pension guarantee. Apparently strong public longevity and investment insurance (i.e., public insurance that insures practically the entire pension from the individual's own account) drives out private annuity insurance. This "small pension effect" holds for normal age retirees (where small pensions are common) and for the full sample (where it signals normal age retirees). However, it does not hold for early pensioners, all of whom had accumulations large enough to choose annuities and who get only weak protection from the MPG. 85% of all early pensioners annuitize in Chile; the presence of limited choice and the absence of strong MPG insurance for them goes far toward explaining their high rate. (But ironically, the small subset with the largest pensions nevertheless choose programmed withdrawals, probably because they are best able to self-insure).

Using early pensioners as our sample of individuals who had choice and weak protection from the MPG, the main sub-group that does not annuitize consists of workers who were forced to start their pension early because of bad health. Thus, some adverse selection by health status does exist, especially if health is bad enough at the payout decision point to lead to behavioral change. The other strong predictor among early pensioners is knowledge about the system. Knowledge appears to be poor, as indicated by an average Score of less than 30% among workers and less than 50% among pensioners on simple factual questions, as well as a lack of understanding among pensioners on determinants of life expectancy. But knowledge is higher among annuitants, based on their average Score, its significance in the regressions and the consistency between their preferences and their behavior. These results provide confirmation of strong crowd-out and modest adverse selection. They underscore the importance of worker education about how pensions work and constraining the choice set to protect the many retirees with little knowledge.

This study faced the limitation that we could not definitively identify all retirees who had choice vs. no-choice, and those who met the 20-year contribution requirement for MPG eligibility; instead, we used proxies. We also lack data on mortality experience of PW pensioners, to compare with annuitant mortality experience. We hope to add these variables in future work, by linking the sample to administrative data on contribution and payout histories.

Table 1A: Percentage distribution: Early versus normal retirement, annuities vs. PW, aggregate stock of pensioners in 2002

	Normal retirement	Early retirement	Total
PW	26%	9%	35%
Annuitization	14%	51%	65%
Total	40%	60%	100%

Source: calculations by authors based on data from Superintendencia de Valores y Seguros (SVS) and Superintendencia de AFP (SAFP)

Table 1B: Percentage distribution: Early versus normal retirement, annuities vs. PW, sample of new-system pensioners in 2002

	Normal retirement	Early retirement	Total
PW	19%	11%	30%
Annuitization	20%	50%	70%
Total	39%	61%	100%

Source: calculations by authors based on EPS 2002

Table 2: Sample Means

Variable	Full Sample	Normal Age Pensioners	Early Pensioners
% annuitant	0.70	0.52	0.82
% women	0.25	0.40	0.15
% with post secondary schooling	0.15	0.16	0.15
% married men	0.61	0.46	0.71
% used agents to make choices	0.27	0.21	0.31
mean age in 2002	64	69	60
mean pension age	59	64	55
mean pension amount in 2002*	$121,919	$102,860	$134,438
% with pension at or below the MPG	0.35	0.51	0.24
% with pension amount >5MPG	0.04	0.03	0.04
% reporting bad health as motive for EP			0.11
% reporting bad health in 2002	0.09	0.14	0.06
% reporting health emergency last year	0.25	0.25	0.25
% optimists with respect to survival	0.23	0.21	0.24
% pessimists with respect to survival	0.12	0.14	0.11
% invests in risky assets or would do so	0.07	0.09	0.06
% making long term planning	0.14	0.11	0.16
% reporting home ownership	0.89	0.85	0.90
Mean score **	4.27	3.64	4.68
Mean year of pension	1997	1997	1997
% with early pension	0.60	0	1.00
#obs	676	268	408
** reduced observations	658	261	397

* In December 2002 the exchange rate was $702 Chilean pesos per US$, so these mean pension amounts were less than US$200.

