Participation in the Peruvian reformed pension system

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Abstract

One of the important aspects in the design of social protection is coverage. In Peru, as in most Latin American countries, social security participation is compulsory only for workers in the formal sector. There is a large sector of the population for which participation is voluntary. This paper investigates the determinants of enrolment to the pension system in Peru. In particular, we found that a selected group of people i.e. married males with at least secondary education, high income and with other family members already participating in the pension system, have a higher likelihood of participation. Moreover, the results also suggest that family based safety nets have a negative effect on the probability of pension participation.

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1. Introduction

Since Chile replaced its public pay-as-you-go pension system with a private funded and managed system in 1981, many other Latin American countries have followed the Chilean example. This reformed pension system is based on individual capitalization and managed by private administrators under government supervision. It is more fiscally sustainable than the old system and also contributes to the development of the financial market[1]. However, Queiseer (1998), after evaluating the pension reforms in several Latin American countries[2], identifies some challenges related to their long run sustainability and effectiveness: the problem of affiliation and effective coverage, the high level of administrative costs, the uniformity of the pension fund's portfolio and the problem of establishing an efficient annuity market to provide adequate retirement pensions.

Workers of informal firms and the self-employed are not obliged to participate in social security in many Latin American countries. Indeed the problem of taking out a private pension and hence, the limited pension coverage[3] is one of the main weaknesses of both the old and reformed pension system in Latin America. Table 1 shows that in 2003 and in relation to the economically active population (EAP), 56% of the workforce is enrolled in the private pension system (SPP) but only 24% contribute to any private pension administrator. The low enrolment and the discrepancy between the number of *affiliates* and number of workers who are actually contributing to their pension funds cast serious doubts about adequate provisions for old age. With the exception of Argentina, Ecuador, Dominican Republic and

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[1] See Uthoff (2001), Schmidt-Hebbel (1999) and Holzmann (1997).
[2] She provides an interesting comparison of the pension experiences of Peru, Colombia, Argentina, Uruguay, Mexico, Bolivia and El Salvador.
[3] Coverage is defined as the ratio of people insured (in any pension system) to population (or economically active population).

Uruguay, affiliation to the pension system is for life and compulsory only for dependent workers (i.e. 'formal' sector). Therefore, the low percentages reflect the large 'informal' sector (unofficial sector beyond government regulation and taxation) for which affiliation to the SPP is voluntary[4]. Enrolment does not necessarily imply contribution to the pension fund because independent workers might default on their pension contributions, dependent workers might leave the labour market or change jobs to start their own business, etc. Poverty also causes low coverage because limited resources of the family must be allocated to the most immediate needs.

This paper aims to examine what prompts Peruvians to invest in a private pension and therefore, provide explanations for the low pension coverage. Peru reformed its pension system in 1993 and similar to other Latin American countries, the affiliation to any pension system (public or private) is mandatory for formal employees and voluntary for the rest. Peru is an interesting case study because of its low pension coverage and large informal sector. The International Labour Organisation (ILO) estimated that over 50% of the 2000 Peruvian urban labour force was 'informal' [5] and according to table 1, only 30% of the EAP was enrolled in the SPP and 12% contributed to their accounts in 2003.

Recent studies (Cox and Edwards, 2002; Holzmann et al, 2000; Packard et al, 2002 and Barr and Packard, 2003) have also tried to uncover the determinants of enrolment to the private pension system in Latin American countries. They applied a binary choice model but without distinguishing between compulsory and voluntary affiliation. Note that in countries with a large number of 'informal' workers for

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[4] See Jimenez and Cuadros (2003) for explanations linking low pension coverage and the informal sector.

[5] The ILO definition of informal sector includes all own-account workers (excluding professionals and technicians) and unpaid family workers, and employers and employees working in establishments with less than 6 persons engaged. Paid domestic workers are excluded.

whom enrolment in pension schemes is voluntary, their test can be interpreted as one of examining the determinants of participation in the 'formal' sector rather than pension enrolment. We consider that it is not adequate to include in the analysis people who are forced to enrol because they do not have any choice. Moreover, empirical results quoted without this distinction might not provide an accurate assessment of the possibility of increasing the pension coverage. We contribute to the existing research by using data from the Peruvian household survey (ENAHO, 2001-IV), which distinguishes between compulsory and voluntary affiliation. Furthermore, it would have been desirable to differentiate between workers who do or do not contribute to their pension funds but most of the household surveys do not provide information about their contribution pattern[6]. In fact, most of the surveys ask only if the person belongs to the pension system without asking if the enrolment was compulsory or voluntary.

In addition, we also test for the importance of the extended family and the family-based safety nets[7]. The extended family plays a prominent role in Peru and as a result, informal family arrangements might help protect family members from risks, losses and ageing. Thus, informal family safety nets could act as substitutes for formal social security. Nevertheless, policy-makers are concerned about both the sustainability and the effectiveness of informal social security schemes in protecting the elderly from poverty (Holzmman et al, 2000). A better understanding of the

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[6] Barr and Packard (2003) is an exception. They used a specially designed survey where about 1000 Peruvians living in Lima were asked about their contribution to their pension accounts, but they were not asked if their affiliation was voluntary or compulsory.
[7] These informal arrangements may be indirectly observed through family size, investments in children education (Jellal, 2002), informal old-age security provided by children (Hoddinott, 1992), help from elderly to their children in domestic tasks, risk-sharing agreements between family members (Kotikloff and Spivak, 1981; Victorio, 2002), co-residence, etc.

affiliation motive might prove helpful in designing policies that could help to increase coverage and indirectly attenuate these problems.

Our results suggest that the profile of the individual with an option to enrol in any AFP belongs to a reduced and exclusive group in any developing country. Only married males with more than secondary education, high income and with other members already participating in the formal social security have a chance to enrol. Previous informal family agreements reduce the possibilities of expansion of the pension coverage.

The paper is organised as follows. Section 2 briefly describes the Peruvian pension system. Section 3 presents the theoretical framework which is based on a modified version of Kotikloff and Spivak (1981) and Brown (1999). Section 4 specifies the empirical model and discusses the data and hypothesis. Section 5 analyses the results from regressions and finally, section 6 concludes the paper.

2. The pension system in Peru

Similar to Chile, Peru reformed its old pension system toward one based on individual capitalization where pensions depend directly on the amount of contributions accumulated. But unlike Chile, Peru has not dismantled the pay-as-you-go public pension system completely. The old defined state benefit system Sistema Nacional de Pensiones (SNP) co-exists with the new private pension system (SPP) but in practice, it is gradually closing (see table 2). The government has indirectly restricted the access to the SNP[8]. Workers affiliated to the public system can remain there or switch to the private system at any time. Transfers from the private system to the public system are not allowed unless there is proven illegal

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[8] The army and the police force have an independent social security system.

malpractice in the process of affiliation[9]. First time dependent workers can choose between the SNP and the SPP but if no decision is made within ten days of starting the job, they will automatically be enrolled in the SPP. In addition, workers already enrolled to the SNP but changing jobs have to confirm that they want to remain in the SNP otherwise they will be automatically transferred to the SPP[10].

Affiliation to any pension system is mandatory for dependent workers but not for independent workers (e.g. the self-employed, household workers, etc.) for whom affiliation is voluntary. As explained earlier, new dependent workers can choose to enrol in any pension system; but independent workers have to decide first to enrol or not in any pension system and then, to choose between the public and private system. Unfortunately, household survey data does not provide information on how many independent workers chose to affiliate to the SNP[11]. However in some cases it is possible to infer how many dependent and independent workers chose to enrol in the SPP.

The level of pension coverage in Peru is low. In 2003, almost 3 million people were enrolled in any AFP but only 1.1 million were contributing to the fund. These figures represented 30% and 12% of the EAP (see table 1).

The private pension system (SPP) has led to the emergence of private institutions called *Administradoras de Fondos de Pensiones* (AFP) in charge of managing the pension funds. The system is simple since workers enrol in only one AFP at a time and contribute with a fixed percentage of their incomes during their working lives. These funds are accumulated in an individual account until the individual reach the retirement age (65 for men and women). At this time, the

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[9] Legislative decree RS 185-99-EF/SAFP.
[10] Legislative decree DS 054-97-EF.
[11] In 2003, out of the total number of workers contributing to any pension scheme, 73% did to the SPP.

accumulated balance remains in the AFP or is transferred to an insurance company that converts it to a monthly pension based on life expectancy. If the pensioner dies, then his/her dependants inherit a share of the pension. There are three main different types of old age benefits: programmed withdrawal managed by the AFP, immediate life annuities managed by insurance companies (pensioner uses the balance to purchase an annuity from an insurance company) and a mixture of programmed withdrawals and annuity.

The AFP invests pension contributions in the domestic and foreign capital markets and the government, through the *Superintendecia de Banca y Seguros*, supervises closely their performance.

In contrast to the Chilean system, the Peruvian pension in practice does not include a minimum pension guarantee[12]. The pension benefits are based on the worker's fund accumulation and it also includes an insurance premium covering disability and death before retirement that are not payable to contributors who have not paid their contributions in four out of the last eight months before the time of disability or death.

The worker contributes with 8% of his/her salary to the pension fund, pays an average administrative fee of 2.3% and an average insurance (disability and sudden death) fee of 0.9%. The Peruvian AFP has the highest administrative fee in Latin America (1.7% average in 2003).

3. The theoretical framework

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[12] Only individuals who have contributed regularly for twenty years in any pension system and born before 1945 are entitled to the minimum pension at the legal retirement age.

The decision to enrol in a pension system can be thought of as one where the individual must decide whether or not to purchase an insurance against the risk of loss of income during old age. The individual maximises an inter-temporal utility subject to a lifetime budget constraint, chooses to participate or not in the pension system and as in the case of any good, this decision will be influenced by the prices and availability of other substitutes, preferences, income, etc.

Our theoretical framework aims to compare the situation of an individual with and without the pension and has been adapted from Kotikloff and Spivak (1981) and Brown (1999) to include some features of the Peruvian private pension system. For simplicity, we ignore bequests, no other form of savings except old age pension, a separable consumption function and a constant stream Y of income over time. Furthermore, instead of evaluating the optimal consumption plan since birth, we do so from the age when the individual enrols in the pension scheme.

If there is no annuity market, an individual will choose a consumption plan C_t so as to:

Max $\qquad\qquad E(U) = \sum_{t=0}^{D-x} \alpha^t \, {}_xP_t U(C_t)$ $\qquad\qquad\qquad\qquad$ (1)

subject to $\qquad \sum_{t=0}^{D-x} C_t \, R^{-t} = \sum_{t=0}^{T-x} Y \, R^{-t}$ $\qquad\qquad\qquad$ (2)

where x is the age of the person at the time of pension enrolment; $\alpha=1/(1+\delta)$ and δ is the individual subjective rate of time preference; ${}_xP_t$ is the probability of survival from age x to age x+t; D is the maximum survival age, R=(1+r) and r is the interest rate. The right side of equation (2) represents all resource flows received prior to their current age and can be interpreted as initial wealth.