Table 3: Knowledge about Pension System among affiliates and pensioners

(percentage correct)	Mean-affiliates	Std. Dev.	Mean pensioners	stdev
BASIC AREAS				
Legal pension age (men and woman)	0.806	0.395	0.891	0.312
Given fund, pension increases with pension age	0.747	0.435	0.728	0.445
Possibility of early pension	0.742	0.437	0.859	0.348
Knows correct answer to 3 questions above	0.486	0.5	0.559	0.497
PENSION MODES				
Annuity	0.202	0.401	0.596	0.491
Programmed Withdrawal	0.192	0.394	0.525	0.500
Temp Withdrawal with deferred annuity	0.069	0.254	0.246	0.431
SPECIFIC RULES				
Pension calculation	0.138	0.345	0.182	0.386
Survivors' benefit (spouse of women)	0.115	0.319	0.133	0.340
MPG Amount	0.041	0.198	0.889	0.531
Qualifying rule	0.012	0.109	0.017	0.128
KNOWLEDGE SCORE	3.064	1.567	4.266	1.791

Note: Calculations over 13,271 affiliates, 658 pensioners

Table 4A: Determinants of the probability of knowing what an annuity is

	dF/dx*	Std Error	Pvalue	var mean
age	0.011	0.002	0	39.456
age sqrd	-0.0001	0.0000	0	1707.090
years of schooling	0.029	0.001	0	10.622
woman	-0.039	0.007	0	0.435
makes voluntary contributions	0.065	0.010	0	0.159
old age pensioner	0.407	0.026	0	0.056
disability pensioner	0.166	0.060	0	0.005
contribution density	0.095	0.011	0	0.677
obs. P	0.203			
pred. P	0.169	(at x-bar)		
# of observations	12,155			
Prob >chi2	0			
Pseudo R2	0.149			

(*) dF/dx is for discrete change of dummy variable from 0 to 1

z and P>|z| correspond to the test of the underlying coefficient being 0

Table 4B: Determinants of Knowledge Score Among Affiliates

	Coef	Std Error	Pvalue	var mean
				3.07
constant	-0.502	0.129	0	1.000
age	0.066	0.006	0	39.456
age sqrd	-0.001	0.000	0	1707.090
years of schooling	0.142	0.003	0	10.622
woman	-0.164	0.025	0	0.435
makes voluntary contributions	0.320	0.034	0	0.159
old age pensioner	1.159	0.068	0	0.056
disability pensioner	0.498	0.167	0	0.005
contribution density	0.442	0.039	0	0.677
# of observations	13,155			
F (8, 13146)	416.21			
Prob >F	0			
R^2	0.2			

Table 5: Probit results-normal age pensioners

Estimates of dF/dx (Probability of being an annuitant)

	1	2	3	4	5	6
Age of pension	--					
Post secondary schooling	--	--	--	--	--	--
Single man	-.17***	-0.17***	-0.17***	-0.17***	-0.17***	-0.18***
Single woman	--	--	--	--	--	--
Married woman	--	-0.13***	--	--	-0.14**	--
Used agents to make choices	0.15**	0.15**	0.13***	0.13***	0.15**	0.14***
With pension at or below the MPG			-0.16*	-0.17*	-0.16*	-0.16**
With pension amount >5MPG			--	--	--	--
Reported bad health in 2002				--	--	--
Reported bad health as motive for EP						
Optimist with respect to survival				--	--	--
Pessimist with respect to survival				--	--	--
Invests in risky assets or would do so					--	--
Long term planner					0.15***	0.16***
Home owner					--	--
Knowledge score						--
Obs P	0.52	0.52	0.52	0.52	0.52	0.51
Pred P at X bar	0.52	0.52	0.52	0.52	0.53	0.52
#of observations	268	268	268	268	268	261
Pseudo R2	0.03	0.03	0.05	0.05	0.07	0.07

dF/dx is for discrete change of dummy variable from 0 to 1

* significant at 1% level,

** significant at 5% level

*** marginally significant at 12% level,

-- included variable not significant

Table 6: Probit results--early pensioners (choice group, weak MPG protection)