Let $\quad {}_xP_t^*$ be the estimated survival probability by the insurance company. If the individual becomes affiliated to any AFP then the budget constraint changes to:

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$$\sum_{t=0}^{D-x} {}_xP_t^* C_t R^{-t} = \sum_{t=0}^{T-x} Y(1-a-c)R^{-t} + \sum_{t=T-x+1}^{D-x} BR^{-t} \qquad (3)$$

$$\text{where } B = \left. \sum_{j=0}^{T-x} cYR^{*j} \middle/ \left(\sum_{j=0}^{D-T} {}_TP_j^* Z^{-j} \right) \right.$$

The right hand side of equation (3) equates to the (discounted) life resource flows. The first term is labour income received between age x and retirement age T, a is an administrative fee rate paid to the AFP and c is the contribution rate. The second term is the (discounted) pension B received between age T and D. The numerator in B represents all the resources accumulated by the individual from age x to T, $R^*=(1+r^*)$ and r* is the pension fund rate of return. The denominator in B is the standard formula used by the insurance firms to calculate the annuity, $Z=(1+z^*)$ and z* is the annuity interest rate.

Note that if a=c=B=0 and ${}_xP_t={}_xP_t^*$ (i.e. the estimated probability of survival by the individual and the insurance company is the same) then we have the case of a 'fair' annuity market where the 'cost' of the annuity is zero. If this is the case, ${}_xP_t(1+r)^{-1}$ could be interpreted as the price of future consumption and the individual will always prefer to affiliate because future consumption with affiliation is equivalent to the case of no-affiliation but with lower prices given that all P_t are less than one except P_o which is equal to 1. This is the so-called, 'annuity puzzle' but there are several factors that can decrease the value of the annuities such as administrative costs, heterogeneity in the survival probability of the population, divergence in the perceptions of the population and the insurance companies

concerning survival probabilities, informal family safety nets that might substitute formal social security, etc.

Assume a constant relative risk aversion utility function $U(C_t) = \dfrac{C_t^{1-\gamma}}{1-\gamma}$ where γ is the relative risk aversion parameter and obtain the indirect utility of not enrolling in the pension system by substituting the optimal consumption plan of an individual not affiliated in (1)

$$Ho(Y) = \frac{Y^{1-\gamma}}{1-\gamma}\left(\sum_{j=0}^{T-x} R^{-j}\right)^{1-\gamma}\left(\sum_{j=0}^{D-x} R^{j(1-\gamma)/\gamma}\,\alpha^{j/\gamma}\,_x P_j^{1/\gamma}\right)^{\gamma} \tag{4}$$

Similarly, the indirect utility of participating is

$$Vo(Y) = \frac{Y^{1-\gamma}}{1-\gamma}\left((1-a-c)\sum_{j=0}^{T-x} R^{-j} + \left(\frac{\sum_{j=0}^{T-x} cR^{*j}}{\sum_{j=0}^{D-T} {}_T P_j^* Z^{-j}}\right)\sum_{j=T-x+1}^{D-x} R^{-j}\right)^{1-\gamma}\left(\sum_{j=0}^{D-x} R^{j(1-\gamma)/\gamma}\,\alpha^{j/\gamma}\,_x P_j^*\left(\frac{_x P_j}{_x P_j^*}\right)^{\frac{1}{\gamma}}\right)^{\gamma} \tag{5}$$

Analogous to the equivalent variation in welfare analysis, one way of evaluating the gains from affiliation is to calculate the increase (in monetary terms) of utility derived from affiliation.   Let M be the percentage increase in income that will make the individual indifferent between affiliating or not. That is,

$$H_0(M\,Y) = V_0(Y) \tag{6}$$

Then, a positive M represents gains from affiliation, and the larger it is, the larger the gains.

Next, we examine the effects on M of changes in pension contribution rate (c), administrative fees (a), return of the pension fund (R*), annuity rate (Z), risk aversion (γ) rate of time preference (δ,) gender and life expectancy. These variables are of

interest because they are related to individual characteristics and the way the SSP is managed.

Applying comparative statics, we can promptly show that the $\frac{\partial M}{\partial a} < 0$, $\frac{\partial M}{\partial R*} > 0$ and $\frac{\partial M}{\partial Z} > 0$. In other words the higher the administrative fees, the lower the gains from affiliation hence low fees could encourage individuals to affiliate to an AFP. But the higher the return on the pension fund (r*) and the higher the annuity interest rate (z*), the larger M needed to compensate for not taking out a pension.

However, $\frac{\partial M}{\partial c}$, can be positive (or negative) depending if $\frac{\partial V_0(Y)}{\partial c}$ is positive (or negative) which in turn depends on $\left(\frac{\sum_{j=0}^{T-x} R^{*j}}{\sum_{j=0}^{D-T} {}_T P_j^* Z^{-j}} \right) \sum_{j=T-x+1}^{D-x} R^{-j}$ being larger (or smaller) than $\sum_{j=0}^{T-x} R^{-j}$. When R*>R, then the enlarge retirement pension in the future compensates for the loss of utility arising form larger contributions. However, there is no reason to assume that the person discounts consumption higher than the factor R* or Z. If we assume that R*=R=Z, then the effect of the contribution rate on M is always negative.

It is tedious but possible to show that $\frac{\partial M}{\partial \gamma} > 0$ and $\frac{\partial M}{\partial \delta} < 0$. As expected, the more risk averse an individual is, the larger the gains from affiliation. But when the time preference rate is very high as in the case of poor people, the gains from the affiliation may decrease or even be negative and affiliation is less probable. Indeed, Packard et al (2002) argue that, especially for the poor and self-employed, the

decision not to affiliate can be a rational choice because it may limit their capacity to smooth consumption.

The gains from affiliation also vary depending on age and gender. Given the nature of the functions involved, their effects on M are more conveniently simulated[13] rather than using comparative statics. Figure 1 shows that as expected, women have lower gains from affiliation because of lower mortality compared to men. Similarly, in figure 2, the gains are less for younger than older people because of their lower mortality in the near future.

Finally, we simulate the effect on M of a discrepancy between the 'true' survival rate and the 'official' survival rate used by the AFP. We assume heterogeneity of survival in the Peruvian population so that on average, they live less than the 'official' estimates[14]. Similar to the AFP, we use a Gompertz function to calculate different 'true' survival probabilities P_t by changing the deterioration rate parameter. The official deterioration rate parameters are 0.999214025 and 0.999525667 for males between 20 and 70 years old and between 70 and 110 years old respectively. Figure 3 shows that the larger the gap between 'true' and 'official' survival probability, the larger the loss when taking out a pension because individuals will not live long enough to receive the full benefits of the pension. In fact, poor people tend to have a low survival rate and therefore they will have little incentive to participate in the private pension system.

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[13] Like Brown (1999) and Cifuentes (2000), we assume a standard interest rate and time preference of 3%. The annuity interest rate is also assumed to be 3% and corresponds to the legal minimum profitability requirement. The administrative fee is 2.3%, the contribution rate is 8% and the retirement age is 65 years old. The survival probabilities are calculated from the 'official' survival tables used by both the AFP and the insurance companies (see the appendix for a summary of the formulas and survival tables). We also simulated the model using the interest rate and time preference rate obtained from a general equilibrium model estimated by Dancourt et al (2004) for the Peruvian economy. Although the results were similar, we preferred not to report them because of the very low values of the parameters.
[14] Indeed, Olivera (2001) argues that the average survival rate of the Peruvian population is lower than the one used by the AFP.

Interfamily transfers, common practice in extended families, may implicitly reflect incomplete annuity markets or more generally, imperfections in the capital market. These family arrangements are part of a more general form of allocations over generations and are associated with forms of exchange within the family[15]. Parents take care of children (education, food, clothes, etc) while they are middle aged. When the parents get old, they receive financial or in-kind support from their children as a form of exchange or compensation. Lucas and Stark (1985), Cox and Rank (1992) and Victorio (2002), analyse the patterns of intergenerational transfers and uncover empirical evidence suggesting that relations of exchange link generations within the family. In particular, Cox et al (1998) find that Peruvian family members expecting to receive pensions have a weaker incentive to enter into intergenerational arrangements for the purpose of old-age support. That is, their evidence suggests that the existence of informal agreements for old-age support might lower the probability of participating in a pension system.

In contrast to a formal social security institution where the payment of pensions can be legally enforced, informal family arrangements are not enforceable and require self-enforcement mechanisms. For example, Cigno (2000) mentions a set of basic principles called 'family constitution'. Other researchers, for instance Cox et al (1998) argue that family altruism, loyalty and trust are keys to enforce family arrangements. Indeed, breaking a promise might be punished with restrictions to participate in the family network. Liquidity restrictions and limited access to the credit market also provide incentives to family members to fulfil agreements.

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[15] See Arrondel and Masson (2004), Laferrere and Wolff (2004) and Stark (1995) for a more comprehensive discussion on transfer motives and their implications.

As a result of better information and trust within the family, family risk-sharing agreements have lower levels of transaction costs, moral hazard, adverse selection and deception than those found in conventional insurance markets (Kotikloff and Spivak, 1981). Moreover, Packard et al (2002) point out that informal social security might be superior to a pension system because the former covers a broader range of risks and is more flexible so it could be tailored according to the needs of the individual.

4. Empirical specification, data and hypothesis

We are interested in examining how both personal and family characteristics as well as the existence of family based arrangements affect the probability of enrolment in pension schemes. Our dependent variable is a binary latent variable y_i^* which takes the value of 1 if the individual i is enrolled in any AFP and zero otherwise. The model is

$$y_i^* = \sum_{k=0}^{K} \beta_k X_k + \varepsilon_i \quad \text{where} \quad y_i = \begin{cases} 1 & \text{if } y_i^* > 0; \\ 0 & \text{Otherwise} \end{cases}$$

Specifically, $\Pr(\text{affiliation}_i = 1) = f(X_i) + \varepsilon_i$

where X_i includes individual and household characteristics affecting M_i and other covariates Z_i. Assuming that ε_i is normally distributed with zero mean, we estimate a probit equation using maximum likelihood.

We use data from the National Survey of Households – Living Standards and Poverty (ENAHO) conducted by the Instituto Nacional de Estadistica e Informatica (INEI) during the fourth quarter of 2001. This survey contains socio-economic information pertaining to households and their members. The sample size consists of

16,515 households including 76,635 people and it is representative at the national, urban, rural and departmental levels.

We drop all individuals who were compulsorily enrolled. Furthermore, we only include individuals belonging to the economically active population and exclude those belonging to extremely poor[16] households. The final sample size is 22,076. Our unit of analysis is the individual and we account for individuals belonging to the same household by clustering.

There are two main characteristics of our sample that must be kept in mind. The first one is related to the definition of our dependent variable. As stated earlier, we exclude individuals who were compulsorily enrolled in an AFP. The ENAHO IV-2001 specifically asks if the individual belongs to the private pension scheme (SPP) but does not directly ask if he/she belongs to the public pension system (SNP)[17]. There are only two pension systems in Peru so we can indirectly infer if a person belongs to the SNP. A person not participating in the SPP but paying monthly pension contributions is classified as one belonging to the SNP and is excluded from the sample.