Estimates of dF/dx (Probability of being an annuitant)

	1	2	3	4	5	6
Age of pension	-0.01***					
Post secondary schooling	--	0.09***	0.09***	--	0.09***	--
Single man	--	--	--	--	--	--
Single woman	--	--	--	--	--	--
Married woman	--	--	--	--	--	--
Used agents to make choices	--	--	--	--	--	--
Pension at or below the MPG		--	--	--	--	--
Pension amount >5MPG		--	--	--	-0.18***	-0.32*
Reported bad health in 2002			--			
Reported bad health as motive for EP				-0.18*	-0.20*	-0.19*
Optimist with respect to survival			--	--	--	--
Pessimist with respect to survival			--	--	--	--
Invests in risky assets or would do so					-0.14***	-0.18**
Long term planner					--	--
Home owner					0.11***	0.15**
Knowledge score						0.04*
Obs P	0.82	0.82	0.82	0.82	0.82	0.82
Pred P at X bar	0.82	0.82	0.82	0.83	0.83	0.84
# of observations	408	408	408	408	408	397
Pseudo R2	0.02	0.01	0.02	0.03	0.05	0.08

* significant at 1% level,
** significant at 5% level
*** marginally significant at 12% level,
-- variable in the equation but not significant

Table 7:Probit results-full sample

Estimates of dF/dx (Probability of being an annuitant)

	1	2	3	4	5	6
Age of pension	-0.02*					
Post secondary schooling	0.09***	0.10**	--	--	--	--
Single man	--	--	--	--	--	--
Single woman	-0.14**	-0.10***	--	--	--	--
Married woman	-0.20*	-0.16*	-0.14**	-0.14**	-0.15**	-0.14**
Used agents to make choices	--	0.07***	--	--	--	--
With pension at or below the MPG			-0.15*	-0.15*	-0.15*	-0.12*
With pension amount >5MPG			--	--	--	-0.22**
Reported bad health in 2002				--	--	--
Reported bad health as motive for ER						
Optimist with respect to survival				--	--	--
Pessimist with respect to survival				--	--	--
Invests in risky assets or would do so					-0.14*	-0.16**
Long term planner					0.09***	0.11**
Home owner					0.08***	0.09***
Knowledge score						0.04*
Obs P	0.70	0.70	0.70	0.70	0.70	0.70
Pred P at X bar	0.72	0.70	0.71	0.71	0.71	0.71
#of observations	676	676	676	676	676	658
Pseudo R2	0.08	0.02	0.04	0.04	0.05	0.07

dF/dx is for discrete change of dummy variable from 0 to 1

* significant at 1% level,

** significant at 5% level

*** marginally significant at 12% level,

-- included variable not significant

Table 8A: Reasons for choice of annuities vs. programmed withdrawals
(percentage of total in sub-group)

Reason	PW pensioners	Annuitants
Want pension for entire life	21.3	74.7
Afraid of running out of money	4.5	3.4
Gives larger pension	17.3	8.0
Gives larger initial income	3.5	3.2
Received present from sales agent	1.0	.4
Permits me to leave an inheritance	3.0	1.3
Not enough money for other mode	21.8	2.7
Didn't know other options existed	19.8	4.2
Other	7.9	2.1
Total	100%	100%

Table 8B: Reasons for choice of annuities vs. programmed withdrawals: large vs. small pensions
(percentage of total in sub-group)

Reason	PW pensioners		Annuitants	
	small	**others**	**small**	**others**
Want pension for entire life	15.46	24.77	72.46	75.68
Afraid of running out of money	5.15	2.75	3.62	3.34
Gives larger pension	11.34	23.85	6.52	8.81
Gives larger initial income	1.03	6.42	2.17	3.34
Received present from sales agent	2.06	0.00	0.72	0.30
Permits me to leave an inheritance	1.03	5.50*	0.00	2.13
Not enough money for other mode	29.90	15.60	5.07	1.82
Didn't know other options existed	25.77	14.68	5.80	2.74
Other	8.25	6.42	3.62	1.82
Total				