The second characteristic is related to the effects of occupations on the probability of participation in an AFP. An individual might change occupations over his/her working life. Therefore, it might not be true that an individual who is enrolled and holds an independent occupation (e.g. self-employed) has voluntarily chosen to

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[16] The INEI classifies Peruvian households into extreme poor, poor and non-poor according to poverty lines based on expenditure thresholds: minimum food calorie intake for the case of extreme poverty and minimum goods and services for the case of poverty. We have also performed the regression including the extreme poor and the results do not change qualitatively. However, given that the extreme poor is not able to choose between enrolling in a pension scheme or not, we decided to present only the results excluding them.

[17] The ENAHO IV-2002 asked if the interviewee belonged to *any* pension system. Given that the public pension system is gradually being replaced by the private system and that our interest is in explaining participation in the reformed system, we preferred to use ENAHO IV-2001 where the question was specifically asked with reference to the private pension system.

affiliate. For instance, a self-employed individual who participates in the pension system at the time of the survey could have enrolled during his/her previous dependent job. Unaccounted changes from dependent to independent jobs (and vice versa) might introduce biases in the analysis. Table 3, based on data from ENAHO shows that 77% of the self-employed in the fourth quarter of 2001 were compulsorily enrolled. We decide not to use occupations as predictors for the probability of affiliation because of the mismatch between actual occupation and the timing of enrolment. For similar reasons and given the lack of data to disentangle chronic from temporary unemployment, we did not include 'unemployed' as a regressor. Instead, we rely on the characteristics of the individual (age, gender, marital status and education) to indirectly control for the employment/occupation status.

In view of our theoretical framework and data availability, we formulate the following hypotheses:

Hypothesis 1: Age has a positive and non-linear effect on the probability of pension affiliation.

We expect a positive effect of age on affiliation. However, since the pension in the SPP depends directly on the length of the period in which contributions are made, it is possible that old workers might not have an incentive to affiliate in the SPP because they will not have enough time to accumulate funds and end up with a desirable pension. Therefore, we expect a non-linear relation between age and affiliation.

Hypothesis 2:

Individuals with more investment in human capital and belonging to households with higher income per capita have a higher propensity to participate in the pension system.

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We expect that more educated individuals living in households with higher per capita income will have a higher probability of affiliation because they would be better able to smooth consumption and allocate resources for social security.

We include variables to signal different education levels (postgraduate, undergraduate, vocational, secondary and less than secondary education), but note that in Peru a large proportion of the population are not adequately employed. In our sample, only 37% of the university graduates are employed in professional type occupations. Therefore, we include an interaction dummy, university*non-professional job, which takes the value of 1 if the individual has a university degree and does not have a professional job. If the person is unemployed, then we considered his/her previous job type. We also include income related proxies such as household income per capita and a variable indicating whether any member of the household has liquid assets.

Hypothesis 3:

The existence of an extended family and a large nuclear family with a high proportion of young and old members reduces the likelihood of affiliation.

The effects of informal arrangements fpr old-age security on the probability of affiliation can be indirectly examined by using the number of household members, proportion of children (less than 14 years old) and elderly (over 65 years old) in the household, and the existence of an extended family.   Also the influence of other members of the household (captured by the participation of other household members in the SPP) increases the probability of affiliation.

Hypothesis 4:

Family transfers decrease the likelihood of affiliation.

As explained in the previous section, there are several reasons why family transfers might occur. One motive might be 'exchange' i.e. a family gives something because they expect to receive something in return[18]. These intergenerational transfers are evidence that the family is engaged in informal social security schemes with children giving transfers to parents and vice-versa. Therefore the existence of these arrangements in the family may reduce the probability of affiliation.

Unfortunately we do not have data on intergenerational transfers. Rather than parent-children transfers, we use a proxy to measure the effect of transfers on the probability of pension affiliation. Our data includes information on provision and receipt of family transfers from and to other family members living outside the household. Therefore, our results should be treated with some caution. We expect that an individual belonging to a household that receives or gives these transfers is less likely to affiliate to a pension scheme.

We also include dummy variables for gender, marital status, head of household and holding private health insurance. These covariates are included to control for risk perception and women's expected value of the future pension, which depends on their own accumulated funds (working women are typically less well paid than men and are more likely to be interrupted in their careers) and the survivor benefits for married women. We also add controls to signal if the household is above the poverty level, if it is located in the urban or rural area and if other members of the household are enrolled in the SPP, are pensioners and have life insurance. Note that the results should be interpreted with certain caution because some of these control variables are potentially endogenous, and unfortunately we could not apply

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[18] See Cox et al. (1998) and Bhaumik and Nugent (2000) for an interesting analysis of Peruvian family exchange relations.

instrumental variables because of lack of suitable instruments.   In particular, holding a private health insurance might be endogenous but given the deficient Peruvian public health system, it is plausible to assume that the decision to enrolling in a pension scheme is subsequent to that of subscribing to a private health insurance scheme.

Tables 4 and 5 present the definition and descriptive statistics of the variables used in this study. We compare the means of our variables and all the means between the voluntary affiliated and non-affiliated groups are statistically different except for the means of extended family and head*female.

5. The empirical results

Table 6 presents our results. Overall, the signs of the estimated coefficients are as expected. As expected in hypothesis 1, age (and age squared) has a positive (negative) and significant effect on the probability of affiliation. The education variables and variables related to household income have an important effect on the probability of affiliation and lend support to hypothesis 2. In particular, holding a postgraduate degree increases the affiliation probability by 6.7% while a university degree increase it by 5.4%. Thus, the larger investment in human capital, the greater the chance of enrolling in an AFP. However, if the individual holds a university degree and works in a non-professional occupation (for example, taxi drivers), then the probability of affiliation decreases. Individuals from households with both higher income per capita and in possession of liquid assets have a higher and significant probability of affiliation.   The effect of household income per capita on the probability of affiliation is non-linear.

Married people have a positive and statistically significant larger probability of enrolment than singles. Gender by itself was found to be insignificant but the interaction gender*marital status exerted a negative influence on the affiliation probability. Married women have more transient jobs and lower income mainly because of childbearing, so they have a lower probability of affiliation.

The positive estimated coefficient of private health insurance suggests that it complements membership in a pension scheme. This can reflect wealth and/or proxy a higher degree of risk aversion.

Risk behaviour of other household members is also important in explaining pension enrolment. We have found positive and statistically significant effects on affiliation when i) any member of the household has life insurance ii) there are any other members enrolled in an AFP and iii) any other member is a pensioner. These results can be interpreted as andimitation effect'. That is members of the household learn about the advantages of formal insurance schemes from other members already belonging to such schemes. Nevertheless, these results might suggest that informal social security agreements are not in place when various members of the household participate in formal social security arrangements.

With respect to hypothesis 3, only the number of household members is statistically significant and has the expected negative sign. However, we have to be cautious when interpreting family size. The number of household members might not be a good proxy for the extent of an informal social security safety net. Packard et al (2002) argue that larger households might have to share resources with more members and this effect might reduce the probability of affiliation in an AFP. The percentage of elderly members in the family and the existence of an extended family affect the probability of affiliation with unexpected positive signs but they are insignificant.

In terms of hypothesis 4, our results suggest a negative effect of the household receiving transfer and providing transfers on the probability of affiliation, but only the former is statistically significant[19]. This might be signalling not only exchange related issues between relatives but also that those receiving transfers are in more need than those providing them.

We assess the extent of the bias introduced by not distinguishing between voluntary and compulsory affiliation. We retested the model and compared the predicted probabilities (evaluated at the mean of the individual characteristics) with and without this distinction. If we are unable to identify the nature of the affiliation, the unweighted predicted probability of participating in the pension system is 15 times higher than when we exclude all those who were 'forced' to participate[20]. To control for different sample size, we weight[21] the respective predicted probabilities by the inverse of the actual percentage of enrolled persons in each sample. The weighted difference is 30%.

6. Conclusions

We have examined the decision to participate in the pension system in Peru including all those individuals for whom the decision to affiliate is voluntary. Overall, our results support our hypothesis. Given the large 'informal' or independent sector in Peru, the pension coverage is limited and restricted to a selected group of

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[19] Before including the dummy variables receiving transfers *and* providing transfers, we tested the model with only one dummy variable which took the value of 1 if the household was providing *or* receiving transfers and zero otherwise. We found that this variable exerted a negative and significant effect on the probability of affiliation and that the estimated coefficients of the other regressors remain almost the same so we decided not to report the results.
[20] In the sample that includes voluntary and compulsory membership to the private pension scheme, the predicted probability (evaluated at average characteristics) is 7.5% which contrasts with 0.51% found in our restricted sample.
[21] The weights are 14.8% and 1.3% for the whole and restricted sample respectively.

individuals. Only married males with at least secondary education, belonging to households with higher income per capita and with other family members already participating in the pension system, have a higher likelihood of participation.

Moreover, our results also suggest that family based safety nets have a negative effect on the probability of pension participation and that care for the elderly in Peru is in serious jeopardy. Family arrangements tend to substitute for formal social security membership but in the long run, taking into account the 'aging phenomenon', we cannot be certain of the effectiveness of these family-based safety nets.

One way to increase pension coverage is the creation of more 'formal' or dependent jobs. But this is a structural, long-term and cumbersome task. As mentioned earlier, the Peruvian pension in practice does not include a minimum pension guarantee so another way might be for the government to provide, similar to Chile, a means-tested welfare pension for low-income people that have not participated in the pension scheme and also a minimum guarantee for people that have contributed to the system but have not been able to accumulate enough to achieve a minimum threshold pension. The problem here is not related only to large fiscal costs but also to moral hazard and appropriate incentives. As suggested in our theoretical analysis, other more plausible policies to increase the coverage are to lower the administrative fees charged by the AFP and to narrow the differences between the 'official' survival probability rates used by the AFP in their pension calculations and the 'true' survival probability rate of the average Peruvians. In addition, note that higher pension fund returns and higher annuity interest rates make the retirement pension more attractive. Therefore, regulation on investments made by both pension funds and insurance firms should be carefully designed in order to safeguard pensioners' contributions and also

provide enough flexibility to help managers to follow optimal investment strategies. These and the effectiveness and sustainability of the informal family arrangements are matters for future research.

Finally, our findings must be taken with some caution due to data limitations. Some of our covariates might be potentially endogenous. Lack of savings data precludes us from examining the relation between savings and pension affiliation. In addition, we do not have a measure of intergenerational transfers but only data related to family transfers from and to other family members living outside the household. It would be desirable to have more detailed survey data to explore the effects of informal family safety nets on the decision to participate in the formal social security system and also to have a history of contributions to be able to assess the extent of effective coverage and the problem of old age vulnerability.