Small = at or below MPG
*this percentage rises to 8.3 if this group is restricted to those with pensions above 4MPG

Table 8C: Reasons for choice of annuities vs. programmed withdrawals: NP vs. EP
(percentage of total in sub-group)

Reason	PW pensioners		Annuitants	
	NR	**ER**	**NR**	**ER**
Want pension for entire life	16.54	26.58	73.03	75.3
Afraid of running out of money	0.79	8.86	3.05	3.57
Gives larger pension	11.81	27.85	6.87	8.63
Gives larger initial income	1.57	7.59	1.53	3.57
Received present from sales agent	0.79	1.27	0.00	0.60
Permits me to leave an inheritance	3.15	3.80	0.76	1.79
Not enough money for other mode	29.13	11.39	3.82	2.38
Didn't know other options existed	26.77	8.86	6.87	2.38
Other	9.45	3.80	3.82	1.79
Total				

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Endnotes

[1] For a fuller description of the payout stage in the Chilean system see James, Martinez and Iglesias 2006; Rocha and Thorburn 2006.

[2] The start of the annuity payout can be postponed through a program called "temporal withdrawals" in which workers purchase a deferred annuity upon retirement and take a monthly withdrawal during the interim period of one or two years. However, participation in this program has been small and the data do not allow us to distinguish between annuitants who purchased immediate annuities versus deferred annuities through TW. Therefore we treat the few interim temporal withdrawal pensioners as annuitants--which they will be in another year or two .

[3] In Chile, both nominal and price-indexed units of account (pesos versus the Unidad de Fomento--UFs) are in common use, and long-term financial transactions are usually quoted in the latter—a consequence of Chile's long experience with inflation. Regulations require annuities to pay fixed amounts, designated in UF's (although this is about to change). Monthly payouts from PW are also specified in UFs for a 12-month period. However, PW valuations are recalculated every 12 months and the formula yields a declining real value over the retiree's lifetime if initial assumptions are met.

[4] This becomes 50% to widow +15% to each child if there are surviving dependent children. This requirement provides insurance for widows, financed by their husbands, rather than the public treasury. The wife is allowed to keep this joint pension in addition to her own pension, if she has worked (see James, Edwards and Wong 2003).

[5] The means test is implemented by requiring the AFPs and insurance companies that are paying the pensions to secure documents from the tax authority and the old pension authority confirming the absence of other income, as part of the application process for the MPG. This administrative cost makes retirees with low pensions expensive to such companies While required to enforce, these companies have little incentive to do so carefully. We are unable to assess how effectively the means test is implemented.

[6] Many Chilean workers will not accumulate the 20 years of contributions needed to be eligible for the MPG, because of their low density of contributions (proportion of adult lifetime working and contributing). Measured as aggregate contributors/active affiliates, the density of contributions has been about 54% (SAFP 2003). The average person with an account, who contributes for 54% of his or her potential working life, exceeds the 20 years required for eligibility. However, analysis of our retrospective data set suggests that contribution densities are much lower—only 36%--for the first quartile of men with primary school education or less. Contribution densities are even lower—25% and 33%, respectively--for the first quartile of women with primary or incomplete secondary schooling. Many of these men and women dropped out of the formal labor force for much of their adult lives or are self-employed and therefore not required to contribute. They are vulnerable both to having very low pensions and not qualifying for the minimum pension guarantee. (Edwards 2006; also see Arenas et al 2004; Berstein et al 2005). Workers who

are not eligible for the MPG might qualify for the lower means-tested benefit for non-contributors (PASIS). The government has recently proposed changing eligibility conditions for the minimum pension in order to increase coverage.

[7] At the point of early retirement an actuarial factor is computed that depends on the retiree's actual age and the interest and mortality rates used in determining pension payouts. At the same time, the actuarial factor is calculated as if the worker were at the normal retirement age, with the same interest rate and mortality tables. This actuarial factor, for example, is about 13% higher for a male at 60 than at 65, thereby producing smaller payouts for early retirees. The MPG that may be paid some day is reduced by the proportional excess of the early factor over the later factor (i.e. by 13% in this example). In effect, part of the pension floor is traded off to permit the option to retire early. This trade-off may deter early retirement for workers with small accumulations who expect to qualify for the MPG in the near future.

[8] There are over 1000 observations of new system pensioners. However, the sample had to be reduced to 676 as a result of missing values of some variables. In 2004 and 2006 this survey was augmented by a second and third round, turning it into a panel, and by the addition of data on non-affiliates as well. Linkages to administrative data of individuals will eventually allow us to check recollections against actual records.

[9] Money's worth ratios and rates of return have been shown to be slightly lower for women and for younger individuals, probably because of the greater risk concerning future mortality rates of these groups. Smaller accumulations also imply slightly lower money's worth ratios, probably due to fixed administrative costs per account. However, the differentials are small. Most money's worth ratios are in the neighborhood of 100% (James, Martinez and Iglesias 2006, Rocha and Thorburn 2006).

[10] Some early pensioners now have pensions below the current MPG, although they initially had pensions above the old MPG level. Their pensions may not be raised to the new higher MPG level because they don't have the 20 contributory years required for eligibility. Even if eligible, early pensioners are entitled to a lower MPG and that only after the normal pension age.

[11] Also, some pensioners with large accumulations may choose PW because this allows them to draw down at a lower rate than the annuity payout, if they so desire. Postponing distributions may enable them to reduce the marginal tax on pension withdrawals. For this group, current pension will greatly underestimate their initial accumulation. However, this is likely to be a very small group.

[12] If they choose annuities, their wives get a guaranteed fixed pension, while if they take PW their wives benefit from the bequest if the husband dies young but get little or no pension if he lives long. Since the wife is usually younger than the husband and has a longer expected lifetime, she bears much of the uncertainty regarding husband's longevity in the case of PW. Then, we would expect married men to annuitize compared

with single men if they want to protect their wives from this risk, while they choose PW if they take a less risk-averse approach on behalf of their wives.

[13] We know from previous work (James, Martinez and Iglesias 2006) that insurance companies offer a slightly lower money's worth ratio and rate of return to younger annuitants, presumably because of the greater risk to the company from providing longevity and investment insurance for a longer period. Of course, these same factors lead younger pensioners to benefit more from avoiding this risk, when they insure. Therefore, the impact of pension age on annuitization probabilities among early retirees will depend on whether younger individuals value this longer-period risk-avoidance more or less than the extra cost imposed by the company, in exchange for bearing this risk.

[14] See question 25, module VI; question 27, module VI; and question 12, module III, sub-module 1.

[15] Virtually all affiliates are pensioners after age 72. The positive effect of "pensioners status" may outweigh the negative effect of age at that point.

[16] Normally PW pensioners are larger than annuities at the beginning but smaller later on. Therefore, claiming that annuitization gave a higher pension could be "correct" for individuals who were focusing on the long run. In contrast, some people we have classified as annuitants got a larger initial payout by choosing temporal withdrawal. Additionally, some sales agents give unofficial (illegal) rebates to clients who buy annuities, which would increase the initial value of the annuity mode. Therefore, desiring a larger initial payout could also be consistent with annuitization in some cases.

[17] The short run advantage of PW could be narrowed by basing the PW formula on an escalating payout or by reducing the assumed mortality and interest rates. The crowd-out effect could be reduced by requiring that all pensioners with small accumulations must purchase immediate or deferred annuities, with the public treasury paying the required subsidy up-front. Payouts to these pensioners in excess of the MPG initially, at the expense of the treasury later on, would then be avoided. This approach is currently used in Colombia.