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Tables

Table 1
Pension coverage in Latin America 2003

	Percentage of EAP		Percentage of Population	
	Affiliated	Contributors	Affiliated	Contributors
Argentina	58.8	20.7	24.6	8.7
Bolivia	22.9	11.9	9.3	4.8
Colombia	28.6	13.9	11.7	5.7
Costa Rica	75.1	---	29.5	---
Chile	105.4	54.7	44.2	22.9
Dominican Republic	20.8	17.2	9.4	7.8
El Salvador	35.8	16.6	16.2	7.5
Mexico	71.8	28.7	30.4	12.2
Peru	30.1	12.2	11.8	4.8
Uruguay	41.2	21.7	18.7	9.8
Weighted average[a]	55.8	23.6	23.3	9.7

a. Weighted by EAP or population
Sources: ECLAC, ILO, International Federation of Pension Funds Administrators.

Table 2
Social security participation in Peru (December, % of the EAP)

	SPP		SNP		TOTAL	
	Affiliates	Contributors	Affiliates	Contributors	Affiliates	Contributors
1993	7.8	n.a.	n.a.	n.a.	n.a.	n.a.
1994	11.7	n.a.	n.a.	n.a.	n.a.	n.a.
1995	13.4	n.a.	n.a.	7.2	n.a.	n.a.
1996	17.9	n.a.	n.a.	6.8	n.a.	n.a.
1997	19.5	8.3 [a]	n.a.	7.4	n.a.	15.6
1998	21.6	9.8	n.a.	6.2	n.a.	16.1
1999	23.6	10.8	n.a.	5.3	n.a.	16.1
2000	25.4	10.6	n.a.	4.5	n.a.	15.1
2001	27.6	11.3	8.0	4.3	35.6	15.6
2002	29.4	11.5	8.3	4.4	37.7	15.9
2003	30.3	12.7	8.7	4.5	39.0	17.1
2004 [b]	30.7	12.2	8.9	4.1	39.6	16.3

a. End of March
b. End of July, except for contributors to the SPP which is end of May
n.a. Not available
Sources: ILO, Superintendencia de Banca y Seguros del Peru.

Table 3
Current occupation and type of affiliation (number of people)

	Occupation at time of affiliation		
Actual occupation	Compulsory affiliated	Voluntary affiliated	Total
Employer	67	39	106
Self-employed	262	77	339
Employee	3071	142	3213
Unpaid family worker	26	8	34
Household worker	13	5	18
Other	2	1	3
Total	3441	272	3713

Source: ENAHO-2001-IV

Table 4
Definition of variables

Variable	Definition
Individual characteristics	
Age	Age in years
Gender	Female=1, 0 otherwise
Marital status	Married=1, 0 otherwise
Married*Female	Female and married=1, 0 otherwise
Head	Head of household=1, 0 otherwise
Head*Female	Head of household and female=1, 0 otherwise
Postgraduate	Postgraduate education=1, 0 otherwise
University	University education=1, 0 otherwise
Vocational	Technical or vocational education=1, 0 otherwise
Secondary	Secondary education=1, 0 otherwise
University*non-professional	University educated and no professional job=1, 0 otherwise
Private health insurance	Individual holds a private health insurance =1, 0 otherwise
Household characteristics	
HH income per capita	Natural logarithm income per capita of the household.
Liquid asset gains	Liquid asset gains are interests from deposits and loans, dividends from shares and equities and firm profits received in the last year by any member of the household. Any member of household receiving liquid asset gains=1, 0 otherwise
HH is non poor	Household non-poor=1, 0 otherwise
Urban	Household located in urban area =1, 0 otherwise
HH size	Number of members in the household
Young depend	Proportion below 14 years old in the household
Old depend	Proportion over 65 years old in the household
Extended family	Any relative in household but not nuclear family=1, 0 otherwise
Receiving family transfers	Transfers and remittances from relatives in other households and received by any member of the household during the last 6 months. Receiving transfers=1, 0 otherwise.
Providing family transfers	Transfers and remittances provided by any member of the household to relatives living in other households during the last 3 months. Providing transfers=1, 0 otherwise.
Receiving or providing family transfers	Receiving or providing transfers=1, 0 otherwise
Other members in the SPP	Other member of the household (except the interviewee) enrolled in the SPP=1 and 0 otherwise.
Receiving pensions	Any member of the household receiving a pension during the last six months=1, 0 otherwise.
Holding a life insurance	Any member of the household paying life insurance during the last 3 months=1 and 0 otherwise.

Table 5
Descriptive statistics

Variable	Voluntarily affiliated		Non-affiliated	
	Mean	S.D.	Mean	S.D.
Individual characteristics				
Age	41.1	13.3	36.7	15.8
Age squared	1862.5	1199.1	1597.8	1358.9
Gender	0.347	0.477	0.461	0.499
Marital status	0.684	0.466	0.555	0.497
Head	0.542	0.499	0.382	0.486
Head*Female	0.063	0.242	0.072	0.258
Private health insurance	0.066	0.249	0.011	0.102
Postgraduate	0.024	0.154	0.001	0.037
University	0.330	0.471	0.065	0.246
Vocational	0.205	0.404	0.088	0.283
Secondary	0.281	0.450	0.453	0.498
University*Non-professional	0.108	0.310	0.042	0.200
Household characteristics				
HH income per capita	7.254	0.765	6.585	0.735
HH income per capita squared	53.207	11.396	43.896	9.927
Liquid asset gains	0.125	0.331	0.029	0.168
HH is non poor	0.868	0.339	0.592	0.491
Urban	0.885	0.319	0.687	0.464
HH size	4.729	1.957	5.106	2.422
Young depend	0.218	0.198	0.234	0.203
Old depend	0.075	0.164	0.073	0.187
Extended family	0.413	0.493	0.400	0.490
Receiving family transfers	0.281	0.450	0.380	0.485
Providing family transfers	0.299	0.458	0.215	0.411
Receiving or providing family transfers	0.503	0.501	0.514	0.500
Other members in the SSP	0.438	0.497	0.177	0.382
Receiving pensions	0.063	0.242	0.013	0.111
Holding a life insurance	0.135	0.343	0.027	0.163

Table 6

Probability of affiliation to the private pension system

Variable	Coeff	Robust S.E.	dF/dX	Mean
Individual characteristics				
Age	0.040***	0.011	0.001	36.8
Age squared	0.0003***	0.000	-0.5E-5	1601.6
Gender	-0.022	0.105	-0.3E-3	0.46
Marital status	0.270***	0.094	0.004	0.56
Married*female	-0.246*	0.131	-0.003	0.25
Head	0.059	0.104	0.001	0.39
Head*Female	0.082	0.146	0.001	0.07
Private health insurance	0.260*	0.133	0.005	0.01
Postgraduate	1.112***	0.261	0.067	0.00
University	1.074***	0.112	0.054	0.07
Vocational	0.628***	0.100	0.018	0.09
Secondary	0.154*	0.082	0.002	0.45
University*Non-professional	-0.545***	0.115	-0.004	0.04
Household characteristics				
HH income per capita	1.477***	0.527	0.022	6.60
HH income per capita squared	-0.091***	0.035	-0.001	44.0
Liquid asset gains	0.250**	0.105	0.005	0.03
HH is non poor	0.092	0.085	0.001	0.60
Urban	0.036	0.091	0.001	0.69
HH size	-0.030*	0.015	-0.4E-3	5.10
Young depend	0.314*	0.169	0.005	0.23
Old depend	0.055	0.166	0.001	0.07
Extended family	0.081	0.064	0.001	0.40
Receiving family transfers	-0.154***	0.060	-0.002	0.38
Providing family transfers	-0.032	0.061	-0.001	0.22
Other members in SSP	0.333***	0.072	0.007	0.18
Receiving pensions	0.329**	0.145	0.007	0.01
Holding a life insurance	0.424***	0.100	0.011	0.03
Constant	-9.586***	1.900		
Number of observations	22076			
Pseudo R2	0.1937			
Pseudo-likelihood	-1231.40			
chi2	535.9(27)			
prob>chi2	0.0			

White/Hubert standard errors

*** Significant at 1%, ** Significant at 5%, *Significant at 10%

Figures

Figure 1

Assumptions

Gender

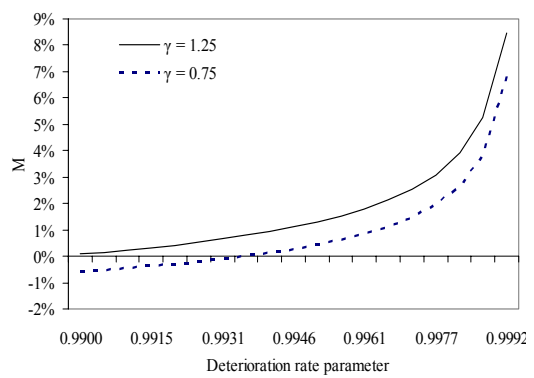| Age	25
Retirement age	65
r=r*=z*	3%
Survival probabilities	Appendix
a	2.3%
c	8%
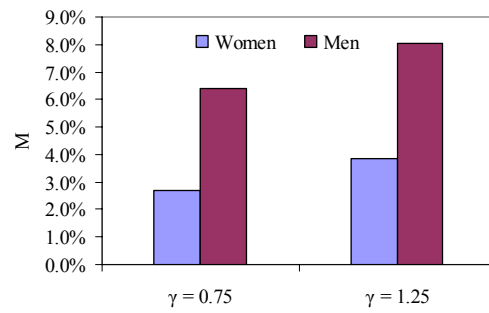
Figure 2

Age (male)
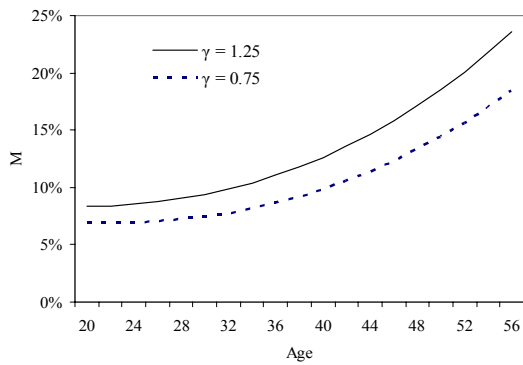
Figure 3

Deterioration rate (male)

Appendix

Survival tables used in the Peruvian private pension system

The probability of survival $_xP_t$ from age x to age x+t is defined as:

$$_xP_t = l_{x+1}/l_x$$

where l_x is the quantity of survivors of a given population and depends on the assumed behaviour of the mortality rate. Assume an initial population (l_I) formed by 100,000 individuals (all of them with the same age I) who can live to a maximum age D (110 years old) and, as it is the case in Peru, assume that the mortality rate (m_x) follows a Gompertz function. Then,

$$l_x = \prod_{i=I}^{x-1} m_i \qquad \text{when x>I, otherwise } l_I = 100,000$$

where $m_x = s\,g^{c^x(c-1)}$ and s, g (i.e. deterioration parameter) and c are parameters that under the Peruvian pension and insurance regulation take the following values

Age	Parameter	Men	Women
From 20 to 70	c	1.089736350	1.098531565
	g	0.999214025	0.999767311
	s	0.999738701	0.999834258
From 70 to 110	c	1.096209882	1.112837803
	g	0.999525667	0.999923115
	s	0.999140668	0.998779052

Therefore, $_xP_t$ can be viewed as $_xP_t = \prod_{i=x}^{x+t-1} m_i$ for any t>=1.